



# Learning from an avatar video instructor: Gesture mimicry supports middle school students' algebra knowledge

Nicholas A. Vest & Emily R. Fyfe, PhD

Department of Psychological and Brain Sciences, Indiana University



## Background

Gestures have a profound effect on thinking and learning (Goldin-Meadow, 2005).

**Gesture mimicry** may be particularly important. Students who spontaneously reproduced a teacher's gesture on a math problem exhibited better learning than students who did not reproduce the gesture (Cook & Goldin-Meadow, 2006).

However, previous work on gesture mimicry has been done with live, human teachers.

## Questions

Do learners mimic the gestures produced by a novel computer-generated avatar instructor?

Do learners who mimic the gestures exhibit better learning than those who don't?

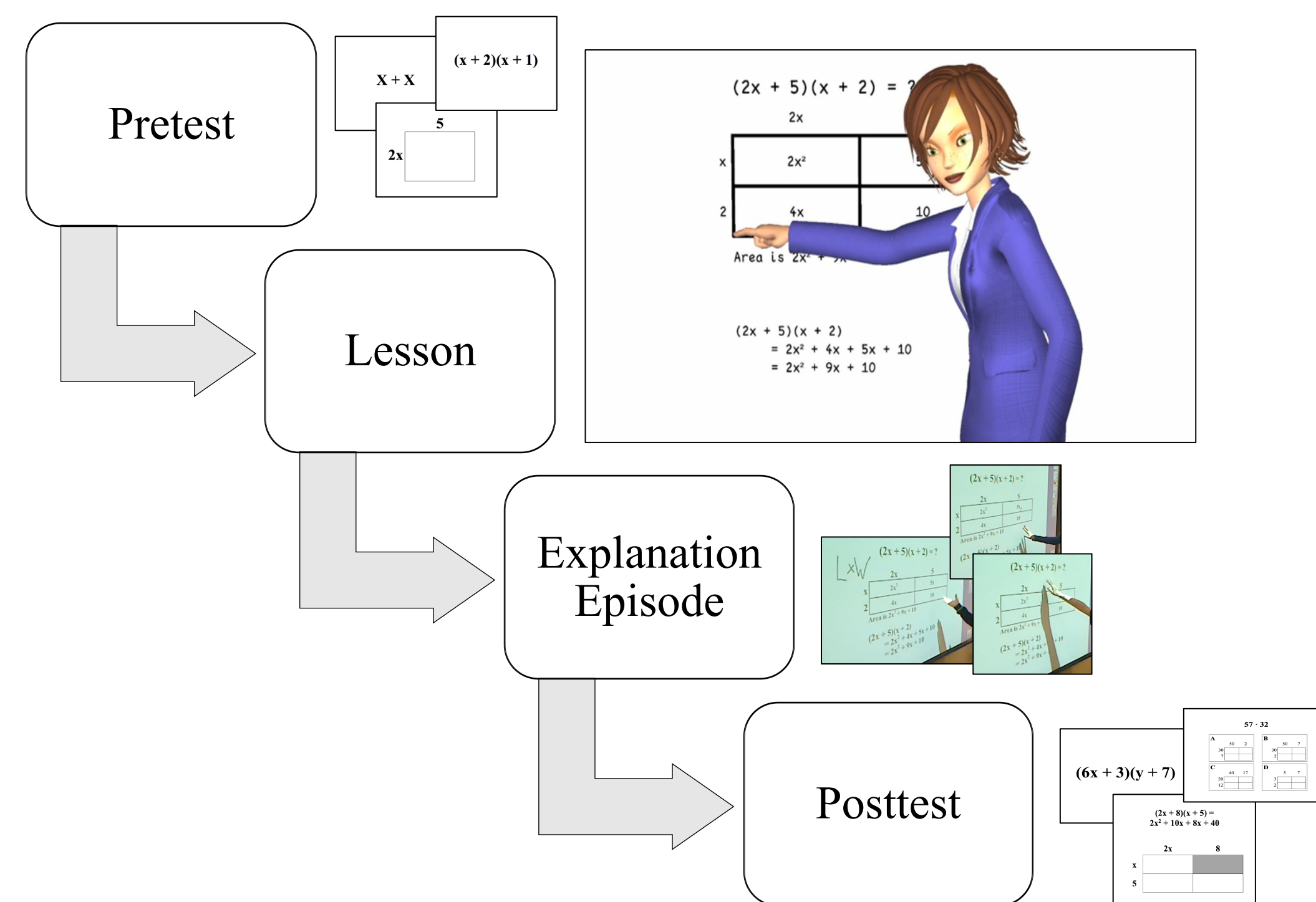
## Method

### Participants

24 seventh- and eighth-grade students ( $M$  age = 13.2 years; 38% female; 75% white)

### Design and Procedure

Students worked at an interactive smart board in a single one-on-one learning session.



