



The effects of feedback on math equivalence understanding in 6- to 11-year-old children



Emily R. Fyfe¹, Sarah A. Brown², & Martha W. Alibali²
¹Indiana University, ²University of Wisconsin-Madison

Introduction

- Feedback often has powerful effects on children's learning and problem solving and can serve as a trigger of cognitive change (e.g., Hattie & Timperley, 2007)
- Feedback may be particularly helpful for problem-solving tasks on which learners are resistant to change, including math equivalence problems (McNeil, 2014)

$$3 + 4 + 5 = 4 + \underline{\quad}$$

- We review the effect of basic, corrective feedback on math equivalence problem solving in school-aged children
- Most studies examined feedback in a one-on-one setting with feedback from a human tutor. Feedback was provided during a problem-solving task and main outcomes were procedural and conceptual knowledge on a posttest

Main Themes

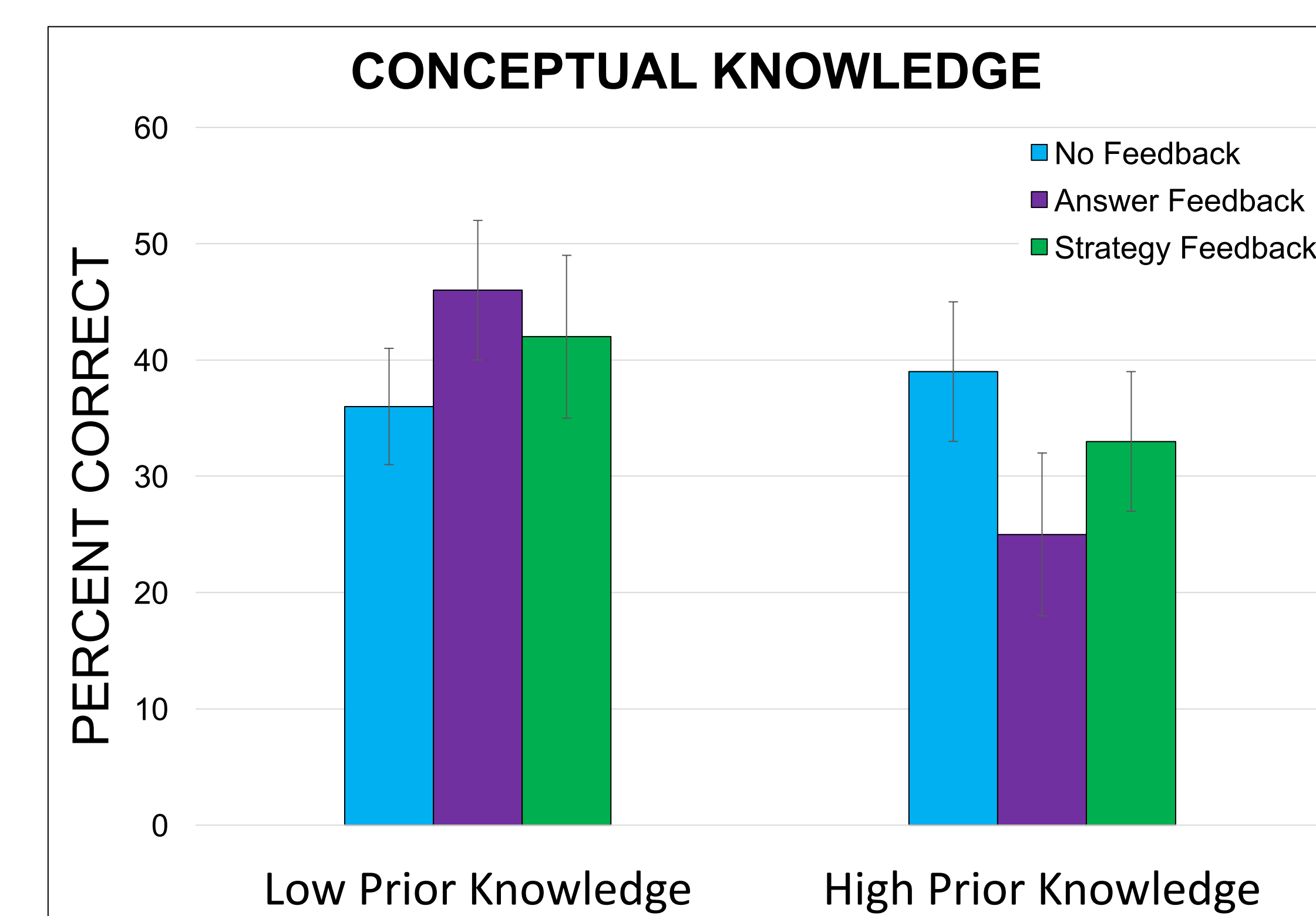
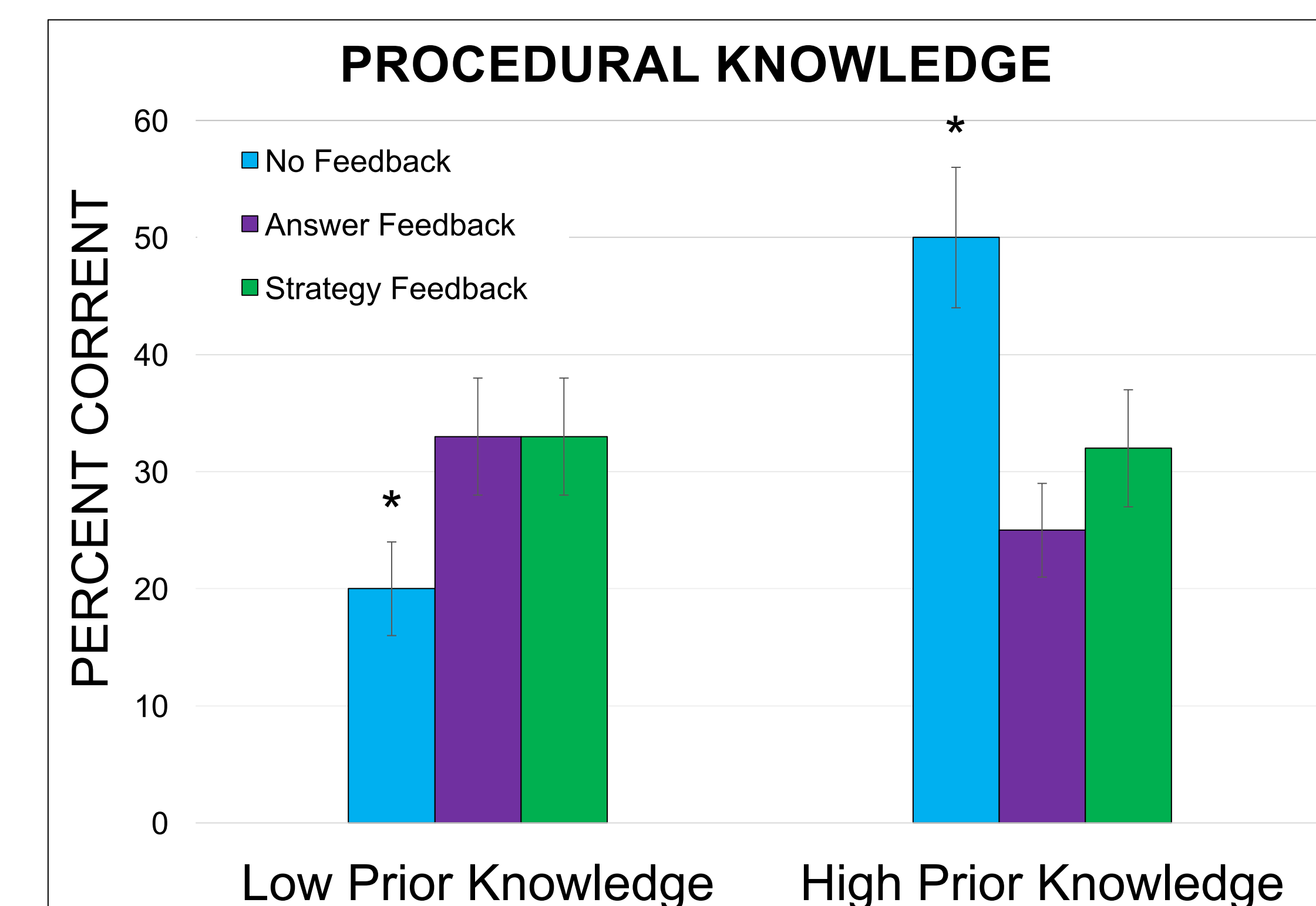
- ★ The effect of feedback often depended on learner characteristics
 - Often positive for children with low knowledge and neutral or negative for children with higher prior knowledge
- ★ The effects of feedback were limited to procedural knowledge outcomes
 - No effect on conceptual knowledge
 - No effect on encoding
- ★ The type of feedback often did not matter
 - Answer vs. strategy
 - Right/wrong vs. correct answer
 - Immediate vs. delayed

