Temple University
Cognition & Learning Lab
Newsletter
Fall 2022

We hope everyone has had a wonderful summer! As it was for many, this past year has been a time of transition for us. We continued to conduct fully online, Zoom-based research studies throughout the year. In the spring, we were very excited to begin in-person research with our local school partners once again.

In this issue of our newsletter, we've included information on who we are and highlights from our recent research we've completed. The Research Profiles include some exciting results examining how childhood spatial skills predict entering a STEM major in college, and investigating the types of language parents use with their children during spatial tasks. We have also been asking questions about how home activities relate to children's spatial and verbal skills, how adults' use of praise and difficulty talk impact children's persistence, and more – stay tuned for results in a future newsletter.

As always, we are very grateful to our school partners, parents, and children who generously give their time to these studies. Without you, we could not answer these exciting research questions. We hope you find the information in this newsletter both interesting and useful. Our contact information is at the end of this newsletter if you have questions or want to know how to get involved in our research. We wish you the best this year and hope to see you soon!

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Liz Gunderson, Ph.D.

Associate Professor of Psychology and Neuroscience, Temple University
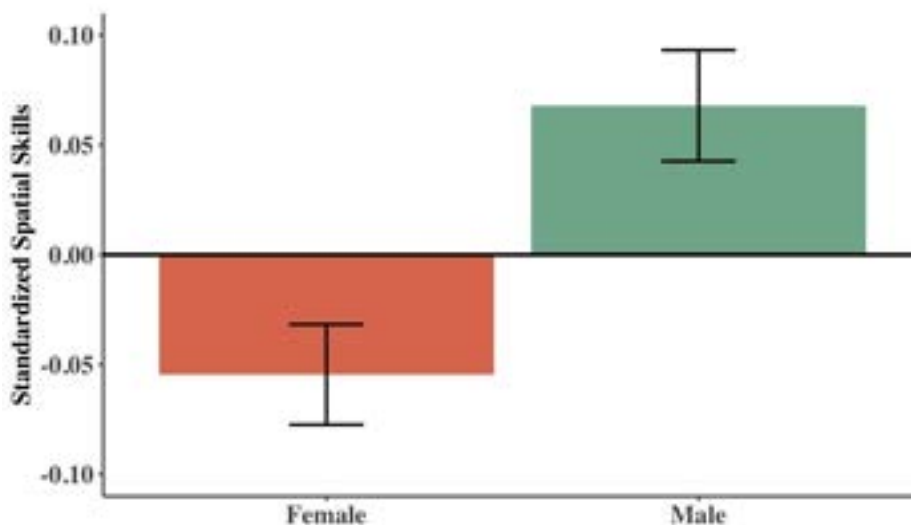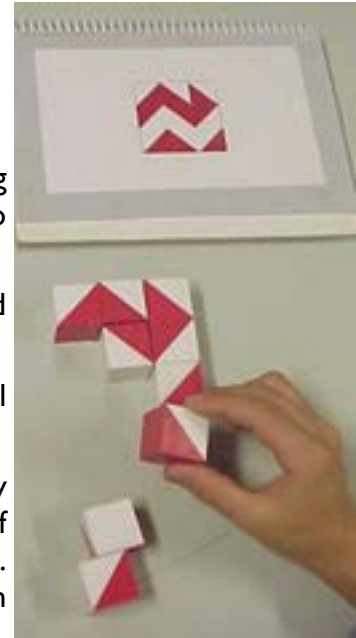
Research Profiles

Childhood Spatial Skills Contributes the Gender Gap in STEM College Majors (Part 1)

Jing Tian, Ph.D.

Over the past 50 years, women have made tremendous progress in education and in the workforce. However, men continue to dominate science, technology, engineering, and mathematics (STEM) domains. Why do fewer women than men pursue STEM fields?

