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Experimental Group Differences in Children's Bracing Ability

Sophia Geisser
Binghamton University--SUNY

Samantha Cintron
Binghamton University--SUNY

Sophie Criss
Binghamton University--SUNY

Kara Gately
Binghamton University--SUNY

Zoe Geisser
Binghamton University--SUNY

See next page for additional authors

Authors
Sophia Geisser, Samantha Cintron, Sophie Criss, Kara Gately, Zoe Geisser, Samanta Herlands, Ariel Kachuro, Vanesa Uhteg, Kimberley William, Danielle Wolfe, and Kayla Yim

Experimental Group Differences in Children's Bracing Ability during STEM Learning

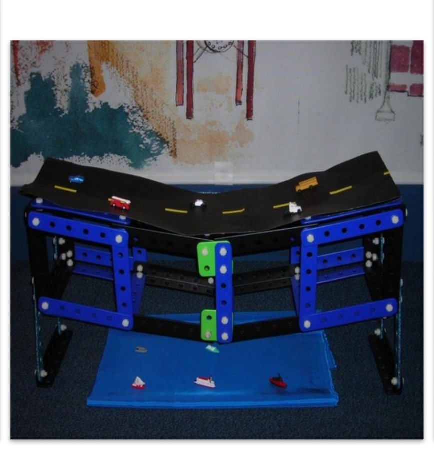
Sophia R. Geisser, Samantha A. Cintron, Sophie Criss, Kara M. Gately, Zoe R. Geisser, Samantha Herlands, Ariel K. Kachuro,Vanessa Uhteg, Kimberley D. Williams, Danielle A. Wolfe, Kayla Yim, Erin Jant
Jant Lab, Binghamton University, Binghamton, NY 13902

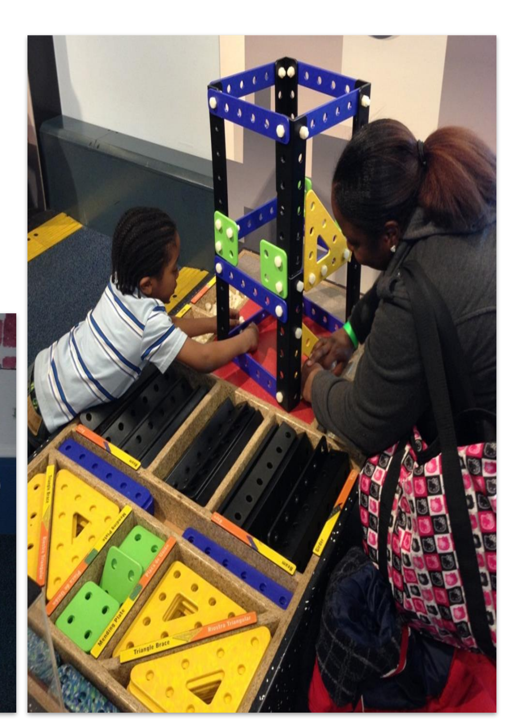
Introduction

- This study will examine how an engineering demonstration of cross-bracing influence children's ability to increase the sturdiness of a skyscraper or bridge.
- Science education research investigates young children's understanding of materials in technological settings linking the concept of matter to tangible properties such as weight or heaviness (Lee, Eichinger, Anderson, Berkheimer, & Blakeslee, 1993; Smith, Carey, & Wiser, 1985).
- Children's comprehension of elements enables them to support and reinforce the structural stability of towers when presented with wobbly structures (Gustafson et al. 1998). Young children understand the relationships between the properties of materials, stability, and bracing during construction (National Association of Advisers and Inspectors in Design and Technology, 1994).
- The Skyline Building at the Chicago Children's Museum hosted an experiment to exhibit STEM learning and the effect of parent-child interactions during a building task.

Method

- There was a sample of 68 families, and the mean age of children is 5 ½ years.
- Families were randomly assigned to two conditions: Demonstration or No Demonstration
- Children completed two tasks:
  - Task 1: Fix a wobbly structure with a parent
  - Task 2: Fix a wobbly structure independently
- Children were asked, *"What stops the wobble?/¿Qué para el bamboleo?"*
- Children predicted the position of a cross bar to "stop the wobble" on a building structure.
- Demonstration of cross bracing principles to increase sturdiness.





