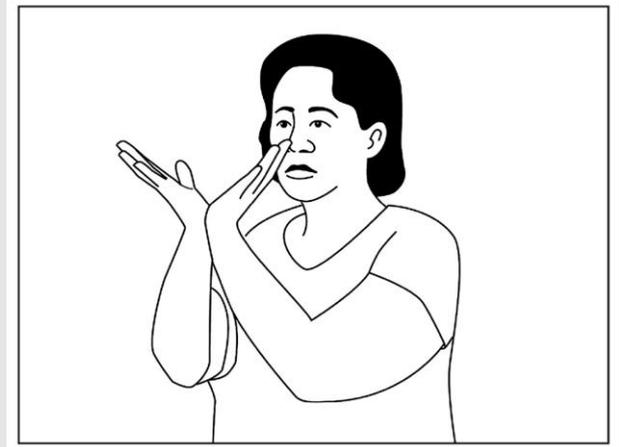
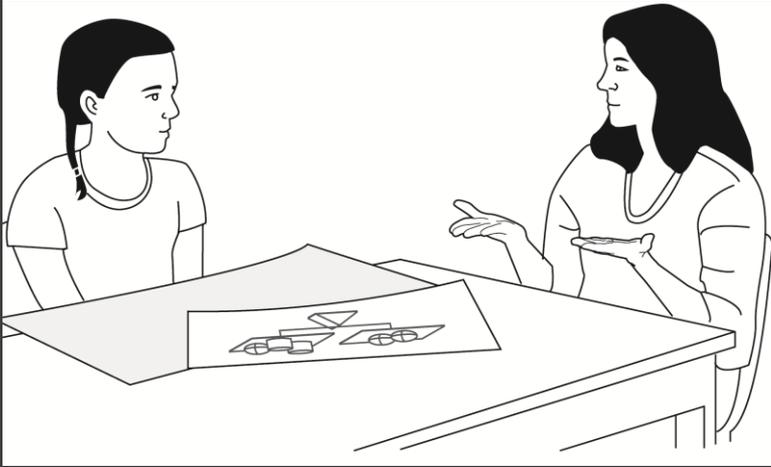


Instructional Gestures: Handy Ways to Promote Comprehension and Learning



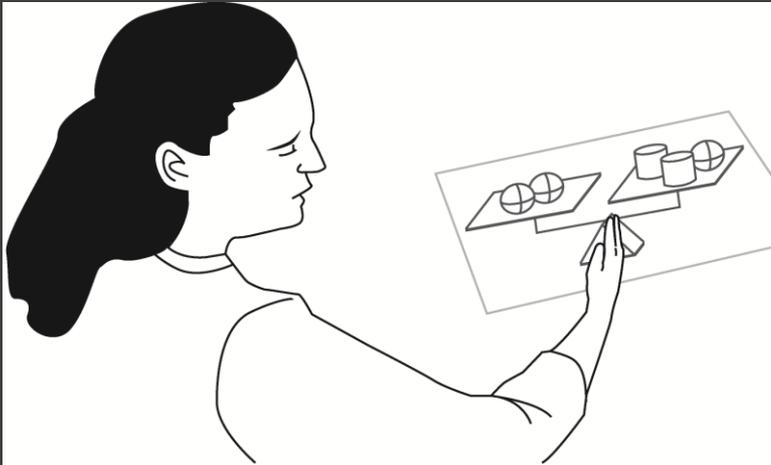
Mitchell Nathan
University of
Wisconsin-Madison





Instructional Gestures

Small, frequent actions during instructional talk to help student comprehension and learning





