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Press Contact: William Harms
(773) 702-8356
w-harms@uchicago.edu

Gestures make big difference in what students gain from mathematics lessons, University of Chicago research shows

University of Chicago researchers have found in a series of experiments in which they videotaped teachers as they presented mathematics lessons to individual students that students pick up on lessons teachers unconsciously convey through their gestures in ways previously unrecognized.

“Children were significantly more likely to reiterate the teacher’s spoken strategy when it was produced in conjunction with gestures that conveyed the same strategy than when it was produced with no gestures at all,” said Susan Goldin-Meadow, Professor in Psychology at the University and author of “What the Teacher’s Hands Tell the Student’s Mind About Math,” published in the current issue of the *Journal of Educational Psychology*. Her co-authors are University of Chicago researchers San Kim and Melissa Singer.

The finding could lead to new approaches to teaching, as educators learn how to better use their gestures to reinforce and amplify points they make in the classroom, Goldin-Meadow said.

“Gesture offers students a second window onto the task, one that students do take advantage of. If gesture were to become recognized as an integral—and inevitable—part of conversation in a teaching situation, it could perhaps be harnessed, offering teachers an excellent vehicle for presenting to their students a second perspective on the task at hand,” she said.

“We need to learn more about how teachers make gestures and how students comprehend what they see, however, before anyone can actually make a recommendation about how teachers should change their teaching to better utilize their gestures,” Goldin-Meadow said. “We also need to learn more about the gestures students make during a class.” Goldin-Meadow and her colleagues are undertaking research on those topics.

Goldin-Meadow, a leading researcher on gesture, conducted experiments with teachers to better understand how nonverbal communication takes place in the classroom. Previous research in this area has focused on topics such as the facial expressions teachers use to express approval or disapproval of student work, but little research has been done on the gestures instructors make spontaneously, and often without noticing, while they teach.

For the experiment, researchers selected eight teachers who taught or formerly taught mathematics or science in Chicago-area schools. The teachers had taught from one to 33 years,

with the average teaching experience being 9.6 years.

The researchers recruited 49 students who were on average about 10 years old to be taught mathematics lessons in individual tutorial sessions. The teachers had not previously taught the students they were tutoring. None of the teachers in the experiments were aware that the focus of the study was gesture. They were told that the purpose of the study was to learn how experienced teachers instruct students in mathematical equivalence.

>For the tutoring session, the teachers worked at a board and taught students to work with equations such as $5 + 3 + 4 = _ + 4$. In the process of explaining solutions, the teachers often made flat palm gestures under each side of the equation to indicate that the two sides ought to be equal in total number. They would group the numbers by making v-shaped hand gestures under numbers they wanted the students to add.

The researchers found that, on average, teachers produced 37 explanations containing gestures during each of the sessions, which lasted an average of 12 minutes. The teachers used gestures in 60 percent of their instructions to students. Two-thirds of the time, the gestures reinforced speech, while one-third of the time, the gestures conflicted with speech. In many of the cases in which speech and gesture were mismatched, the teachers were describing a strategy they wanted the students to avoid.

Importantly, how well the teachers' words were understood depended on how they moved their hands. If the teachers' gestures conveyed the same information as speech, it made that speech easier to understand. Conversely, if the teachers' gestures conveyed different information from speech, it made the speech harder to understand. Comprehension of speech appears to depend on the gestural company it keeps, Goldin-Meadow said.

Gesture may be particularly significant in situations where speakers are not aware of the messages they convey, as in classrooms where teachers can convey unintended and, at times, incorrect ideas through their gestures, Goldin-Meadow said.

Further studies may show that teachers in a variety of disciplines take advantage of gestures. Work by Goldin-Meadow and David McNeill, also Professor in Psychology at the University of Chicago, shows that gesture is particularly useful in capturing the visual features and imagery of an idea.

"Indeed, gesture's power comes from the fact that its strengths are different from, and complementary to, speech," Goldin-Meadow said.

Goldin-Meadow is among a group of researchers with the University's Early Childhood Initiative, a program funded by the Robert R. McCormick Tribune Foundation. Her work on gesture was supported by a Spencer Foundation Grant.

University of Chicago News Office
5801 South Ellis Avenue - Room 200
Chicago, Illinois 60637-1473

(773) 702-8360
Fax: (773) 702-8324
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