Relevant Studies

Citation	Setting	Sample	Feedback Conditions	Main Findings
Alibali (1999)	1-on-1 In person	143 3 rd and 4 th graders Scored 0% on pretest Mean age = 9.7	1. No FB 2. Strategy FB 3. Strategy FB + Instruction	1. Neutral effect of FB on PK 2. Positive effect of FB + instruction on PK
Fyfe, Rittle-Johnson & DeCaro (2012, Exp. 1) ★ ★ ★	1-on-1 In person	87 2 nd and 3 rd graders Scored <80% on pretest Mean age = 8.5	1. No FB 2. Strategy FB 3. Answer FB + Correct Answer	1. Positive effect of FB for low-knowledge children on PK 2. Negative effect of FB for high-knowledge children on PK 3. Neutral effect of FB on CK
Fyfe, Rittle-Johnson & DeCaro (2012, Exp. 2) ★ ★ ★	1-on-1 In person	95 2 nd and 3 rd graders Scored <80% on pretest Mean age = 7.9	1. No FB 2. Strategy FB 3. Answer FB	1. Positive effect of FB for low-knowledge children on PK 2. Negative effect of FB for high-knowledge children on PK 3. Neutral effect of FB on CK
Fyfe & Rittle-Johnson (2016a, Exp. 1) ★ ★	1-on-1 In person	108 2 nd and 3 rd graders Scored 0% on pretest Mean age = 8.4	1. Instruction + No FB 2. Instruction + Answer FB 3. No FB 4. Answer FB	1. Positive effect of FB for no-instruction-children on PK 2. Negative effect of FB for instruction-children on PK 3. Neutral effect of FB on CK
Fyfe & Rittle-Johnson (2016a, Exp. 2) ★	1-on-1 In person	101 2 nd and 3 rd graders Scored <80% on pretest Mean age = 8.2	1. Instruction + No FB 2. Instruction + Correct Answer FB 3. Instruction + Summative Correct Answer FB	1. Negative effect of FB for instruction-children on PK 2. Negative effect of FB for instruction-children on CK
Fyfe & Rittle-Johnson (2016b) ★ ★	1-on-1 On computer	75 2 nd graders Scored <80% on pretest Mean age = 8.2	1. Instruction + No FB 2. Instruction + Correct Answer FB 3. Instruction + Summative Correct Answer FB	1. Positive effect of FB for low-knowledge children on PK 2. Neutral effect of FB for high-knowledge children on PK 3. Positive effect of immediate FB on measure of mastery 4. Positive effect of immediate FB on transfer PK
Fyfe & Rittle-Johnson (2017) ★ ★	Small groups In classroom	243 2 nd and 3 rd graders Scored 0-100% on pretest Mean age = 8.3	1. Instruction + No FB 2. Instruction + Correct Answer FB 3. Instruction + Summative Correct Answer FB	1. Positive effect of immediate FB for instruction-children during task 2. Neutral effect of FB for instruction-children on immediate PK 3. Negative effect of FB for instruction-children on one-week PK
Brown & Alibali (2015) ★ ★	1-on-1 In person	77 2 nd and 3 rd graders Scored 0% on pretest Mean age = 8.5	1. No Feedback 2. No Feedback + Exposure to New Strategies 3. Strategy Feedback 4. Strategy Feedback + Exposure to New Strategies	1. Neutral effect of FB for low-confidence children on PK strategy change. 2. Negative effect of FB for high-confidence children on PK strategy change 3. Neutral effect of FB on CK

NOTE. All feedback conditions include trial-by-trial feedback on a set of math equivalence problems and provide only a right/wrong judgment unless otherwise noted. All effects are reported in regard to feedback versus no-feedback. FB = feedback. PK = procedural knowledge outcome. CK = conceptual knowledge outcome.

Sample Results from Fyfe, et al., 2012



Future Directions

- Why does feedback help some children but hurt others?
 - May be due to drawing attention to self over task
- Would other kinds of feedback affect conceptual knowledge?