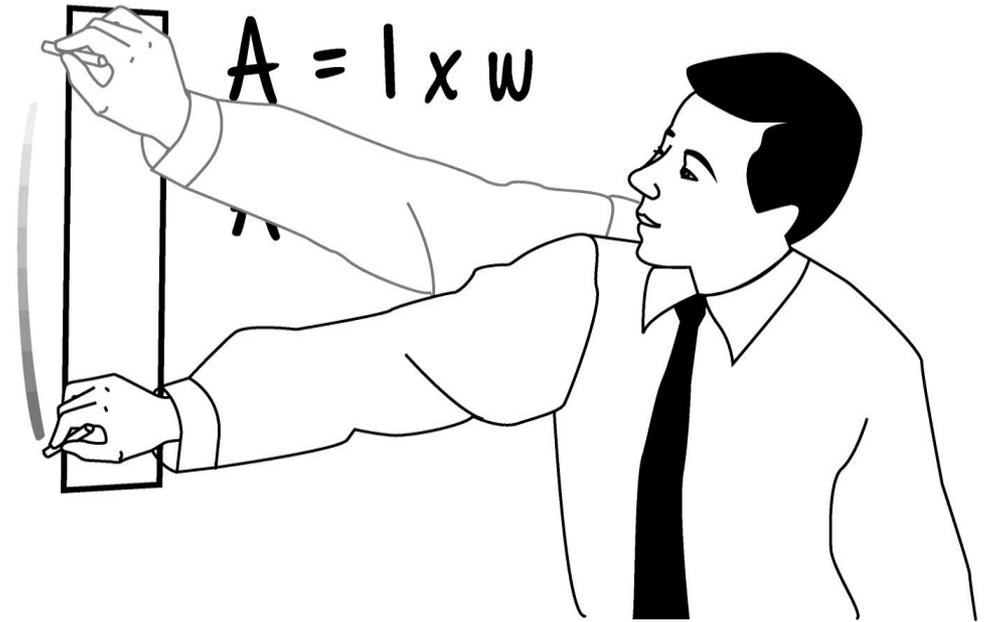
Gestures Matter for Listeners

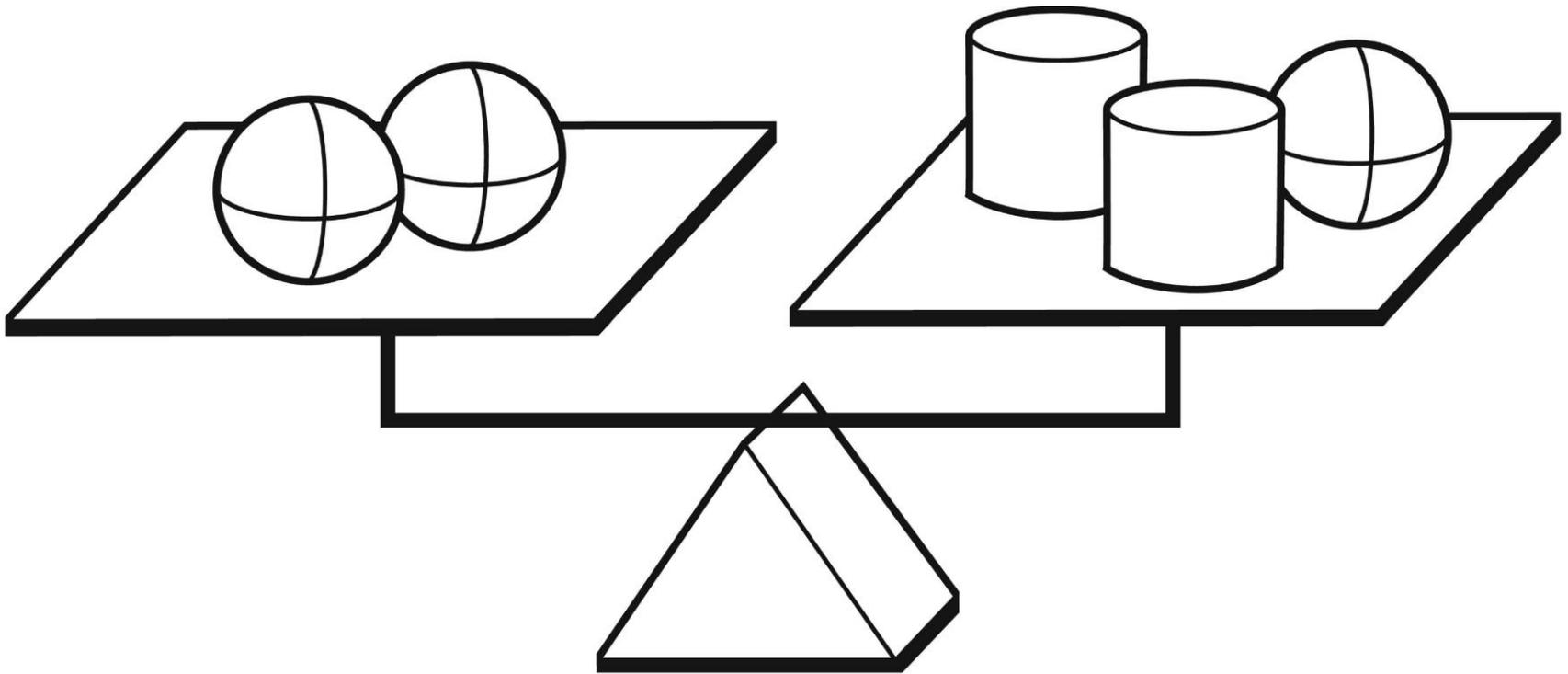
- Speech is comprehended better with gestures
- Gestures help when verbal message is complex or ambiguous
- Listeners interpret information expressed in gestures

