

ABSTRACT

This study provides evidence that spatial anxiety may impact geometric reasoning, as measured by verbal mathematical insight and transformational proof production. For mathematical insights, spatial anxiety may act as a moderator between spatial ability and insight production. For transformational proof, there was a direct effect of spatial anxiety on proof production as well as a moderation effect of spatial anxiety on relationship between spatial ability and proof. These findings are consistent with previous results in other domains of mathematics⁸ while highlighting several novel associations. These findings add to the spatial anxiety literature and may provide the foundations for future work exploring the mechanisms behind these associations such as the impact of spatial anxiety on gesture production during geometric reasoning.

RESEARCH QUESTION

What is the relationship between spatial anxiety and geometric reasoning, as seen in verbal insight and transformational proof?

THEORETICAL BACKGROUND

- **Spatial ability** has been linked to success on geometry related tasks from both experimental accounts³ and domain-centric analyses¹.

- **Spatial anxiety**, a domain-specific trait anxiety², has been linked to spatial ability⁴ and standardized math assessments⁸, but little is known about its links to geometric reasoning.

- **Verbal mathematical insights**⁵ are correct general thoughts about the mathematical properties behind a conjecture, often without the complete details.

- **Transformational proofs**^{3,5} go beyond correct insights to include three essential qualities: Generality, operational thoughts or actions, and logical inference.

METHODS

PARTICIPANTS:

- 94 undergraduate students
- Average Age: 20.13 years
- 71% Female
- 63% White, 26% Asian, 12% Other
- 81% Native English Speakers
- Online due to COVID19 pandemic

PROCEDURE:

- Completed a series of demographic and covariate measures online via Qualtrics™
- Played *The Hidden Village*⁶, an embodied video game, via Zoom™ with a researcher
- Eight conjectures were transcribed and coded for correct verbal insight and transformational proof^{3,5}
 - N = 752 video clips
- Logistic regression models were fit for each code with age and gender as covariates



MEASURES:

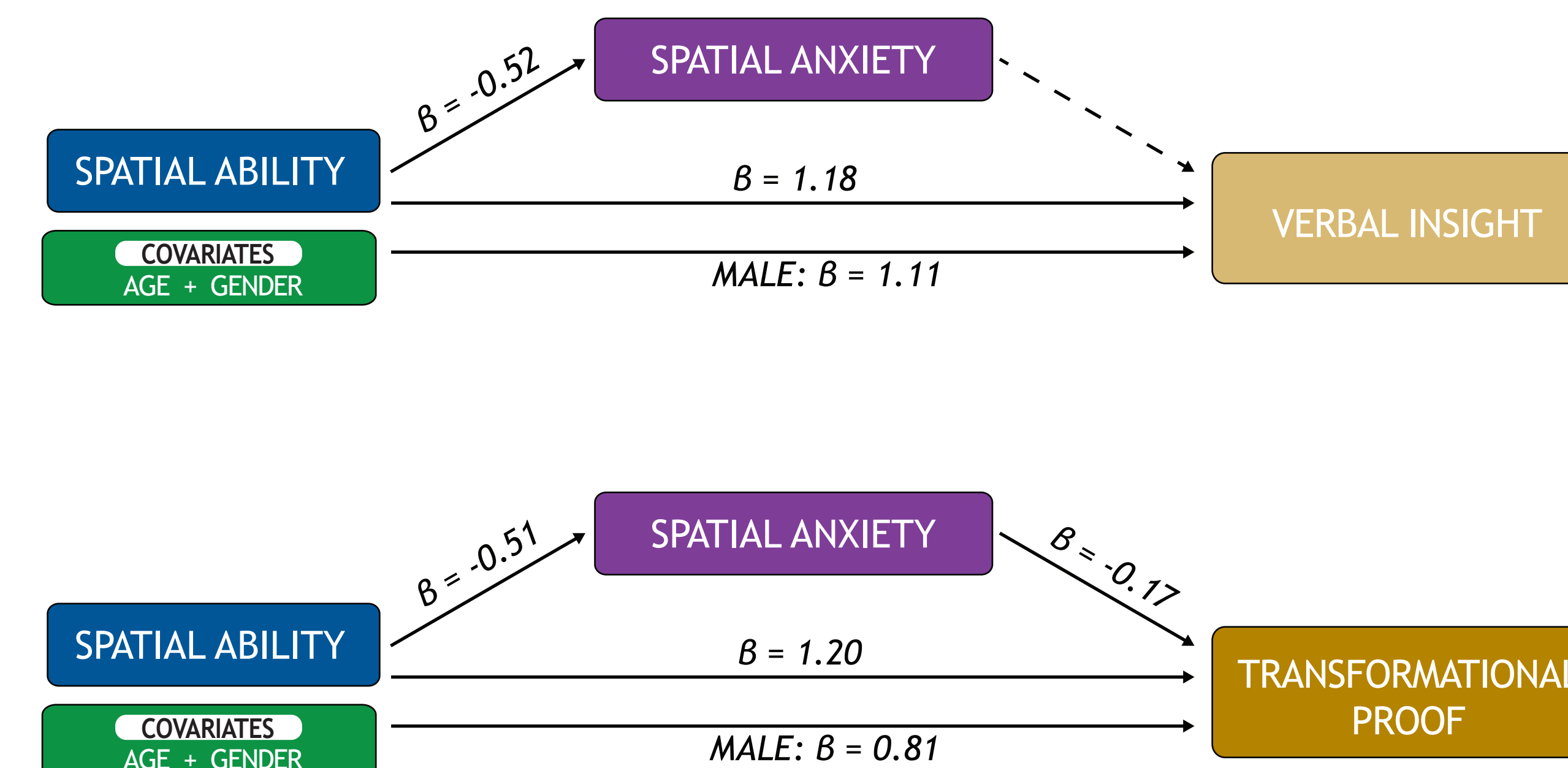
SPATIAL ABILITY

- 15 question assessment based on the Spatial Reasoning Assessment⁷

SPATIAL ANXIETY

- Novel Spatial Anxiety Scale²

RESULTS



DISCUSSION AND FUTURE WORK

- The **interaction** between spatial ability and spatial anxiety was significantly associated with a **decrease** in the chance of producing **correct verbal insight and a transformational proof**.

-As spatial anxiety scores increase the effect of spatial ability on geometric reasoning decreases.

-**Lower spatial anxiety scores** were significantly associated with higher chances for a transformational proof.

- **Higher spatial scores** were significantly associated with **higher relative chances** of correct insight and transformational proof.

- **Males** were significantly **more likely** than females to produce correct insight, but **less likely** than females to produce transformational proofs.

- These effect may need to be considered by researchers and educators who are looking to improve students' geometric reasoning.

-Future work will continue to explore these relationships along with the impact of spatial anxiety on gestures production during geometric reasoning.

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