

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

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## Background

- *Math anxiety* may prevent many from entering STEM workforce (e.g., an estimated 25 - 50% of U.S. college students have math anxiety<sup>2,3</sup>)
  - Math anxiety can be transmitted from parents to children<sup>4</sup>
- It is critical to understand how this anxiety can be alleviated in order to prevent its transmission.

We explore whether the breadth of an individual's definition of math—their “math conception”—might be linked to their math anxiety.

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*).

## Research Questions

- Do individuals' math conceptions vary?
- Is math anxiety related to math conception?

Because individuals with a broader math concept may have more opportunities to recognize their own math engagement or expertise, they may also experience less math anxiety.

## 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<sup>5</sup>.

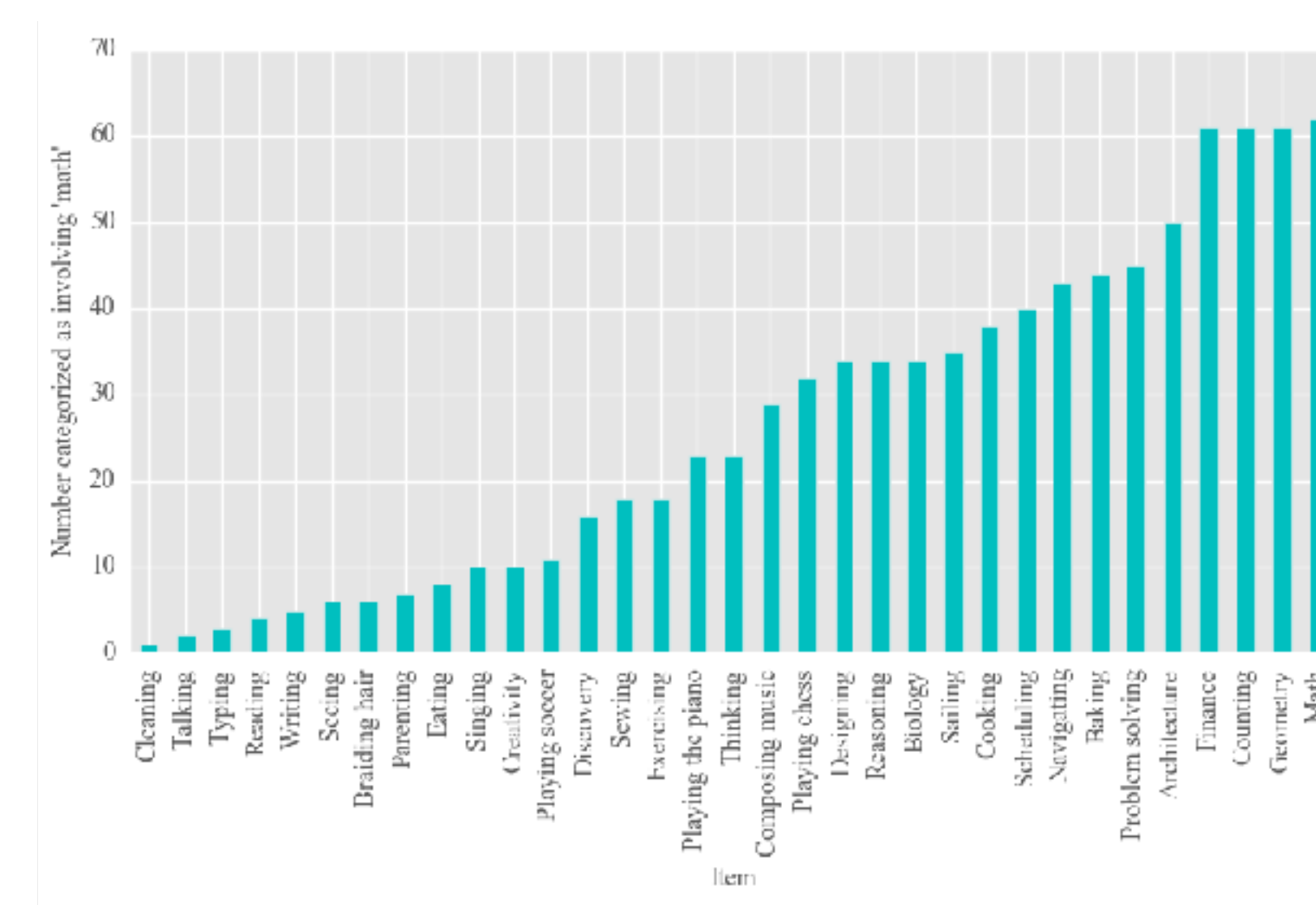
In another block, we gave participants a list of topics and asked them to indicate whether or not each “involved math.” These items were:

