When does feedback help?

The impact of human- versus computer-generated feedback on mathematics problem solving

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Focus

Does feedback facilitate learning during math problem solving?

Do the effects of feedback depend on the source or timing of feedback?

Background

Feedback effects vary and are not universally beneficial (Hattie & Gan, 2011).

A leading theory suggests feedback may be less helpful when it directs attention to the self (e.g., I got that wrong so I must not be smart) and away from the task (Kluger & DeNisi, 1996, 1998).

Feedback source may matter. Computer feedback is viewed as less evaluative than person feedback and may focus attention on the task (Karabenick & Knapp, 1988).

Feedback timing may also matter (Kulik & Kulik, 1988). Immediate feedback can draw attention to the self during the task and disrupt processing. Summative feedback can still draw attention to the self, but does so after the target task.

We examined the source and timing of feedback for children solving math equivalence problems.

Experiment 1: Person Feedback

Experiment 2: Computer Feedback

PARTICIPANTS

Second- and third-grade children ages 7 – 9 (n = 101 in Exp. 1, n = 75 in Exp. 2) who scored below 80% correct on a math equivalence screening measure. From one of five ethnically-diverse schools.

DESIGN AND PROCEDURE

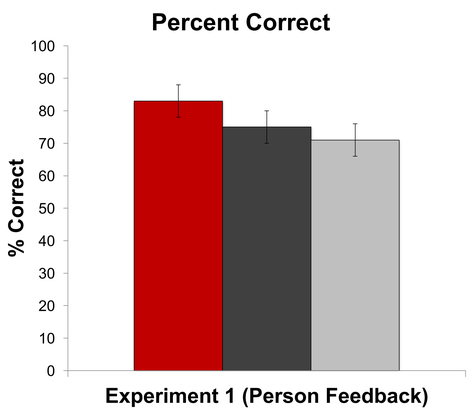
Children participated in a one-on-one tutoring session followed by a posttest. Children first received instruction on a correct problem-solving strategy from an adult tutor. Then, children solved 12 math problems on the computer. In both experiments, children were randomly assigned to receive no feedback, immediate feedback after each problem, or summative feedback after all the problems.

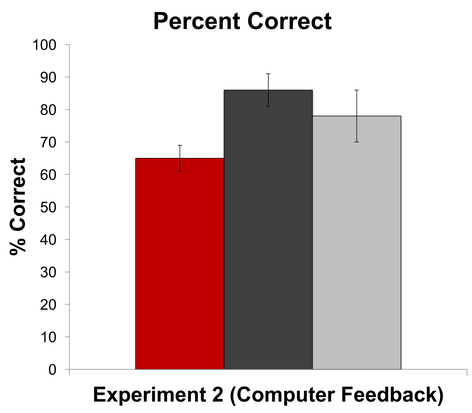
KEY DIFFERENCES

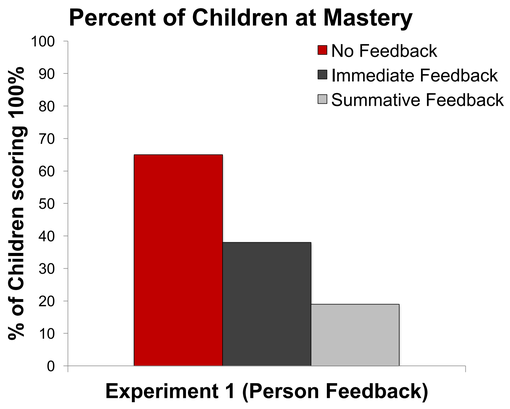
- Feedback provided verbally by tutor
- Right/wrong feedback and correct answer
- Posttest was immediately after the session

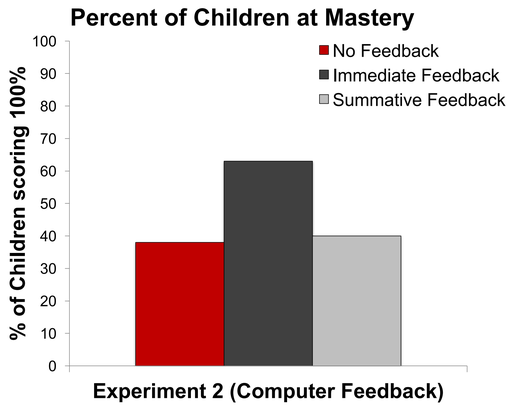
- Feedback provided visually on computer
- Feedback only contained correct answer
- Posttest was the day after the session

Results: Posttest Performance









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

In all analyses, condition was dummy coded with no feedback as the reference group. Children's age and pretest score were entered as covariates.

Results

Experiment 1: Feedback results in lower scores
Percent correct: no effect of immediate FB, p = .52, negative effect of summative FB, $F(1, 90)$ = 3.60, p = .06. Percent at mastery: negative effects of immediate FB, β = –1.16, p = .03, and summative FB, β = –2.07, p = .001.

Experiment 2: Feedback results in higher scores
Percent correct: positive effects of immediate FB, $F(1, 67)$ = 8.20, p = .006, and summative FB, $F(1, 67)$ = 4.09, p = .04. Percent at mastery: positive effect of immediate FB, β = 1.32, p = .05, but no effect of summative FB, p = .60.

Conclusions

Feedback benefitted math learning when provided in a less evaluative context (i.e., from a computer with no explicit right/wrong judgment), but feedback harmed learning relative to no feedback in a more evaluative context.

Timing of feedback had smaller, and less consistent impact; thus, whether affective reactions are triggered may matter more than when they are triggered.

Educators should be mindful of their students' cognitive and affective responses to feedback.