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Beyond the Paradox: A Longitudinal Analysis of Gender, Intelligence, and the Reciprocal Dynamics of Mathematics Self-Concept and Competence

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PREREGISTERED

THEORETICAL BACKGROUND

- Academic self-concept and academic competence reciprocally influence each other over time (e.g., Arens et al., 2017).
- Previous studies have often relied on models that are unable to distinguish between-person stability from true within-person change (i.e., CLPM; e.g., Arens et al., 2017; Huang, 2011; Marsh & Craven, 2006)
- **Gender paradox:** The generally lower math self-concept (MSC) for girls (Reilly et al., 2015) despite minimal gender differences in math competence (Mejía-Rodríguez et al., 2021) remains underinvestigated in longitudinal studies.

RESEARCH QUESTIONS

Do changes in students' math self-concept and math competence predict each other over time, and do girls and boys differ in the strength of these reciprocal effects?

METHOD

Data & sample

- German NEPS, Starting Cohort 3 (5th Grade) (Blossfeld & von Maurice, 2011)
- N = 1,225 (48 % boys, 52 % girls)
- School tracks: 92 % academic track ("Gymnasium")

Variables and measures

- *Math competence* – WLE scores in grades 5, 9 and 12
- *Math self-concept* – two 4-point Likert scale items to assess in grades 5, 9 and 12:
  - "I get good grades in math."
  - "Math is one of my best subjects."
- *Covariates:*
  - IQ (perceptual speed & reasoning)
  - SES (HISEI index)

RESULTS

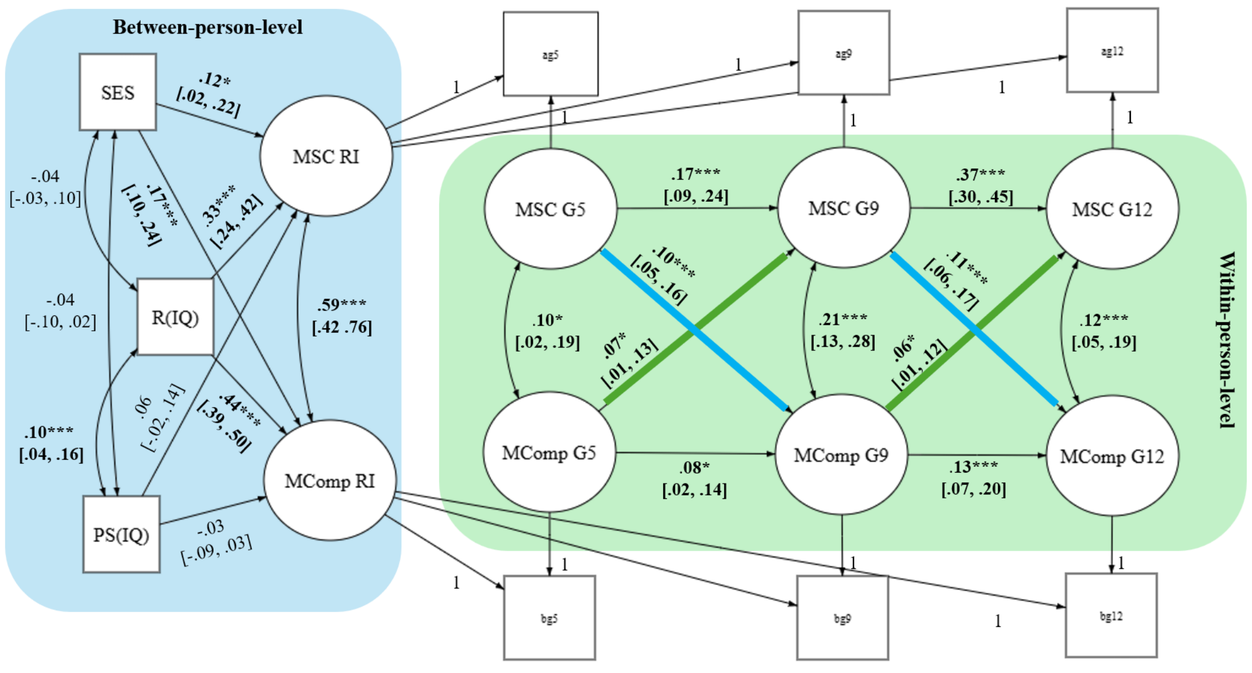

Fig. 1 Random Intercept Cross-lagged Panel Model of Math Self-Concept and Competence for grades 5, 9 and 12. **Good Absolute Model Fit** (CFI = .985, RMSEA = .050, SRMR = .021)- *Note*. RI = random intercept, SES = Socio-economic status, R(IQ) = Reasoning, PS(IQ) = Perceptual speed, MComp = Math Competence, MSC = Math Self-Concept. Standardised estimates are presented in figure. *** $p < .001$, *$p < .05$

- **Reciprocal MSC and Competence relationship is confirmed**
- Reciprocal effects **did not differ by gender** ($p = .755$)
- Gender differences in math self-concept couldn't be tested as scale lacks scalar measurement invariance: Boys and girls might use the response scale in different ways (e.g., a „3" on the scale might not mean the same for girls and boys)

Internalized stereotypes and different socialization may lead girls to apply stricter criteria to themselves, potentially leading to the gender-paradox. !

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