Gesture Affects Learning from Lessons

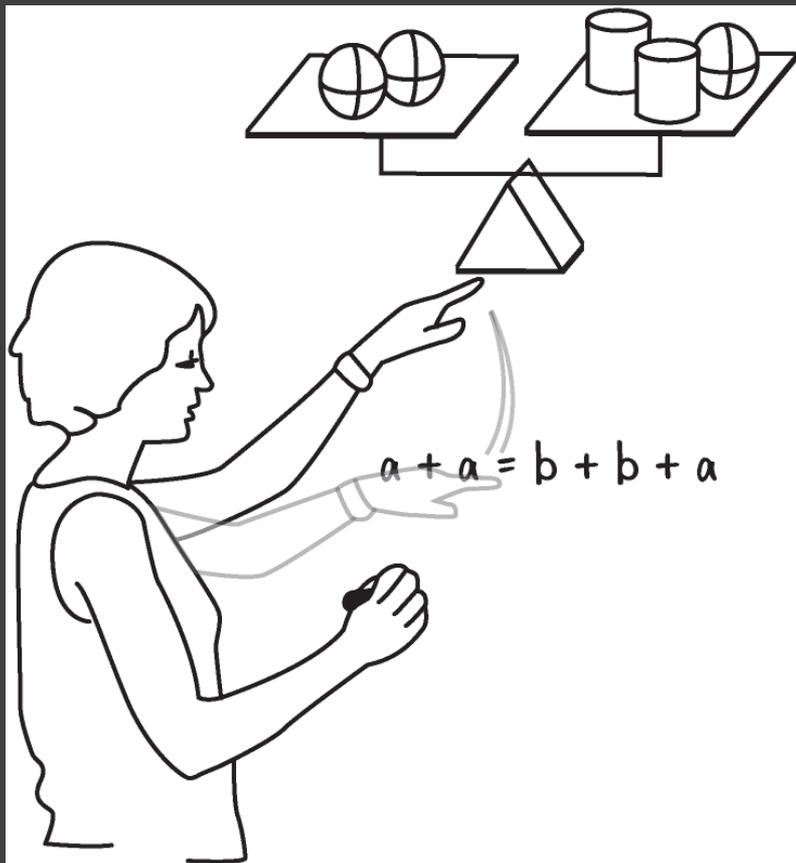
Students are more likely to reiterate teachers' speech if it includes gesture

Children learn more from speech-plus-gesture lessons than from speech-only lessons





