



“In Math Class, I am Confident in Solving Word Problems”: Creating a Strengths-Based Mathematics Survey



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Introduction

- Children’s beliefs about their math competence and interests are related to their later mathematical achievement.¹
- Prior measures of beliefs about math competence often have focused on math learning and skills more generally.²
- However, the strengths children believe they bring to math class can vary across dimensions beyond just math skills.
- Understanding children’s beliefs about the various strengths they bring to the classroom could provide insight into how teachers and researchers can build on these strengths to promote mathematical achievement.⁴

Current Study

- We have developed a strengths-based mathematics questionnaire to understand fourth and fifth-grade children’s beliefs about their strengths in the math classroom.
- This survey was created with input from focus groups with teachers.
- In **study one** we piloted a 21-item questionnaire examining underlying components and create hypothesized subscales of strengths children might hold.
- In **study two** we examined how a shortened questionnaire (16-items) related to various math skills and beliefs.

Study 1: Survey Creation

Sample

- The sample contains 107 fourth (N = 63) and fifth graders (N = 45). These children were recruited from 5 different classrooms in the same school district in Massachusetts.
 - Girls = 40, Boys = 51, Prefer Not to Say = 16
 - Data was collected Spring 2021 as part of a larger study

Procedure

- Children completed a 21-item questionnaire where they indicated how confident they are in various aspects of math class.

When I am in math class I am confident in...



Analysis

- Scale reliability was good ($\alpha = .88$).
- Data was transformed to account for nested variables.
- Velicer’s MAP test indicated that two components could be extracted.
- An exploratory principal component analysis (PCA) with Promax rotation was conducted identifying two components, “problem solving skills” ($\alpha = .87$) and “peer help seeking skills” ($\alpha = .73$).

