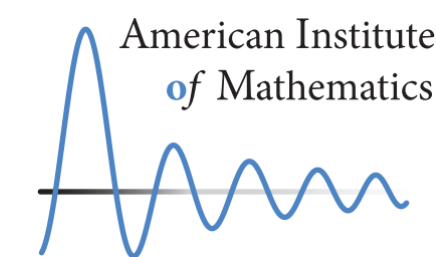


What is math?

Shaping teachers' mindsets and views of math as a discipline through participation in Math Teachers' Circles



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Introduction

- **Math Teacher's Circles (MTC)** is a nation-wide intervention for K-12 math teachers where teachers and mathematicians engage in community building and investigation of non-routine problems
- Through integrating the teaching and practice of math, **teachers are encouraged to engage with their students as mathematical problem solvers**
- **Teachers who participate in MTC adopt more incremental mindsets about learning, show higher levels of professional engagement, and implement high-leverage teaching practices in their classrooms** (e.g., using tasks promoting reasoning and problem solving, facilitating meaningful mathematical discourse, and supporting productive struggle in learning mathematics)^{1,2}

This study 1) **validated the Conceptions of Mathematics as a Discipline scale** and 2) used this measure to predict the relationship between MTC participation, conceptions of math and K-12 math teachers' healthy mindsets and pedagogical strategies.

Conceptions of Math as a Discipline Scale

- The newly developed 12-item Conceptions of Math as a Discipline scale measures the level of endorsement of two orientations to mathematics
 - 1) A **"research" view of math which represents math as a subject in which the core practice is the creative process of understanding relationships and patterns.**
 - Example item: "Good solutions to mathematics problems typically lead to more questions"
 - 2) A **"traditional-school" view which represents math as a formula-driven domain with clear steps and procedures.**
 - Example item: "Knowing what steps to take is an essential part of approaching mathematics problems"

Subscales indexing the "research" and "traditional-school" views had high internal reliability (Cronbach's $\alpha = .76$ and $.70$, respectively)

Design and Procedures

Participants: 249 K-12 Math teachers who have participated or were planning to participate in MTC.

Procedure: Data was collected through the American Institute of Mathematics, the developer of MTC intervention. K-12 math teachers who had already participated or were anticipating participating in MTC were solicited to complete a questionnaire. As MTC takes place in several states across the US, the sample includes math teachers from across the nation.