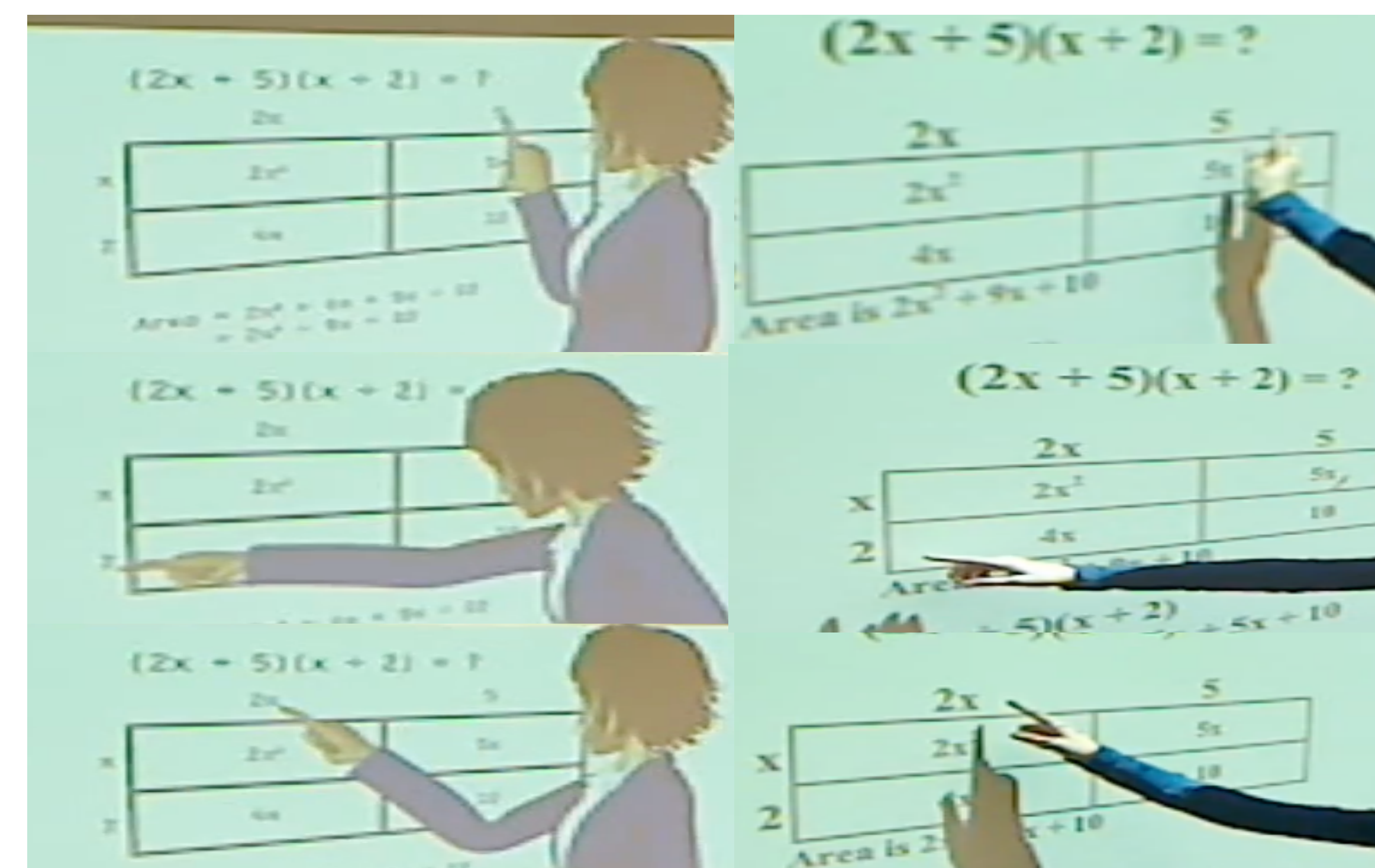
## Coding Gesture

After the lesson, students explained how to solve a target problem. We coded their gesture using ELAN annotation software.

