

## Alleviating Anxiety about Spatial Ability in Elementary School Teachers

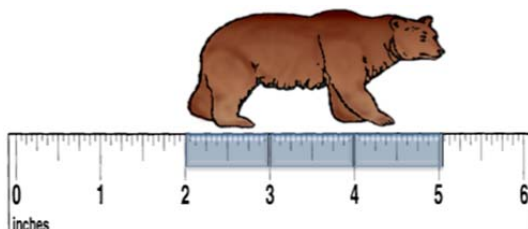
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We present data from a teacher professional development intervention, a work circle between SILC researchers and Kindergarten through 2<sup>nd</sup> grade teachers focused on spatial intelligence and learning. The main goals of the work circle were: a) to familiarize elementary school teachers with the domain of spatial reasoning, b) to inform teachers about lab studies in the field of spatial reasoning, focusing on using spatial tools to teach mathematical concepts, and c) to bring together researchers and teachers to develop “Spatial Toolkit” activities that were based on lab studies for use in the classroom. Teachers implemented and augmented Toolkit activities throughout the school year and reported back to the work circle to discuss ideas for further refinement, ideas for other content that could be taught spatially, and questions that future lab research could address.

One example of a Spatial Toolkit activity concerns linear measurement. During the work circle, researchers presented the results of a training study that found that teaching students to measure objects misaligned with the zero-point on a ruler by laying discrete one-inch transparent plastic units on top of the ruler improved students’ performance on this typically challenging task (Levine, Kwon, Huttenlocher, Ratliff & Dietz, 2009). This study was then turned into a Toolkit activity, a worksheet where students would be instructed to use unit-chips to help them measure items misaligned with the zero-point on a ruler. During the work circle teachers were asked to take the idea of using discrete units on a ruler and transfer it to the number line, a tool that is used on a daily basis in elementary school classrooms. Teachers then presented their ideas to the large group. Some examples of teacher-generated activities included using units of different sizes on the number line to teach addition/subtraction and multiplication/division.

Figure 1. Example of a Spatial Toolkit activity.



We collected quantitative and qualitative data from students and teachers at the beginning and end of the school year, and are currently investigating whether participation in the work circle affected teacher and student behavior and attitudes.

Here, we present findings from the work circle regarding teacher attitudes about spatial reasoning. The relationship between an individual's anxiety about math and his or her impaired performance in and avoidance of math in educational and career choices is well-established (e.g., Ashcraft & Krause, 2007; Hembree, 1990; Chipman, Krantz & Silver, 1992). Teacher anxiety may have even more widespread effects, though. A recent study showed that 1st and 2nd grade female teachers' math anxiety impacted their female students' (but not their male students') learning of math over the school year (Beilock, Gunderson, Ramirez & Levine, 2010)<sup>1</sup>. A mediation analysis showed that the effect of teacher math anxiety on female students' end-of-year math performance was mediated by girls' endorsement of the negative stereotype. These analyses all controlled for teacher math ability—during the school year, teacher anxiety about math influenced girl students' attitudes about math and gender, which affected girl students' math learning.

Compared to research in the domain of math, little is known about the relationship between anxiety, performance, and educational and career choices with respect to spatial reasoning. There is, however, preliminary evidence to suggest that teacher spatial anxiety negatively impacts student spatial performance (Gunderson, Ramirez, Beilock & Levine, in progress). Previous research in the domain of math anxiety has shown that when math instruction for preservice elementary school teachers focuses on how concepts should be taught to students (as opposed to instruction that focuses on teaching teachers content), teacher math anxiety decreases (Tooke & Lindstrom, 1998). Since the work circle focused on how to use spatial tools to teach students, we hypothesized that participating in the work circle might lead to a decrease in teacher anxiety about spatial reasoning.

Ten teachers (all happened to be female) from 7 Chicago area schools who taught either kindergarten, 1st or 2nd grade participated in the work circle. The heart of the work circle intervention consisted of a full week of intensive meetings between teachers and researchers that took place in August, toward the end of the summer vacation. At the beginning of the week-long intervention, teachers completed a battery of assessments, including self-report questionnaires to assess levels of domain-specific anxiety. Throughout the school year, teachers implemented and refined ideas from the week-long intervention, and participated in a variety of follow-up meetings, observations, and interviews. Teachers also completed the anxiety measures at the end of the school year.

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<sup>1</sup> The vast majority of elementary school teachers, particularly in the lower grades, are female (National Education Association, 2003). Additionally, elementary education majors have the highest math anxiety of any college major (Hembree, 1990).

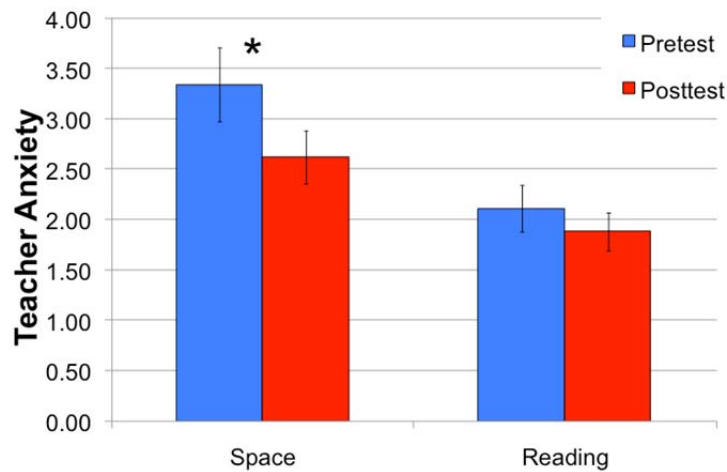


Figure 2. Teacher anxiety about space decreased from the beginning of the school year ( $t(9)=2.55, p<0.05$ ), while teacher anxiety on a control measure (reading) did not ( $t(9)=1.75, ns$ ).

Participating in the work circle was related to a decrease in spatial anxiety, but not in anxiety on a control measure (reading). Our future work will focus on identifying the precise aspects of the intervention that were critical in achieving these results, and also examine the impact of this kind of intervention on student attitudes and behavior. We are also currently working in collaboration with *Everyday Mathematics*, a widely used math curriculum, to incorporate Spatial Toolkit activities into the PreK – 2<sup>nd</sup> grade curricula.

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