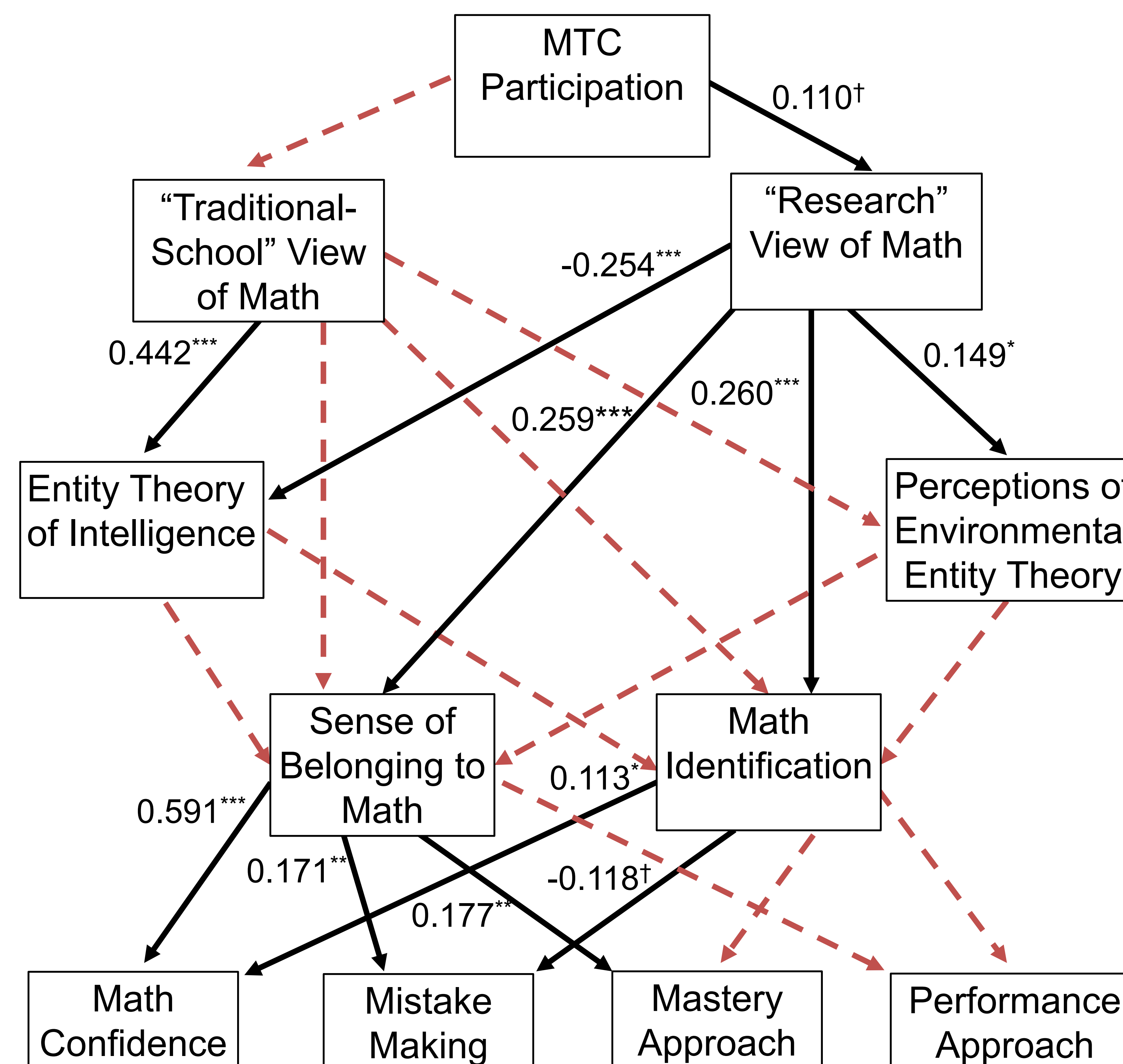
Measures:

- Sense of belonging to math³; 28 items; $\alpha = .96$
- Math identification⁴; 4 items; $\alpha = .86$
- Entity Theory of Intelligence⁵; 7 items; $\alpha = .89$
- Perceptions of Environmental Entity Theory³; 4 items; $\alpha = .96$

Design and Procedures (cont.)

- Patterns of Adaptive Learning Scale: Mastery Approach⁶; 4 items; $\alpha = .76$
- Patterns of Adaptive Learning Scale: Performance Approach⁶; 5 items; $\alpha = .78$
- Instructor beliefs about mistakes⁷
 - "[...] making mistakes is a key part of learning math."
- Math Confidence; 4 items, $\alpha = .92$
- Conceptions of Math as a Discipline Scale; 12 items; $\alpha = .70$

Model of Participation in MTC



As participation in MTC increased, teachers reported higher levels of identification with math and displayed a stronger "research" orientation toward math (this relationship does not exist for "traditional school" math orientation and MTC participation).

Red-dotted arrows represent non-significant pathways $^{\dagger} p < .1$. * $p < .05$. ** $p < .01$. *** $p < .001$

Model Fit Indices for MTC Participation

Model	χ^2	df	p	χ^2/df	CFI	TLI	RMSEA	RMSEA 90% CI	p -close
All parameters free	12.18	8	.143	1.48	.991	.939	.046	[0.000, 0.094]	.496

Note. CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root-mean-square error of approximation.

Discussion

Overall, the MTC intervention fostered psychological well-being and endorsement of positive pedagogical strategies for K-12 math teachers

- Increased participation in MTC predicted a more "research" view of mathematics, but not a more "traditional-school" view of mathematics
- **A more "research" view of math was also predictive of a number beneficial psychological and pedagogical outcomes.**
- "Traditional-school" view of math was not impacted by the MTC intervention and did not predict psychological or pedagogical outcomes

Future work should investigate the longitudinal effects of MTC participation.

This work has potential to inform policy recommendations surrounding teacher education and professional development.

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