

Word Problems: How Performance Varies with ADHD Traits and Math Anxiety

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Introduction

Math word problems can be difficult to solve because they require both mathematical knowledge and comprehension of the story within the problem. Individuals with ADHD or math anxiety are more likely to experience difficulties with both mathematics and word problems (Frazier et al., 2007; Miller & Bischel, 2004).

The goal of the present study is two-fold:

1. To test two competing story problem hypotheses: The Foregrounding Hypothesis (Mattarella-Micke & Beilock, 2010) and the Inconsistent-Operations Hypothesis (Jarosz & Jaeger, 2019).
2. To understand how ADHD and math anxiety contribute to story problem difficulties.

Foregrounding Hypothesis

- If numeric content associated with a set of objects is foregrounded, the elicited situation model should affect math performance

Inconsistent-Operations

- Linguistic associations prime an operation inconsistent with, but related to, the problem, thus leading to solution difficulty

	Multiplication Performance	Division Performance
Foregrounding Hypothesis	Associative + Interfering < Dissociative + Interfering	Associative + Interfering < Dissociative + Interfering
Inconsistent Operations Hypothesis	Associative + Interfering < Dissociative + Interfering	Associative + Interfering > Dissociative + Interfering

Method

Participants: 359 adults ($M = 20.09$, 67% female) completed self-report measures of ADHD traits (ASRS) and math anxiety (AMAS).

Story Problems: 48 multiplication and division problems followed by a comprehension question.

- Association: object associated with or dissociated from the protagonist.
- Interference: numerical distractor (i.e., 15 for 7×8) or linguistic distractor.

Tara needs to prepare cookies for the bake sale at her kids' school. On her way home from the grocery store she picks up/drops off 15/some flyers to advertise for the sale. If Tara makes enough dough for 7 batches of cookies and each batch takes 8 minutes to make, how long will it take for her to make all the cookies?

Results

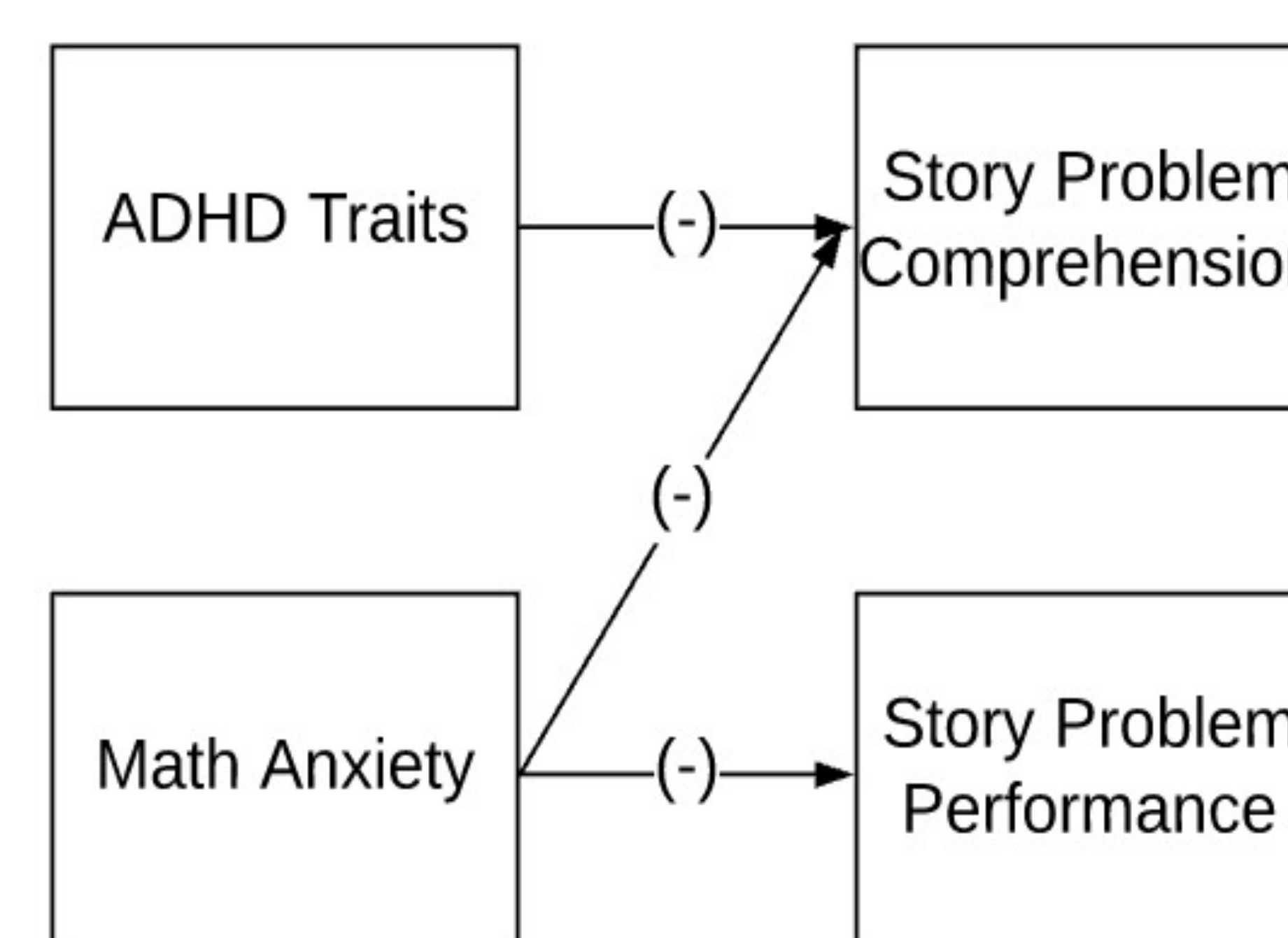


Figure 1. Relations among ADHD traits, math anxiety, story problem comprehension and story problem math performance