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

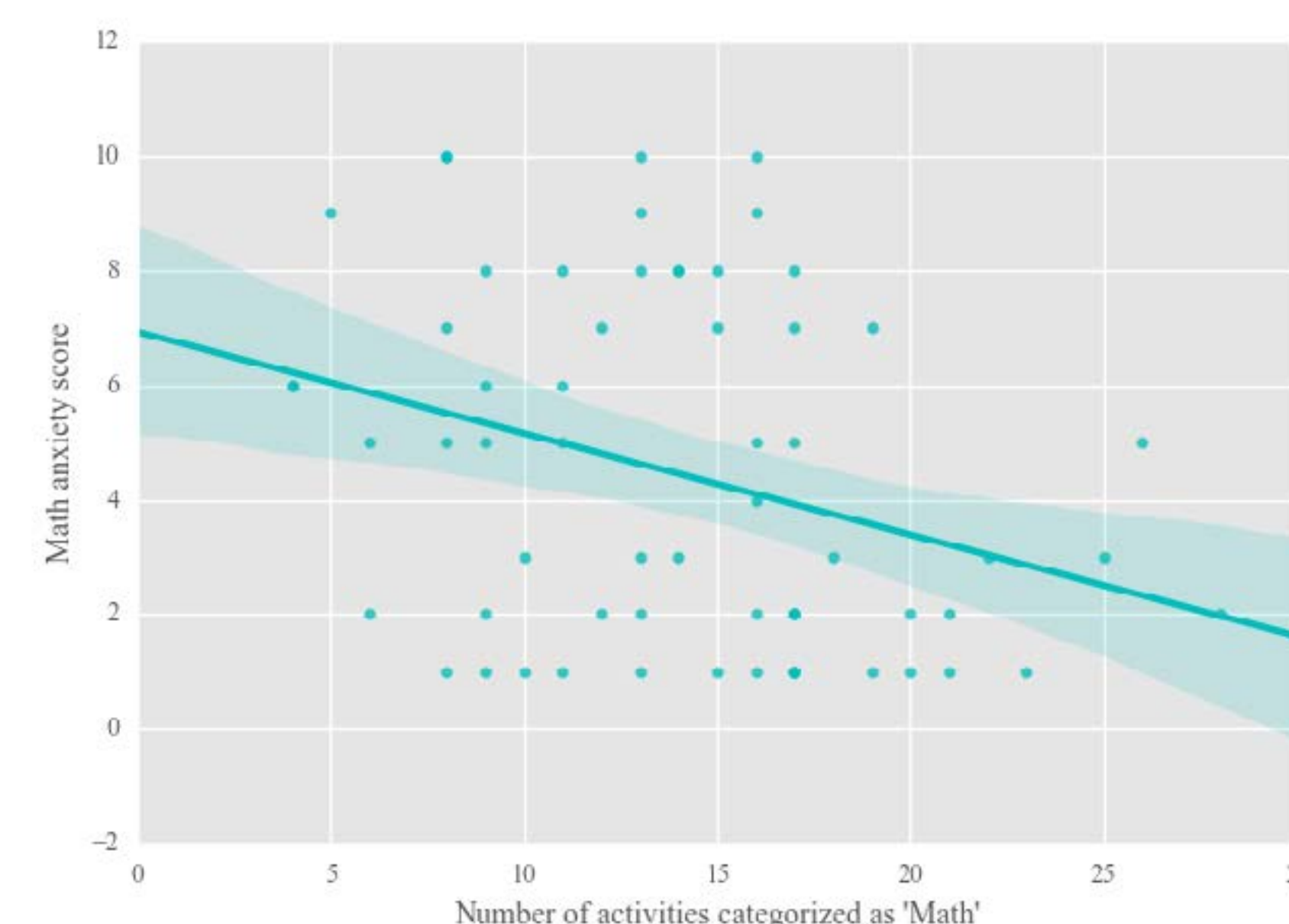
## Study 1: Adults, cont.