In this project, we examined the role of spatial skills in explaining the gender gap in STEM major choice in college. Spatial skills here refer to the ability to mentally manipulate objects in space and reasoning about spatial relationships. Prior research often found that males on average had better spatial skills than females. Further, spatial skills are essential for success in many STEM domains. We used data from a national longitudinal dataset of 690 children born in 1991 (the NICHD SECCYD). When children were in 4th grade, they completed a spatial skill task where they constructed designs matching sample models or pictures using cubes of red, white, and half red and half white faces (see image to the right). Consistent with prior research, we found boys performed better than girls on this task.
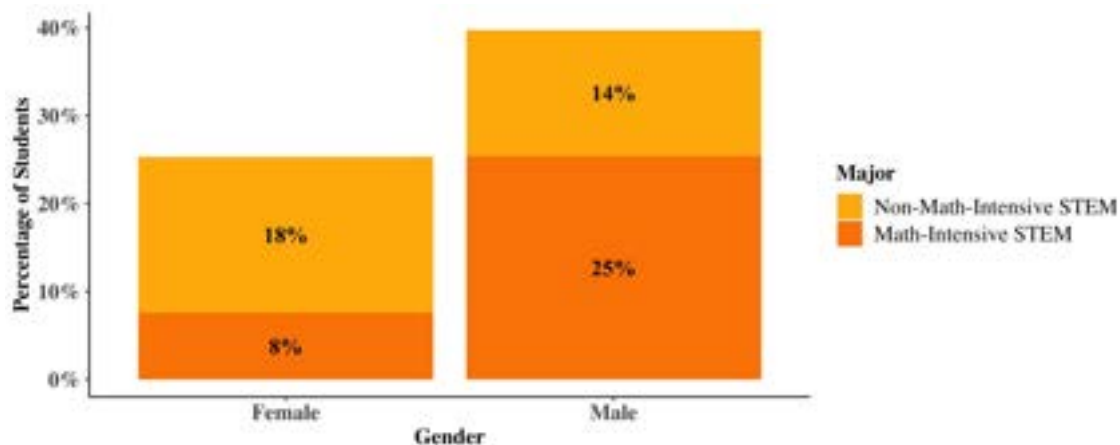
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Research Profiles

Childhood Spatial Skills Contributes the Gender Gap in STEM College Majors (Part 2)

Jing Tian, Ph.D.

These children were followed into adulthood, and they reported which major they took in college. Consistent with the national trend, fewer females than males pursued STEM majors.

We then modeled the relationship between childhood spatial skills and STEM major choice while controlling for cognitive abilities and motivation in math and verbal domains between 4th grade and college. We also controlled for family background variables in the model. Our results showed that strong spatial skills in childhood directly increased the likelihood of choosing STEM majors, above and beyond achievement, motivation, and family background.

The size of the effect of childhood spatial skills on STEM majors is quite notable: Assuming average levels on all predictors in the model except for spatial skills, the probability of entering a math-intensive STEM major was 50% greater for a student with high (one standard deviation above the mean) than low (one standard deviation below the mean) spatial skills in childhood. The probability of entering a non-math-intensive STEM major was 24% greater for a student with high than low spatial skills.

Critically, we also found gender differences in childhood spatial skills partially explained women's underrepresentation in STEM college majors. These results suggest that the gender gap in STEM college majors starts to take shape as early as middle childhood, in the form of a male advantage in spatial skills. Enhancing spatial skills in childhood promises for setting more children, especially girls, on a pathway toward STEM achievement in adulthood.

Tian, J., Ren, K., Newcombe, N. S., Weinraub, M., Vandell, D. L., & Gunderson, E. A. (2022). Tracing the origins of the STEM gender gap: The contribution of childhood spatial skills. *Developmental Science*, e13302.

Research Profiles

Fathers' and mothers' praise and spatial language during play with first graders (Part 1)

Liz Gunderson, Ph.D.

Parents play a crucial role in their child's development. Parents can help children learn by talking about spatial concepts using words like "triangle", "curve", "left" and "edge." Parents' can also support children's motivation by praising them (e.g., "good job trying hard", "great"), while avoiding praise that focuses on personal traits (e.g., "you're smart"). Yet, most past research has studied either spatial language, or praise, but not both – even though they happen in the same interactions. Also, most studies have also only focused on mothers, leaving fathers out of the equation.

