The Woodcock-Muñoz Foundation

Research Brief
Doctoral Dissertation Abstract

CONFIRMATORY ITEM FACTOR ANALYSIS INVESTIGATING ADOLESCENT GENDER DIFFERENCES IN APPLIED QUANTITATIVE KNOWLEDGE

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The Woodcock-Muñoz Foundation (WMF) is a private non-profit operating foundation that supports the advancement of contemporary cognitive assessment practices. The Doctoral Dissertation Abstract Project is part of the Foundation's efforts to disseminate research findings that bridge the theory-to-practice gap in cognitive assessment.

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Abstract

The intense study of mathematical gender differences is not recent. Previous research has investigated "why" gender differences exist, and cited social and environmental factors such as anxiety, teacher expectation, and class selection. While external (i.e., environmental) influences on gender performance are important, current research takes an in-depth look at mathematical items, building an internally focused research framework. Item complexity and gender differences at the item-level are examined to investigate plausible mediators of performance differences. It is hypothesized that mathematical word problems will prove to be more complex than previously thought. Also, said item-level complexity is believed to differentially influence male and female performance. Finally, it is hypothesized that relationships to non-quantitative cognitive factors can mediate item-level gender differences. Baron and Kenny's causal steps mediation methodology was employed. Theoretically, cognitive abilities (reasoning and processing speed) are associated with quantitative ability and show gender differences. Once those abilities are explained in the analytic model, item-level gender differences are expected to disappear. A portion of Woodcock-Johnson III's standardization sample was selected and contained (N = 3874) school aged children ranging from 9 to 19 years of age (*M* = 13.06). The Applied Problems test of WJ-III's Achievement scale was central to item-level mathematical mediation analyses. Confirmatory factor analyses tested within-item complexity and possible mediation effects. Results suggest that mathematical word problems are complex and individual items contain aspects of reasoning, speed, and spatial ability, which support previous research by Carroll (1996), who postulated that mathematical ability is highly related to other cognitive factors (reasoning, spatial ability, and processing speed). Showing that mathematical items can exhibit strong relationships to indicators of cognitive ability further reinforces this link and could be indicative of differential processing strategies. However, the relationship between gender and these item-level cognitive ability associations was not strong enough to validate a mediation model. Future research should pursue with-in item complexity and mathematical item-level gender performance differences in other achievement tests to assess previously undetected bias and strengthen the mathematical ability measurement tools.