Figures

Figure 1

Child with Family Ratio of Functional-to-Total Pieces Added to Structure

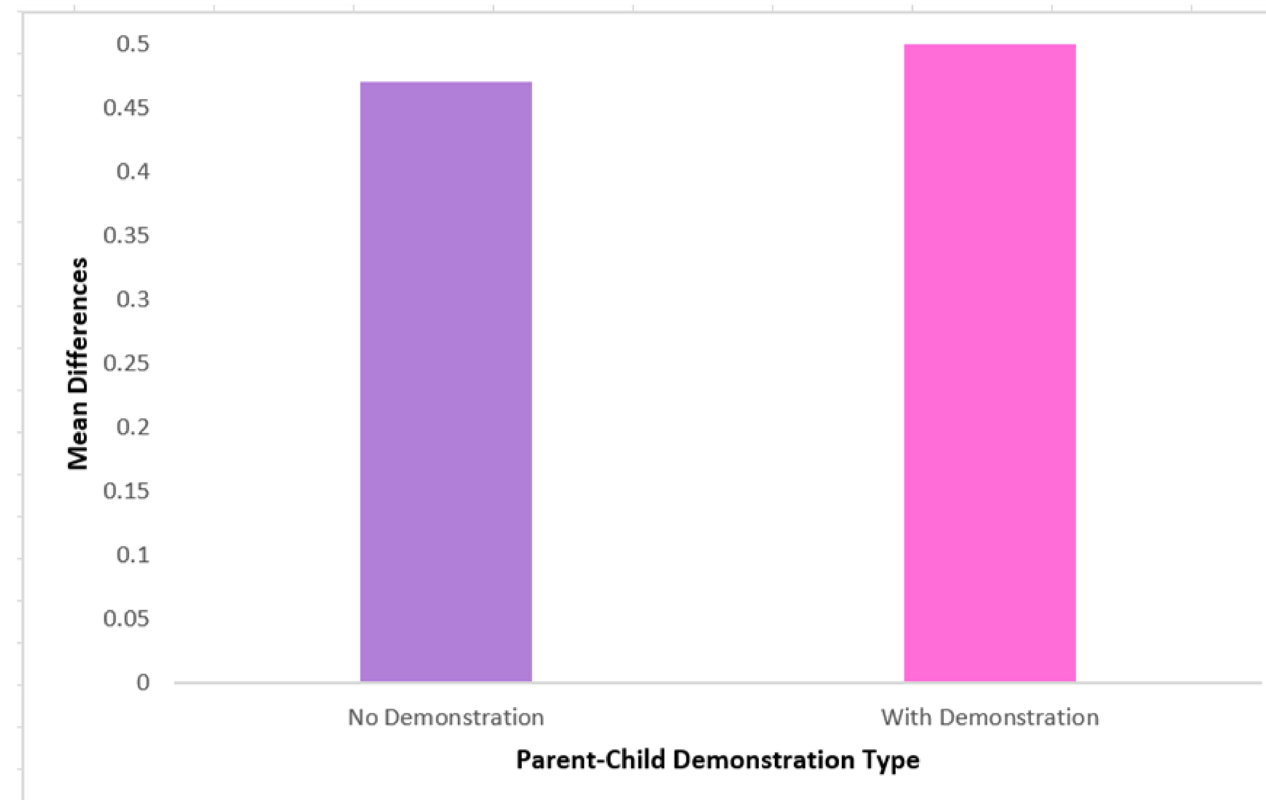


Figure 2