In this study, we looked at both *spatial language* and *praise*, from both mothers and fathers, while they played with their 1st grade children. We wanted to know if certain activities would lead to more spatial language and praise from parents. We also asked if parents use more spatial language and praise with boys or with girls. Finally, we wanted to see if children who heard more spatial language and praise would have better math and spatial skills 2-3 years later.

We studied videotaped play sessions from 107 families. The families lived in the Philadelphia area and took part in a longitudinal study of children born in 1991 (the NICHD SECCYD). When children were in 1st grade, they completed a 15-minute play session with their mother, and a separate 15-minute play session with their father. (Most, but not all, children completed both sessions.) In each play session, the parent and child did three activities, shown below. These included an Etch-a-Sketch activity, a block activity (pattern blocks or color cubes) and a simple card game.
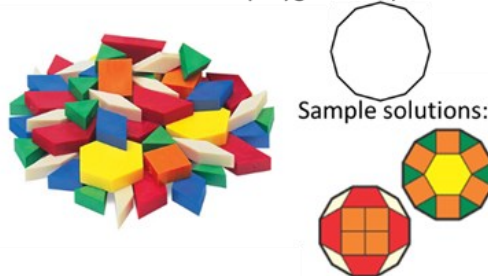

Etch-a-Sketch Task (Mother and Father)
Task: Copy target image. Parent controls one knob and child controls the other.

Pattern Blocks Task (Mother)
Task: Fill the 12-sided polygon 2 ways.

Sample solutions:

Color Cubes Task (Father)
Task: Create two target images (example shown).

Card Games (Mother and Father)

Research Profiles

Fathers' and mothers' praise and spatial language during play with first graders (Part 2)

Elizabeth Gunderson

First, we found that the activities mattered for how parents talked. Mothers and fathers both used more spatial language and more praise during the Etch-a-Sketch and block activity than the card game. The Etch-a-Sketch activity elicited the most spatial language from mothers and fathers. Second, both parents used the same amounts of praise and spatial language with boys and girls. Third, the amount of spatial language and praise was *not* related to better math and spatial skills 2-3 years later. In fact, for boys, hearing more spatial language from their father actually predicted *worse* math achievement. This was surprising, since other studies with 3-5-year-olds found that more spatial language and praise predicted higher achievement. We think that the difference in our results might be because we studied 1st graders instead of 3-5-year-olds. First-graders might need more independence and freedom to think about the activities on their own. In other words, when parents step in and talk too much, that can limit their chances to learn.

Altogether, this study showed remarkable similarities between mothers and fathers, and between boys and girls, in how parents talked. But, our results did not support the idea that "more is better" when it comes to using spatial language and praising children. By 1st grade, children are gaining independence, and parents may need to step back and give support only when it is really needed.

Ren, K., Wang, Y., Weinraub, M., Newcombe, N. S., & Gunderson, E. A. (2022, June 27). Fathers' and mothers' praise and spatial language during play with first graders: Patterns of interaction and relations to math achievement. *Developmental Psychology*. Advance online publication. http://dx.doi.org/10.1037/dev0001410

<u>Meet the Lab</u>

<u>*Dr. Elizabeth Gunderson*</u>

Elizabeth Gunderson, Ph.D., is an Associate Professor in the Department of Psychology and Neuroscience at Temple University and director of the Temple University Cognition & Learning Lab. She received her Ph.D. in Developmental Psychology from the University of Chicago in 2012 and her B.A. in Computer Science & Psychology from Yale University in 2005. Dr. Gunderson's research focuses on the cognitive and socio-emotional factors that affect young children's academic achievement, especially in the domain of mathematics.

