



# Procedural Fluency and Strategy Selection in Mathematics



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## Background

- Procedural fluency: the ability to apply procedures accurately and efficiently.
- Strategy selection: The ability to select a more efficient strategy during problem solving with less effort and fewer errors.
- Procedural fluency is positively correlated with math achievement, but the relationship between procedural fluency and strategy selection is unclear
- Aim: Investigate the relationship between procedural fluency and strategy selection in the domain of algebra.

Table 1: Examples of standard and innovative strategy

Problem	Standard Strategy	Innovative Strategy
$4(x + 1) = 16$	Distribute the parenthesis: $4x + 4 = 16$	Divide the same constant on both sides: $x + 1 = 4$
$4(x + 1) + 2(x + 1) = 12$	Distribute the parenthesis: $4x + 4 + 2x + 2 = 12$	Combine like terms: $6(x + 1) = 12$
$4(x + 1) = 12 + 2(x + 1)$	Distribute the parenthesis: $4x + 4 = 12 + 2x + 2$	Subtract the same term from both side: $2(x + 1) = 12$
$\frac{4x+4}{4} + \frac{3x+3}{3} = 4$	Find the common denominator before adding: $\frac{(4x+4) \times 3}{4 \times 3} + \frac{(3x+3) \times 4}{3 \times 4} = 4$	Reduce the fraction before combining: $x + 1 + x + 1 = 4$

Figure 1. Example Item from the Procedural Fluency Task

$$\frac{1}{2}x = 9 - 7 \qquad x =$$

Figure 2. Example Item from Strategy Selection Task

1.  $4(x - 2) = 24$

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## References

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## Methods

### Participants:

103 middle and high school students in grades 8-12.

### Measure

#### Procedural fluency task:

24 simple linear algebra task within 3 minutes

#### Strategy selection task:

12 algebraic linear equation task. Coded the strategy to be innovative or standard.

### Analysis

Pearson Correlation between procedural fluency task accuracy and frequency of innovative strategy used during the strategy selection task.

## Result and Discussion

- Weak positive correlation between procedural fluency and strategy ( $r(103) = .33, p < .001$ )
- The better a student's ability to retrieve procedural knowledge, the more innovative their strategy may be
- Educational Implications:
  - Emphasize on procedure execution
  - Give more practice examples
- Future Direction:
  - Provide insight into students' problem solving behaviors.
  - Laid foundation for future interventions.

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