Child Alone Ratio of Functional-to-Total Pieces Added to Structure

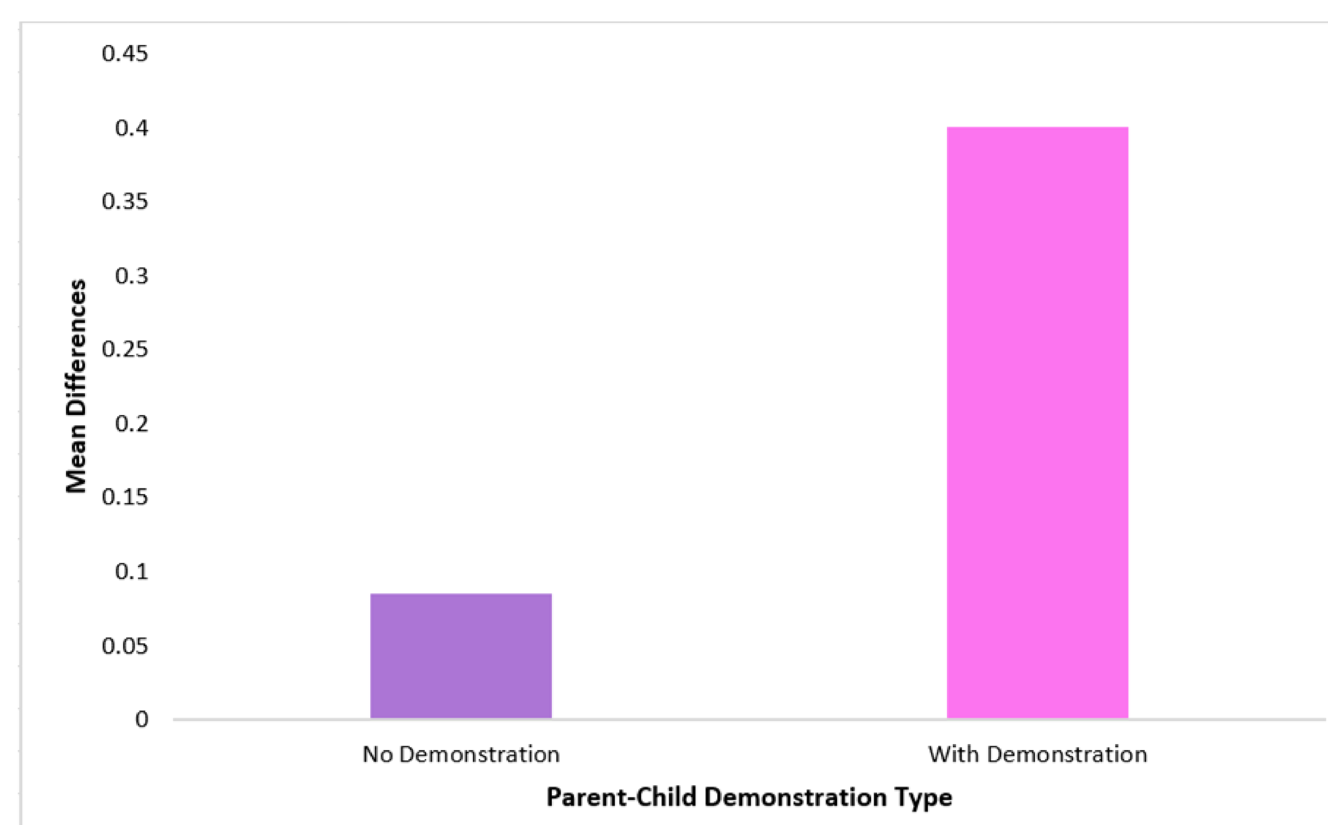
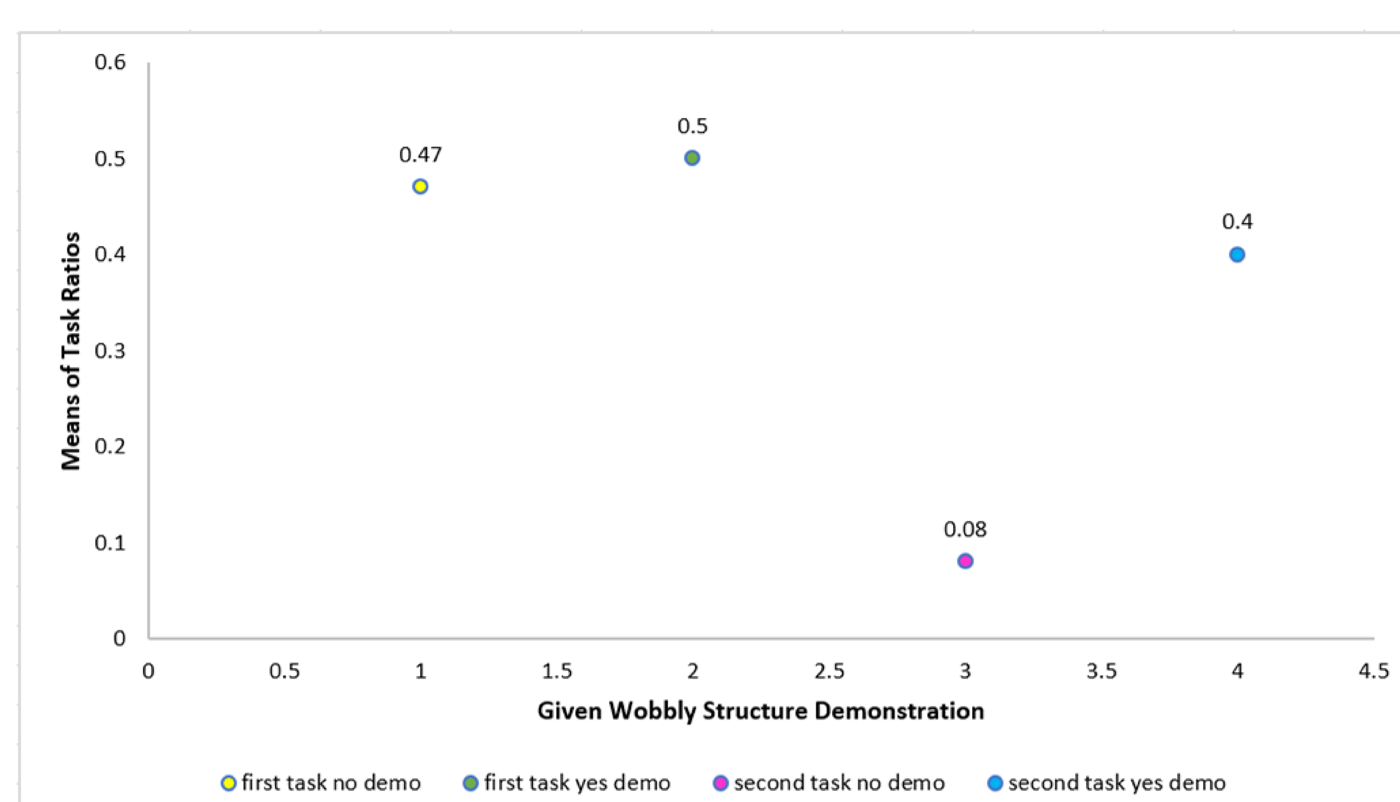