**Frequency:** We tabulated the number of times each student produced a distinct gesture.

**Mimicry:** We compared whether the gesture sequences produced by the student matched those produced by the avatar.

### Examples of Gesture Mimicry



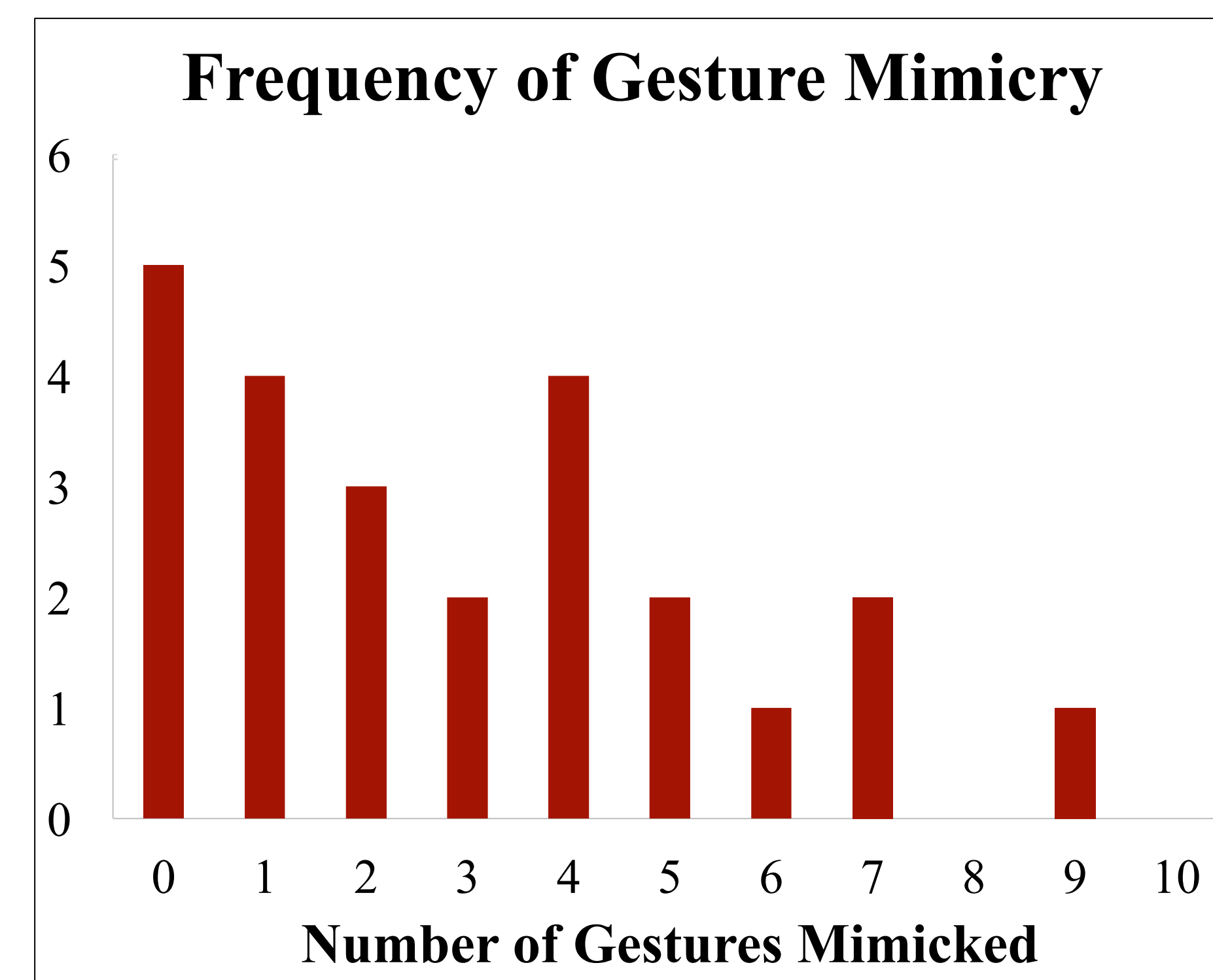
## Results

### Pretest

Students had background knowledge ( $M = 67%$ ,  $SD = 31%$ ); but only one student correctly solved the target problem.