Study 1: Results

Problem Solving Skills

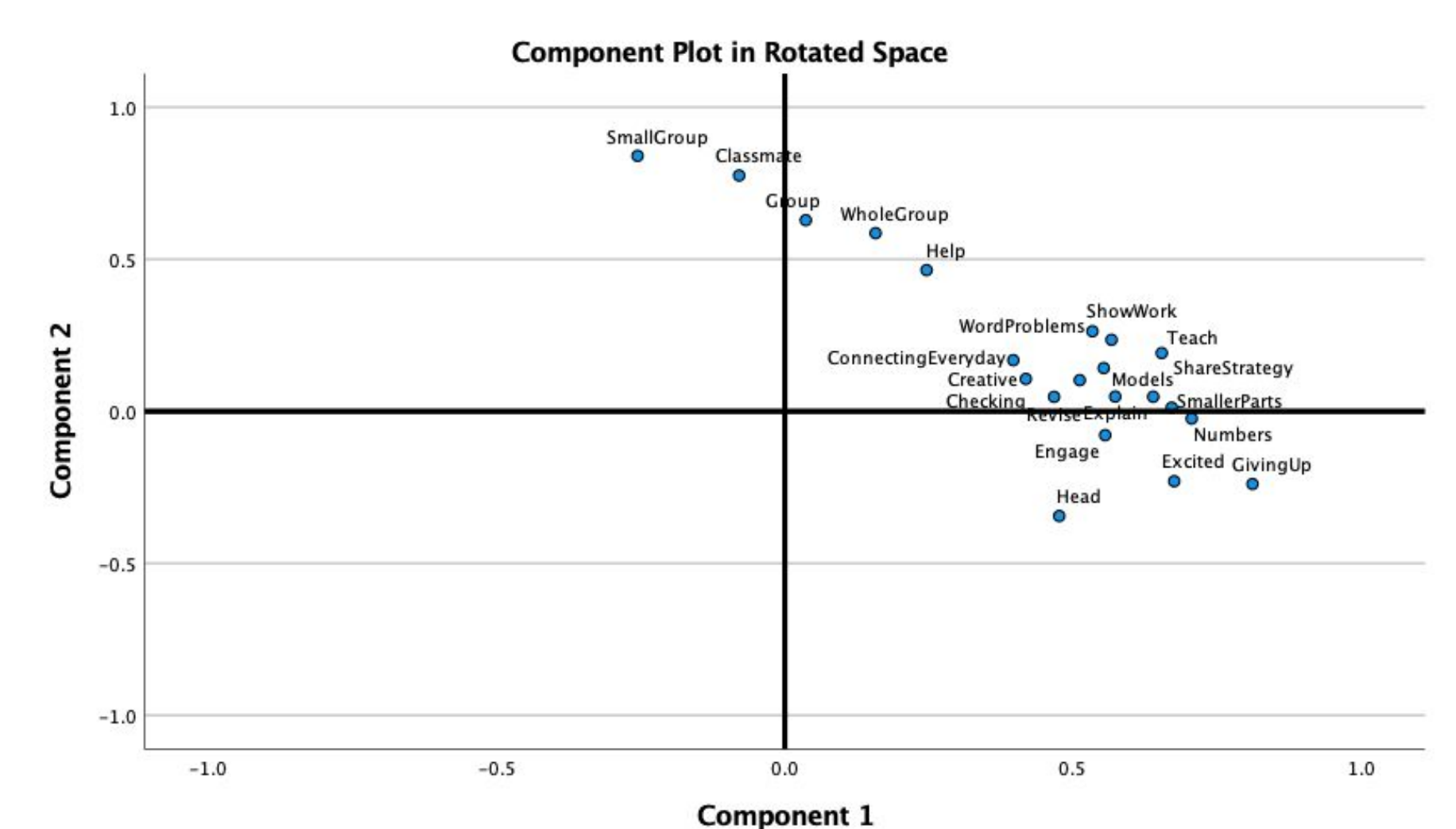
Question

Explaining how I solved a problem
Connecting math to things I do and see everyday
Thinking of creative ways to solve tricky problems
Changing my thinking when my strategy does not work
Working on problems and not giving up even when they are hard
Being excited to learn new topics in math
Participating in the activity my teacher presents
Going back through and checking my work
Breaking down big problems into smaller problems
Solving problems with pictures/models
Solving problems with numbers and equations
Solving word problems
Solving math problems only in my head
Showing my work
Teaching my classmates how to understand a problem
Sharing different math strategies I use with my classmates

Peer Help Seeking Skills

Question

Asking for help when I am working in small groups
Asking my classmates for help
Asking questions in whole group discussions
Knowing when to ask for help in math class
Working with a group on a math problem



21 questions administered organized by component.

Highlighted question indicate lower loadings (less than .5). These questions were removed for study two.

Study 2: Survey Correlates

- The sample contains 212 fourth graders (Girls = 94, Boys = 82, Other = 6, Prefer Not to Say = 30)
 - These children were recruited from 7 different classrooms in two school districts in Southern California.
- Data was collected in Spring 2023 as part of a larger study.
- Children completed a 16 item strengths-based survey.
- They also completed a growth mindset survey and assessments of math knowledge: fractions knowledge, fact fluency, magnitude comparison, number line estimation.

Discussion

- A strength-based survey could provide insight into children's beliefs about their math skills.
- The survey also highlights additional components of individual differences such as the malleability of math skills and social aspects of mathematical learning.

Study 2: Results

Both Peer Help Seeking and Problem Solving skills were correlated with growth mindset scores. Problem Solving Skills was correlated with math scores on fact fluency and magnitude comparison.

Table 1: Correlations of measures with strength survey sub-scale

	Problem Solving Skills	Peer Help Seeking Skills
Peer Help Seeking Skills	0.47***	1
Growth Mindset	0.49***	0.3***
Fractions	0.11	-0.08
Fact Fluency	0.24***	-0.08
Number Line	0.25***	-0.09
Magnitude Comparison	0.1	-0.12

References

- 1) Susperreguy, M. I., Davis-Kean, P. E., Duckworth, K., & Chen, M. (2018). Self-Concept predicts academic achievement across levels of the achievement distribution: Domain specificity for math and reading. *Child Development*, 89(6), 2196–2214. <https://doi.org/10.1111/cdev.12924>
- 2) Simpkins, S. D., Davis-Kean, P. E., & Eccles, J. S. (2006). Math and science motivation: A longitudinal examination of the links between choices and beliefs. *Developmental Psychology*, 42(1), 70–83. <https://doi.org/10.1037/0012-1649.42.1.70>
- 3) Kobett, B. M., Karp, K. S., & Fennell, F. (2020). *Strengths-based teaching and learning in mathematics: 5 teaching turnarounds for grades K-6*. Corwin.