FRACTIONS & ALGEBRA PROJECT

Fractions or Decimals?
A Study of Patterns of Representational Flexibility

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BACKGROUND

- Learning rational numbers is fundamentally difficult (Siegler & Lortie-Forgues, 2017).
- Children's representational flexibility in fractions and decimals relates to their problem-solving ability (Gagatsis et al, 2016).
- The choice to use fractions or decimals is a strategic decision that may affect accuracy on mathematics tasks.

RESEARCH QUESTIONS

RQ1: How many students use decimal representations on fraction and algebra tasks for which they were asked to use exact answers?
RQ2: How do students' strategy profiles relate to their accuracy on fraction and algebra tasks?
RQ3: How do students' strategy profiles relate to their individual cognitive skills?

METHODS

Participants

- 291 students from grades 7 to 9 in the US
- 53.6% male, 44.7% female, 2.1% other/non-binary
- 70.6% White, 17.9% Asian, 5.5% Black, other < 3% each
- Data used here was collected as part of a larger project investigating relations between fraction concepts and algebra concepts.

Fraction and Algebra Tasks

Fraction Arithmetic

Items assessing arithmetic fluency using fractions.

$\frac{3}{8} + \frac{2}{8} =$

Long Division

Items assessing numerical fluency and procedural accuracy.

400⟌1400 8⟌56

Algebra

Items assessing reasoning about expressions, equations, functions, proportions and generalized arithmetic.

Solve the equation: $\frac{6}{b} = 9$

Solve the equation: $\frac{14}{x} = \frac{21}{30}$

Solve the equation: $5(y-2) = -3(y-2) + 4$

Cognitive Skill Tasks

Backward Digit Span

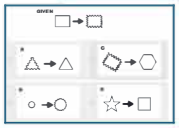
Items assessing working memory by testing ability to recall a series of numbers in reverse order.

Ravens

Items assessing fluid intelligence and nonverbal reasoning.

TORR

Items assessing relational reasoning.

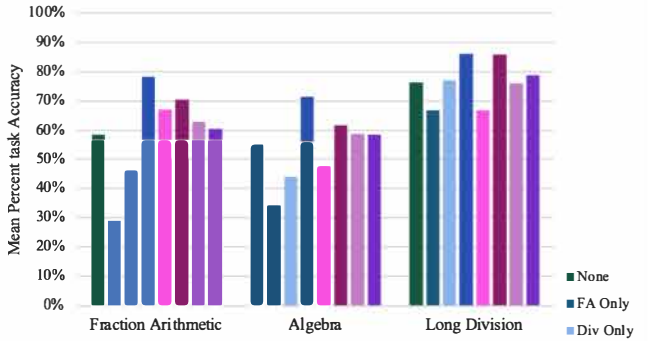


RESULTS

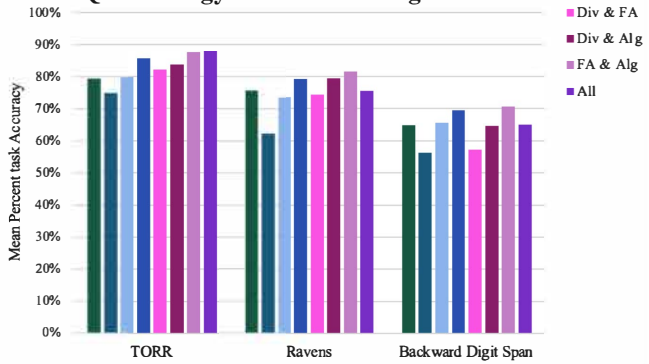
Strategy Profile **RQ1**

Strategy Name	Description	Number of Students
None	Students didn't use decimals on any of the tasks (Fraction Arithmetic, Long Division and Algebra)	50
Fraction Arithmetic Only	Students use decimals only on Fraction Arithmetic	4
Long Division Only	Students use decimals only on Long Division	24
Algebra Only	Students use decimals only on Algebra	100
Long Division and Fraction Arithmetic	Students use decimals only on Long Division and Fraction Arithmetic	7
Long Division and Algebra	Students use decimals only on Long Division and Algebra	60
Fraction Arithmetic and Algebra	Students use decimals only on Fraction Arithmetic and Algebra	23
All	Students use decimals on all tasks (Fraction Arithmetic, Long Division and Algebra)	25

RQ2: Strategy Profiles and Fraction and Algebra Tasks



RQ3: Strategy Profiles and Cognitive Skills



CONCLUSIONS

- There are differences in accuracy on fraction and algebra tasks between the profiles, suggesting that strategic choices about representational flexibility matter.
- There are no large differences in accuracy on cognitive skill tasks between the profiles.

Future directions:

- Test instructional strategies to improve representational fluency between fractions and decimals.
- Examine how representational fluency develops over time.

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