Broad definitions of math are linked to lower levels of math anxiety

Rachel Jansen, Ruthe Foushee, Mahesh Srinivasan
University of California, Berkeley

Background

- *Math anxiety* may prevent many from entering STEM workforce (e.g., an estimated 25 - 50% of U.S. college students have math anxiety[1,2])
- Math anxiety can be transmitted from parents to children[3]

➔It is critical to understand how math anxiety can be alleviated in adulthood in order to prevent its transmission.

- Individuals can hold math conceptions that range from **narrow** (*I am only doing math when I do arithmetic*) to **broad** (*Swimming is mathematical because the angle of your arm affects your speed*).
- We explore whether the breadth of an individual's definition of math—their "math conception"—might be linked to their math anxiety.

We hypothesize that because individuals with a broader math conception may have more opportunities to recognize their own math engagement or expertise, they may also experience less math anxiety. Narrow math conceptions may instead be a risk factor for math anxiety.

Research Questions

- **How do individuals' math conceptions vary?**
- **Is math anxiety related to math conception?**

Study 1: Adults

Methods

Study 1 investigated adults' attitudes toward math and the breadth of their math conceptions.

Participants: 62 adults were recruited via Amazon's Mechanical Turk (19-74 years, M = 33.24). In one block, we assessed their math anxiety using the single item math anxiety scale[4]:

On a scale from 1 to 10, how math anxious are you?

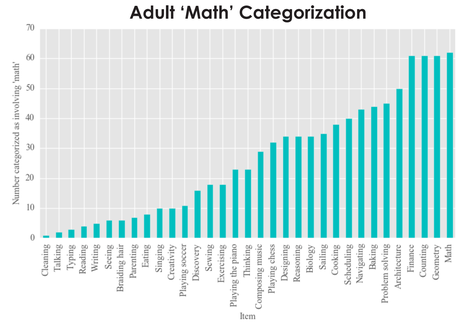
In another block, participants saw a list of topics or activities and indicated whether or not each "involved math":

- Thinking
- Sailing
- Counting
- Architecture
- Finxance
- Braiding hair
- Sewing
- Exercising
- Cleaning
- Singing
- Playing soccer
- Playing chess
- Composing music
- Parenting
- Seeing
- Discovery
- Geometry
- Writing
- Typing
- Eating
- Playing the piano
- Navigating
- Scheduling
- Creativity
- Problem solving
- Talking
- Baking
- Cooking
- Biology
- Reading
- Designing
- Reasoning

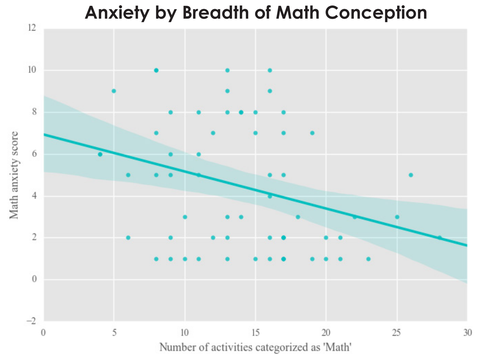
Study 1: Adults, cont.

Results

There was substantial variation in the activities that participants considered to involve "math":



Critically, math anxiety was negatively related to the number of activities adults categorized as "math," even after controlling for education (p = 0.01):



Study 2: Children

Methods

Participants: 19 children (4.13-7.48 years, M = 5.64). In one block, we probed children's beliefs and attitudes about math in a structured interview. In another, we showed participants images of children engaged in different activities:

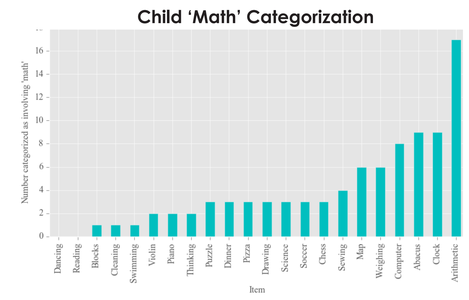



After showing each image, we asked:
"*Is this kid doing math?...Why/why not?*"

Study 2: Children, cont.

Results

Preliminary results indicate considerable variation in children's math conceptions:



There was also variation in their math anxiety levels (e.g., five children were 'nervous' about math). Children's qualitative explanations of math-involvement ranged from invoking abstract or spatial concepts (e.g., "piano-playing is math because the keys are in a pattern"), to exclusively identifying math with symbolic numbers or traditional manipulatives.

Conclusions

- Both adults and young children have varied conceptions of math.
- Individuals whose conceptions of math are broad enough to support them identifying 'math' in diverse activities are less likely to experience math anxiety.
- Math conceptions are distinct from math experience or education.

Future Directions

- Along what other qualitative dimensions, beyond breadth, do math conceptions vary?
- What is the causal relationship between math conceptions and math anxiety?
- Can interventions aimed at individuals' ideas of what counts as "math" broaden their math conceptions?
- Could they lower math anxiety?

References

1 Jones, W. G. (2001). Inquiry, 6(2), 60–65.
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4 Núñez-Peña, M. I., Guilera, G., & Suérez-Pellicioni, M. (2013). Journal of Psychoeducational Assessment, 20(10), 1–12.