Feedback Both Helps and Hinders Mathematics Problem Solving

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Focus

Does feedback facilitate learning during math problem solving?

Do the effects of feedback depend on the learner's prior knowledge?

Background

Feedback often improves learning and is highly recommended (Alfieri et al., 2011; Hattie & Gan, 2011).

However, feedback effects vary widely and are not universally beneficial (Kluger & DeNisi, 1996).

Recent research suggests feedback may benefit low-knowledge learners, but not moderate-knowledge learners (Fyfe et al, 2012).

Raises question as to whether teachers and parents should provide feedback early in the learning process.

Goals

Test whether familiarity with a correct strategy predicts if feedback will have positive or negative effects (using prefamiliarization technique; Petersen & McNeil, 2013).

Examine impact of feedback on strategy discovery and use.

Method

PARTICIPANTS
108 children who could *not* solve math equivalence problems correctly (ages 7 – 9; *M* age = 8.4 years; 67 girls, 41 boys).

DESIGN AND PROCEDURE
Children participated in a one-on-one tutoring session followed by an immediate posttest. They were assigned to one of four conditions based on a crossing of two factors: strategy instruction (yes vs. no) and feedback (present vs. absent).

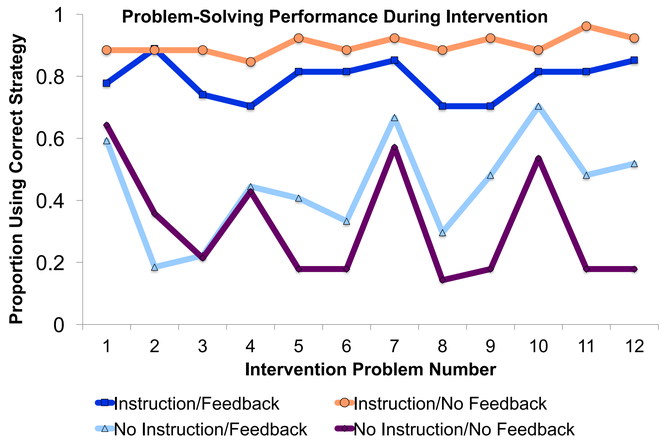
Conditions

KNOWLEDGE MANIPULATION
First, we manipulated children's knowledge. Children in the ***Instruction*** group received instruction on a correct strategy. Children in the ***No-Instruction*** group completed a filler task.

FEEDBACK MANIPULATION
Second, children solved 12 math equivalence problems. Children in the ***Feedback*** group received trial-by-trial right/wrong feedback, and children in the ***No Feedback*** group did not.

Results: Intervention and Posttest

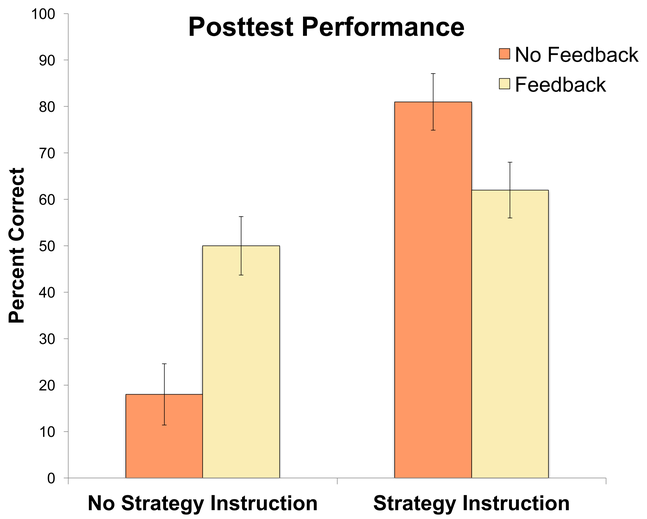
INTERVENTION PROBLEM SOLVING
For *no-instruction* group, feedback facilitated generation and use of correct strategies. For *instruction* group, feedback facilitated generation and use of incorrect strategies.



Prototypical Strategy Activity by Condition		
	No Feedback	Feedback
No Instruction	Perseverate on same incorrect strategy	Generate new correct strategy
Instruction	Perseverate on same correct strategy	Generate/use variety of incorrect strategies

POSTTEST PERFORMANCE
Significant feedback by instruction interaction, $F(1, 93) = 16.80$, $p < .001$, $\eta_p^2 = .15$.
Positive effect of feedback for no-instruction group, $p < .001$.
Negative effect of feedback for instruction group, $p = .03$.

Posttest Assessment	
Learning Items	Transfer Items
8 = 6 + __	__ + 2 = 6 + 4
3 + 4 = __ + 5	8 + __ = 8 + 6 + 4
3 + 7 + 6 = __ + 6	5 + 6 – 3 = 5 + __
7 + 6 + 4 = 7 + __	5 – 2 + 4 = __ + 4



Conclusions

Feedback can have both positive and negative effects; depends on prior knowledge.

Children with no knowledge of a correct strategy learned more when they received feedback, but children with knowledge of a correct strategy learned more without feedback.

Feedback impacts strategy use during problem solving.

It reduced perseveration and supported generation of correct strategy for low-knowledge group (Phye & Bender, 1989).

Implications

There is a time for exploration without external guidance. Don't always need to "rescue" learners (NCTM, 2014).

Learner characteristics matter and can determine whether a technique will be effective.

References

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