Alleviating Anxiety about Spatial Ability in Elementary School Teachers

Raedy M. Ping, Claire Bradley, Elizabeth A. Gunderson, Gerardo Ramirez,
Sian L. Beilock, Susan C. Levine

The University of Chicago

Introduction

• **Teacher math anxiety impacts student beliefs and performance in math.** Compared to less-anxious teachers, female teachers who report higher rates of math anxiety have female students who are more likely to endorse a stereotype about math that favors boys (Beilock, Gunderson, Ramirez & Levine, 2010). These students, then, also show lower math performance at the end of the school year.

• **Teacher spatial anxiety impacts student performance on a spatial task.** Students of teachers who are more anxious about their own spatial abilities improve less on a mental rotation task over the school year (Gunderson, Ramirez, Beilock & Levine, in progress).

• **Does teacher spatial anxiety have any impact on student beliefs about math?** Math and spatial abilities are believed to be closely related, and preliminary evidence supports this possibility (Gunderson, Ramirez, Beilock & Levine, under review). Female teachers' spatial anxiety might impact student endorsement of gender-based stereotypes about math.

• **Can teacher spatial anxiety be alleviated by professional development (PD) that focuses on how to teach spatially?**

Teacher Work Circle

Participants were 10 teachers (all female) and their Kindergarten, 1st or 2nd grade students.

• The work circle consisted of a week of intensive meetings during the summer, one refresher meeting during the winter, and a concluding meeting at the end of the school year.

• Teachers completed anxiety questionnaires before the summer meetings and at the end of the school year.

Goals of the Work Circle

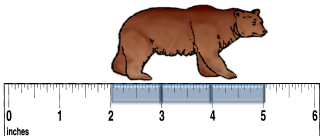
• Introduce teachers to the idea of spatial reasoning and familiarize them with developmental trajectories
• Inform teachers about empirical research supporting the use of spatial tools to teach math content
• Partner with teachers to create "Spatial Toolkit" activities based on lab research, and modified for use to teach math in K-2nd grade classrooms. Teachers used and refined activities throughout the school year.

Toolkit Example

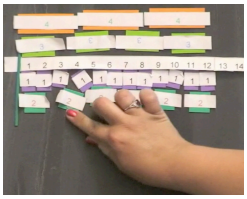
Measurement

Lab research revealed an effective instructional method for teaching measurement: using discrete unit pieces overlaid on a ruler to measure objects that do not start at the zero-point. (Levine, Kwon, Hulltenlocher, Ratliff & Dietz, 2009)

Toolkit activities use this method:



Teachers adapted the general principals of this activity (discrete units on a number line) in order to teach addition, subtraction, multiplication, and division:



Results

Does teacher spatial anxiety have any impact on student beliefs about math?

Students are asked to draw a picture of a student who is good at math and a student who is good at reading.

Confirm stereotype = boy for math, girl for reading.

Do not confirm = any other combination.

Beginning of School Year			
		Confirm	Do Not Confirm
Teacher Spatial Anxiety	High	26%	74%
	Low	38%	62%

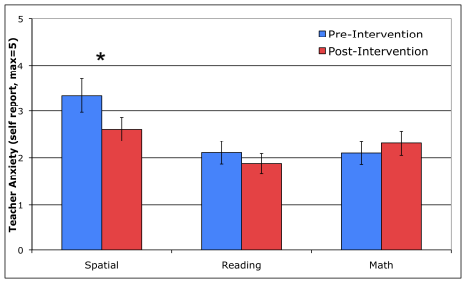
$\chi^2(1)=1.74$, *ns*

End of School Year			
		Confirm	Do Not Confirm
Teacher Spatial Anxiety	High	38%	62%
	Low	19%	81%

$\chi^2(1)=4.90$, $p<0.05$

Results

• **Can teacher spatial anxiety be alleviated by PD that focuses on how to teach spatially?**



Teacher Anxiety

Discussion

• Female teachers with higher spatial anxiety had students who were more likely to endorse gender-based stereotypes about math at the end—but not the beginning—of the school year.

•This is important since the vast majority of early elementary school teachers are female (National Education Association, 2001), and women report higher levels of spatial anxiety than do men (Lawton, 1994).

• Teacher spatial anxiety decreased over the course of the work circle intervention.

• PD focused on how to teach spatially, and not directly on teaching teachers spatial skills.

• This is consistent with findings showing that teacher education that focuses on how math concepts should be taught to students (as opposed to directly instructing teachers in the domain of math) decreases teacher math anxiety (Tooke & Lindstrom, 1998).

Future Directions

• Open questions for future research:

•Does teacher spatial anxiety impact student math performance or endorsement of gender-based stereotypes about space?

•Which aspect(s) of the work circle were most effective in reducing teachers' spatial anxiety?

• Would male teachers show similar effects?

• Since spatial reasoning is not a part of most curricula, spatial anxiety may lead teachers to avoid spatial content in the classroom.

•We are collaborating to increase and enhance spatial content in the widely-used *Everyday Math* curriculum.

SILC
THE UNIVERSITY OF CHICAGO
NATIONAL SCIENCE FOUNDATION