Investigating Potential Strategy Flexibility in Linear Algebra

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Introduction

- The frequent problem within the education system is recalling ways to solve a problem using the most effective method.
- Participants have trouble using the most effective solution
- Knowledge of strategies are related to strategy selection (Xu et al.,2017; Liu et al., 2018)
- Current study investigates potential strategy flexibility.
- potential strategy flexibility:
  - knowledge of the strategy
  - knowledge of multiple strategies
  - knowledge of strategy efficiency
- We predict that participants with more knowledge of multiple strategies will have high knowledge of strategy validity and strategy efficiency.

Abstract

Previous studies have found that students know multiple strategies to solve a given problem but do not always use the best strategy to solve it (Liu et al., 2018; Hickendorff, 2020). The current study is interested in investigating potential strategy flexibility. We define potential strategy flexibility as consisting of knowledge of strategy validity, knowledge of multiple strategies, and knowledge of strategy efficiency. We predict that students with more knowledge of multiple strategies will have high knowledge of strategy validity and strategy efficiency. In the current study, college students were given three different tasks in algebra. To assess their knowledge of multiple strategies, participants were given 12 linear equation problems and asked to generate as many solutions as possible. To assess their knowledge of strategy validity, participants received 36 solved linear equation problems. The solutions reflected standard strategies, innovative strategies, and wrongly executed strategies and participants were asked to judge the validity of each solution. We tested their knowledge of strategy efficiency by showing them two different solutions for the same problem, reflecting the standard and innovative strategy, and asking them to choose the strategy they think is better. The current study is still ongoing, result will be available by the time of the symposium.

Methods

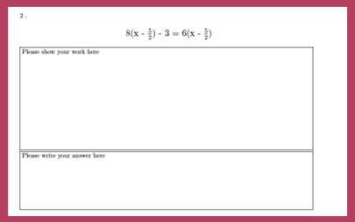
Participants

- 11 undergraduate students from a large public university located in the south of U.S
- 2 participants completed the knowledge strategy validity task and the knowledge of strategy efficiency task.

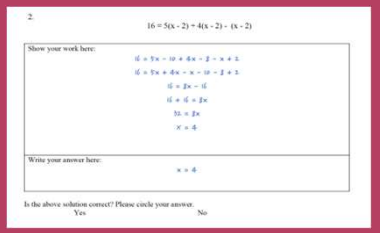
Measure

Problem	Standard algorithm		Innovative strategy	
$4(x-2)=24$	Begin by distributing the parentheses	$4x-4\times2=24$	Divide a constant to both sides before distributing	$x-2=24/4$
$5\left(x+\frac{3}{7}\right)+3\left(x+\frac{3}{7}\right)=16$	Begin by distributing the parentheses	$5x+5\times\frac{3}{7}+3x+3\times\frac{3}{7}=16$	Change in variable-combine	$8\left(x+\frac{3}{7}\right)=16$
$5(x+0.6)+3x=5(x+0.6)+7$	Begin by distributing the parenthesis	$5x+3+3x=5x+3+7$	Change in variable-subtract from both	$3x=7$
$\frac{2x-6}{2}+\frac{6x-18}{3}=5$	Begin by obtaining a common denominator for the two algebraic expressions	$\frac{3(2x-6)}{3\times2}+\frac{2(6x-18)}{2\times3}=5$	Reducing each fraction before combining	$(x-3)+(2x-6)=5$

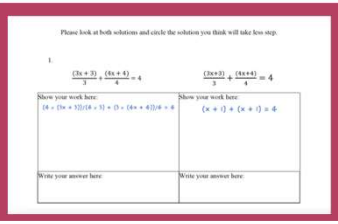
Knowledge of multiple strategies
Participants were asked to generate as much different strategies to a given algebra problem



Knowledge of Strategy Validity
Participants were asked to judge the validity of a given solution (standard, innovative, wrong)



Knowledge of Strategy Efficiency
Participants compared two solutions (standard vs. Innovative)



Results

Discussion

- On average participants have low knowledge to give multiple strategies to solve the problems
- They do not always view innovative strategies are valid
- They do not view innovative strategies as more efficient
- Our results are different from past studies because our participants have lower knowledge of multiple strategies
- Demonstrating innovative strategies in school can help students create multiple ways to solve problems

References

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Xu et al. (2017). Measures of potential flexibility and practical flexibility in equation solving. *Frontiers in psychology*