### 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:

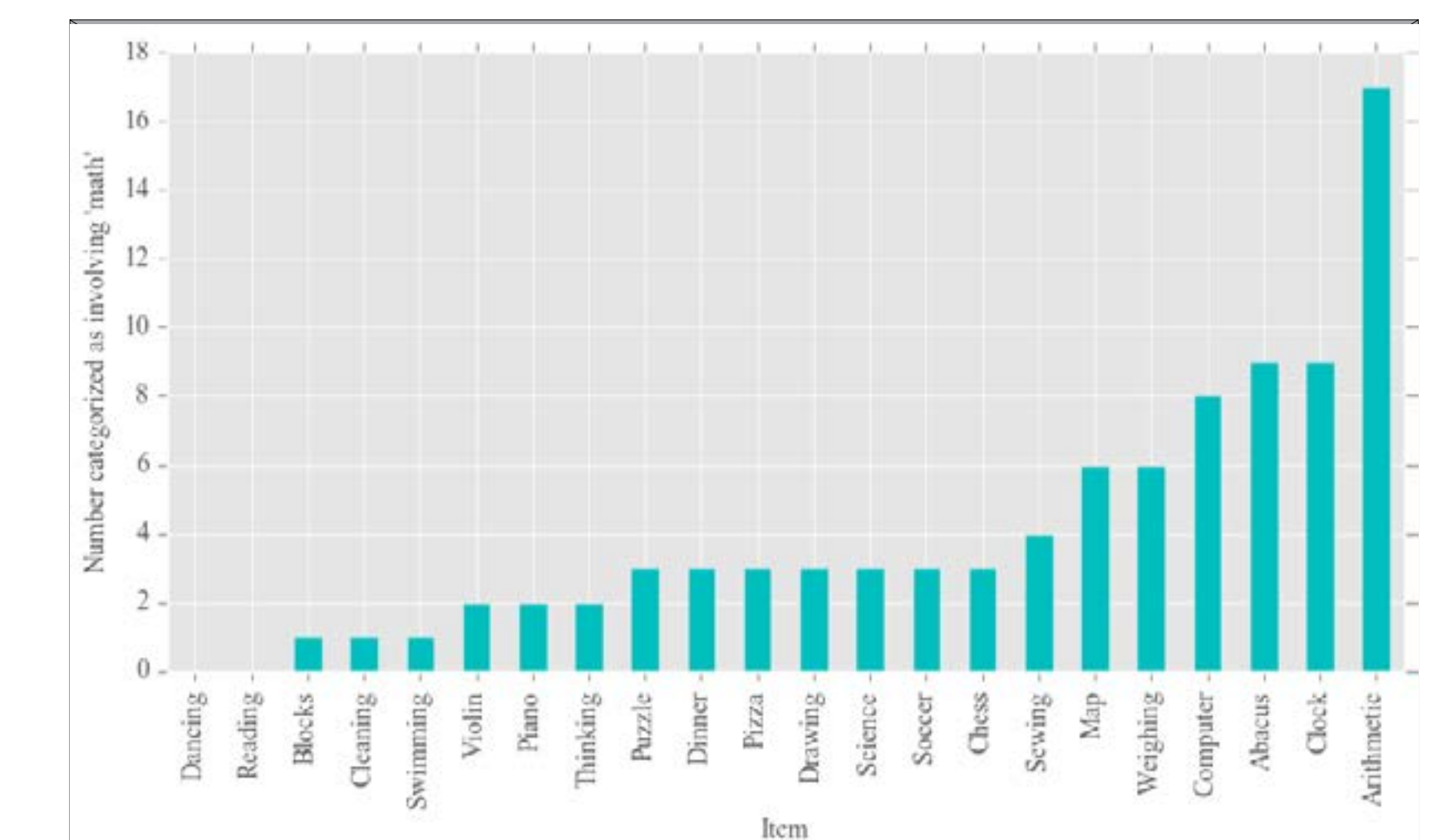


After showing each image, we asked:  
“Is this kid doing math?...Why/why not?”

## Study 2: Children, cont.

### Results

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



There was also variation in their math anxiety levels (e.g., five children were ‘nervous’ about math). Children's qualitative definitions of “math” ranged from broad ones invoking spatialization (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.
- There is a relation between adults' levels of math anxiety and the ‘breadth’ of their math conceptions
- In particular, individuals with broader math conceptions are less likely to experience math anxiety.

## 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

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