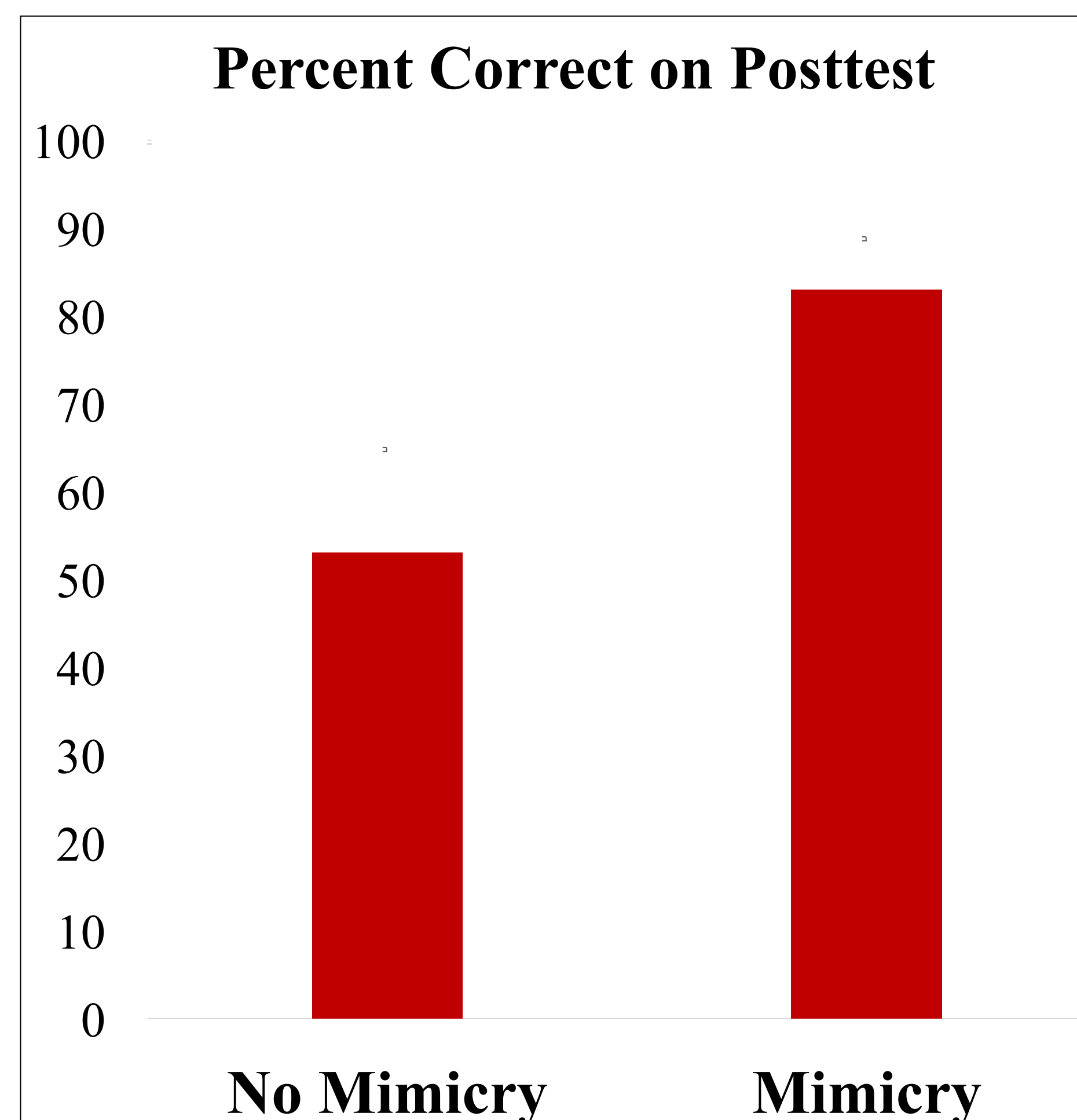
### Explanation Episode

Explanations were 57 seconds in length ( $range = 9s$  to  $4min$ ). Students gestured 29 times ( $range = 4$  to  $108$ ). Their rate of gesture was  $\sim 1$  every 2 seconds. During the lesson, the avatar produced 15 gestures. Students mimicked 3 on average.



### Posttest

Students displayed high knowledge on the five posttest items ( $M = 77%$ ,  $SD = 28%$ ), and 71% correctly solved at least one polynomial multiplication problem. There was a large main effect of gesture mimicry after controlling for pretest score and gesture rate,  $F(1, 20) = 4.93$ ,  $p = .04$ ,  $\eta_p^2 = .20$ .



## Conclusions

**Middle school students mimic the gestures produced by an avatar instructor.**

**Students who mimicked an avatar instructor's gestures scored higher on a posttest than students who did not mimic the avatar instructor's gestures.**

## Implications

Gesture has been shown to be helpful in supporting learning for a wide variety of content, including mathematics, language, and science (McGregor, 2008; Singer et al., 2008).

The current study extends prior work on gesture to suggest that gesture from a novel computer-generated avatar instructor can be helpful as well, at least in mathematics.

To our knowledge, this is the first evidence that students mimic the gestures of a non-human animated agent. This may have implications for mathematics instruction.

## References

- Cook, S. W. & Goldin-Meadow, S. (2006). The role of gesture in learning: Do children use their hands to change their minds? *Journal of Cognition and Development*, 7, 211-232.
- Goldin-Meadow, S. (2005). *Hearing gesture: How our hands help us think*. Harvard University Press.
- McGregor, K. K. (2008). Gesture supports children's word learning. *International Journal of Speech-Language Pathology*, 10, 112-117.
- Singer, M., Radinsky, J., & Goldman, S. R. (2008). The role of gesture in meaning construction. *Discourse Processes*, 45, 365-386.