Pan balance

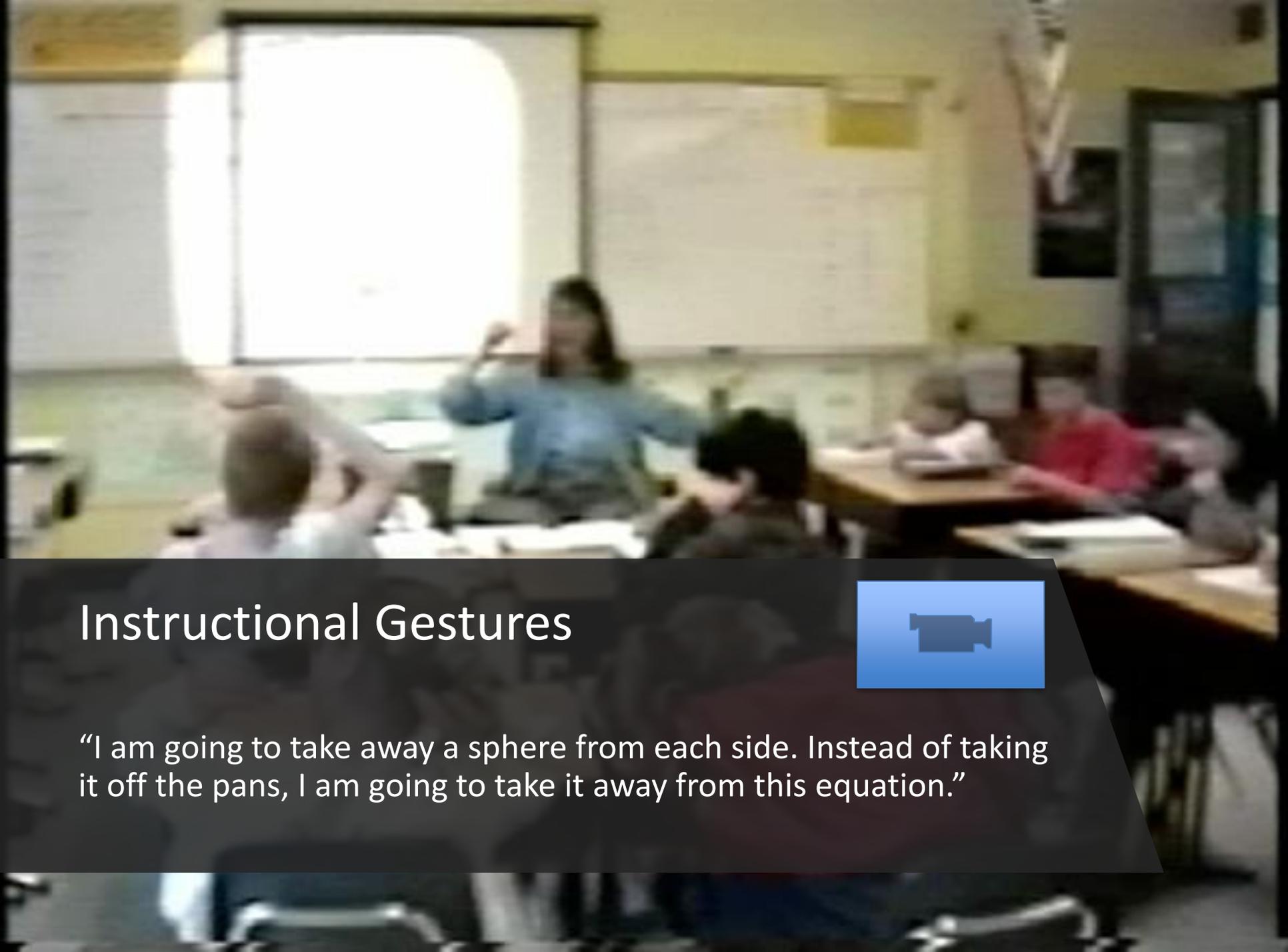


Making Connections

Linking is crucial in education

- Meaning making via links to representations
- Ground abstractions to familiar objects & ideas

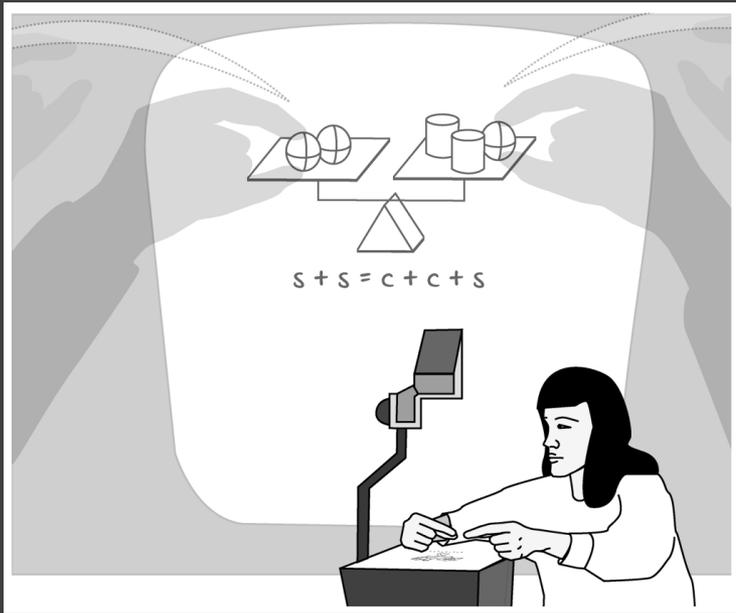
Teachers combine speech with gesture, writing, & object manipulation