Figure 3

Interaction Between Demonstrations in First Tasks and Second Tasks



Results

- Ratio of functional-to-total pieces such as cross-braces and triangle pieces increased in participants who received a demonstration of cross-bracing principles.
- There is an interaction between the task number and getting the demonstration.
- In task 2, when children are building independently, both experimental and control groups displayed a lower ratio of functional-to-total pieces but children who received the demonstration added more cross-braces.
- Functional pieces increased the stability of each structure.
- $F(1, 57) = 8.26$, $p < .05$, $n^2 = .127$

Discussion and Future Research

- No significant difference was found between children who received a demonstration or did not receive a demonstration when their parent was present during the solving of a simple engineering task.
- Children in the second task added more functional pieces to the structure as opposed to children who did not receive a demonstration prior to completing the task.
- The demonstration condition of engineering concepts prior to a simple engineering task resulted in the transfer of knowledge to help increase sturdiness of a bridge or skyscraper.
- Parents' interactions with children during the completion of the engineering task may have increased the amount of functional pieces used due to discussion of STEM concepts, elaborative talk, or open-ended questions on how to fix the wobbly structure.
- Informal learning settings may consider incorporating core basics of engineering and STEM concepts in fun ways to enhance learning opportunities.
- Future studies could examine the factors that are influencing children to work better alone after the demonstration in Task 1.
- Unequal participants in our control group versus demonstration group could lead to issues in terms of generalizability.

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