<u>*Dr. Jing Tian*</u>

Jing is a post-doctoral researcher in the Department of Psychology and Neuroscience at Temple University. Jing completed her Ph.D. in Psychology at Carnegie Mellon University in 2018 and received her B.S. in Chemistry and Psychology from Peking University in 2013. Jing is interested in children's learning, especially in the area of mathematics. Her research focuses on understanding difficulties children experience during learning and aims to provide insights for more

Meet the Lab

Nadia Tavassolie

Nadia is a doctoral student in Developmental Psychology at Temple University. She received her B.A. at George Washington University double majoring in Anthropology and Human Services & Social Justice. She is interested in how children develop math knowledge, with a focus on social factors that influence academic motivation and achievement in math. She hopes to apply this research towards identifying the most important skills for later math achievement, and to develop tools that can be used at home or in school to cultivate those skills.

Grace Bennett-Pierre

Grace is pursuing her doctoral degree in Developmental Psychology at Temple University, after completing her B.A. in Psychology at Wellesley College in 2016. She has previously studied the development of young children's understanding of difficulty and its use in decision-making as a lab manager for Dr. Hyowon Gweon. In the Temple Cognition & Learning Lab, she is excited to explore how children form domain-specific concepts of difficulty and how these conceptions influence their achievement motivation.

Xinhe Zhang

Xinhe is a doctoral student in Developmental Psychology at Temple University. She received her M.Sc. in Psychology at University of Birmingham in 2017. After graduation, she worked in educational companies to research and develop competence assessments for middle school students and then focus on gamified cognitive ability tests and training for Primary School students. In the Temple Cognition and Learning Lab, she is interested in the development of spatial and numerical processing.

Meet the Lab

Emily D'Antonio

Emily is a full-time lab manager in the Temple University Cognition & Learning Lab. They received their B.A. in Psychology from Catholic University of America in 2021. As a research assistant for Dr. Nancy Adleman, they studied social and attention abilities as well as the impacts of implicit memory on mood recall. They hope to study parent-child interactions with LGBTQ+ populations to understand children's social and cognitive development and school performance.

Lexi Sylverne

Lexi is a full-time lab manager in the Temple University Cognition & Learning Lab. Lexi received their B.A in Psychology with a minor in Gender, Sexuality and Women's Studies from Temple University in 2021. Lexi was previously an undergraduate research assistant for Dr. Gunderson, where they assisted on projects investigating predictors of early math achievement, and how parent-child interactions can influence the development of children's spatial skills. They are interested in researching how to best support mental health and educational performance in children with developmental disabilities, such as Autism Spectrum Disorder and ADHD.
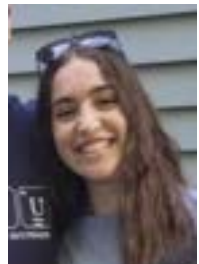
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Meet the Lab

Joei Camarote

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Minor: Cognitive Neuroscience

Ashley Bontempo

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Minor: Criminal Justice, American Sign Language certificate

Katie Probst

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Caitlin Romanelli

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Elisabetta Disalvo

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Minor: Neuroscience

Jada Macksoud

Undergraduate Intern

B.A expected Spring 2024

Major: Psychology

Minor: Cognitive Neuroscience

Taylor Chernuta

Undergraduate Intern

B.A. expected Spring 2023

Major: Psychology

Minor: Adult & Organizational Development

Natasha Vahora

Undergraduate Intern

B.A expected Spring 2023

Major: Psychology

Sherese Bennett

Undergraduate Intern

B.S expected Fall 2023

Major: Neuroscience

Minor: Psychology

Ava Pasewicz

Undergraduate Intern

B.A expected Spring 2024

Major: Psychology

Jules Mirales

Undergraduate Intern

B.A expected Spring 2025

Major: Psychology

Minor: Cognitive Neuroscience

Contact us!

If you would like more information about our research, or are interested in participating, please contact us via e-mail or phone.

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Check us out on the web!
https://sites.temple.edu/cognitionlearning/

Interested in participating in research?

https://redcap.link/TUCLResearch