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Sixth graders' reasoning ability on invalid conditional inferences predicts concurrent algebraic achievement

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Reasoning ability has been proposed to be associated with mathematics achievement, but empirical evidence is needed to specify such an association. The current study aimed at exploring students' conditional reasoning ability and its relationship with algebraic achievement. Sixth graders (n = 101) were assessed on their conditional reasoning ability and algebraic achievement, in addition to control variables (e.g., intelligence, working memory) and potential mediator (ability to detect violation of arithmetic principles). Factor analysis using scores from four inferences in true, false and abstract contexts yielded a 4-factor structure. Subsequent regression revealed that the ability to identify invalid conditional inferences (i.e., affirmation of consequent (AC) and denial of antecedent (DA)) in true and false contexts significantly predicted concurrent algebraic achievement, controlling for all control variables and mathematics achievement at the fourth grade. Further mediation analysis showed that the ability to detect violation of arithmetic principles partially mediated the relation between conditional reasoning and algebraic achievement. The study demonstrated the contribution of conditional reasoning ability to a specific mathematical domain in elementary school level and provided evidence for the potential mechanism behind the relation.

Keywords: Conditional reasoning, algebra, arithmetic principles, affirmation of consequent, denial of antecedent