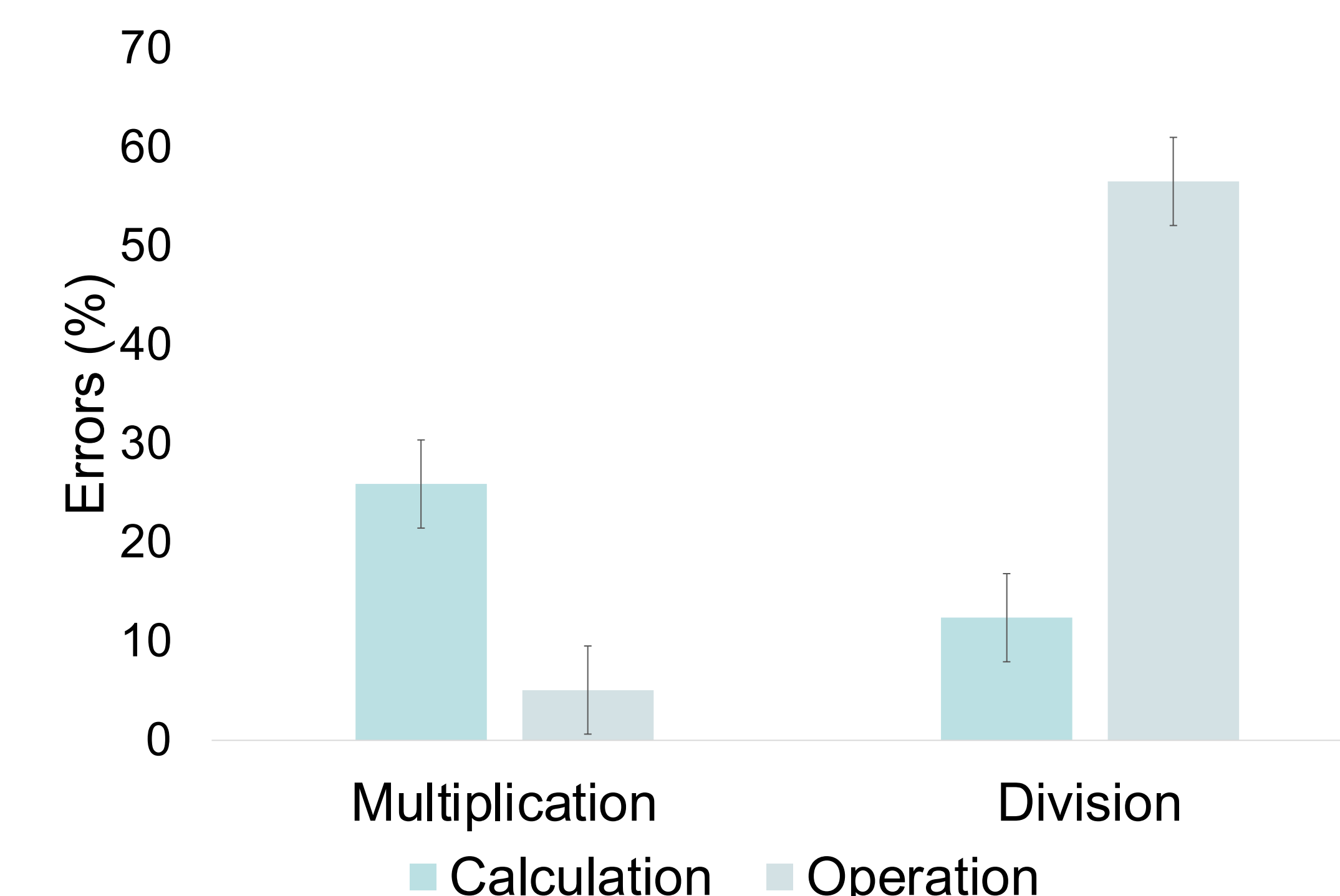


Figure 2. Distribution of calculation and operation errors across multiplication and division operations. Error bars represent 95% confidence intervals.

- ADHD traits negatively predicted comprehension but not math performance
- Math anxiety negatively predicted comprehension and math performance
- No support for Foregrounding or Inconsistent-Operations Hypotheses
- Contrary to both hypotheses, participants rarely added (2.64% of errors) when they should have multiplied or subtracted (0.91% of errors) when they should have divided
- Most common errors were calculation errors for multiplication problems and operation errors for division problems

Discussion

- No support for either hypothesis
- Participants did not make more errors on associative-interfering multiplication problems nor dissociative-interfering division problems
- Difficulties stem from calculation errors and failure to extract correct equation
- Both mathematical and linguistic components can influence word problem performance, especially in individuals with more ADHD traits and/or high levels of math anxiety
- Future research could examine impairments in a clinical population
 - Investigate the role of executive functions, including working memory, in solving word problems