Instructional Gestures



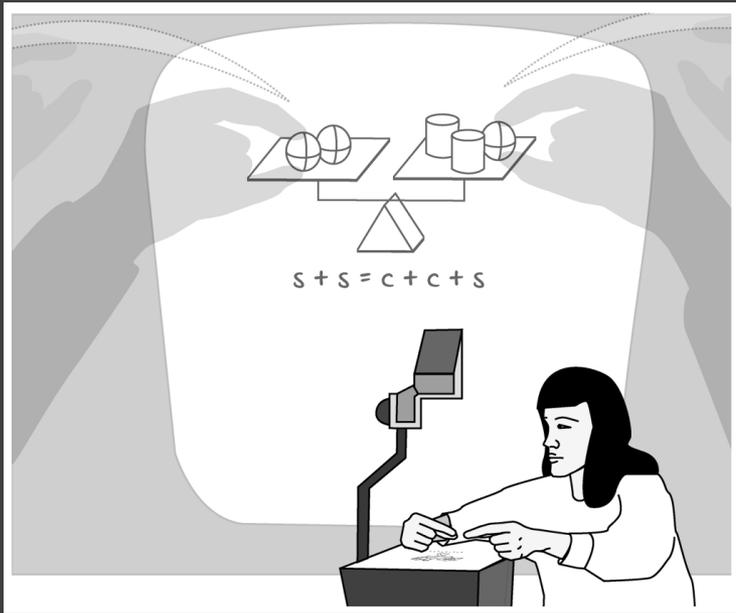
“I am going to take away a sphere from each side. Instead of taking it off the pans, I am going to take it away from this equation.”



Instructional Gestures



Discuss what you noticed



Instructional Gestures

Two ways gestures matter for learning

1. Content connections
2. Common ground



1. Content

Gestures make connections between representations

Gestures connect

- Symbols to equations
- Before / after changes
- Cause & effect

These connections also direct learners' attention to what is important

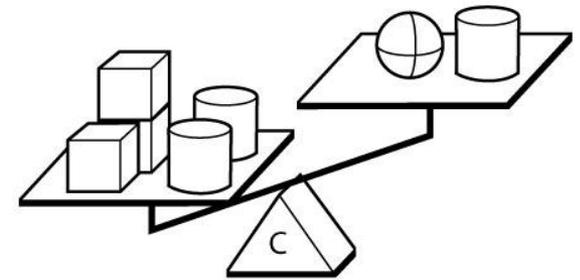
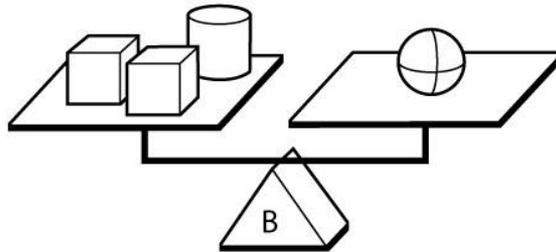
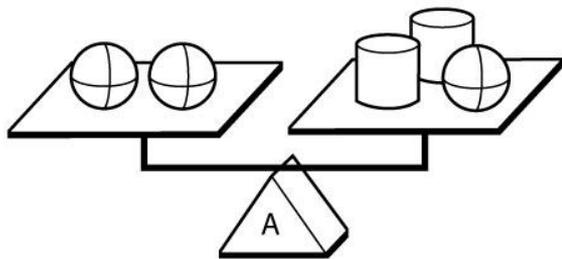


2. Gestures produce and maintain “common ground”

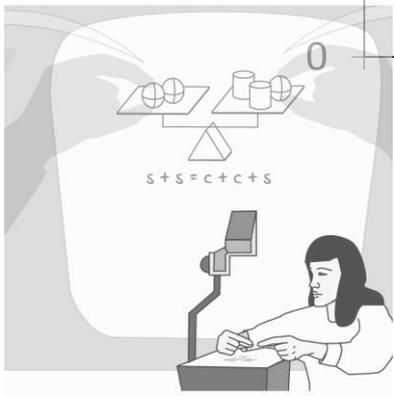
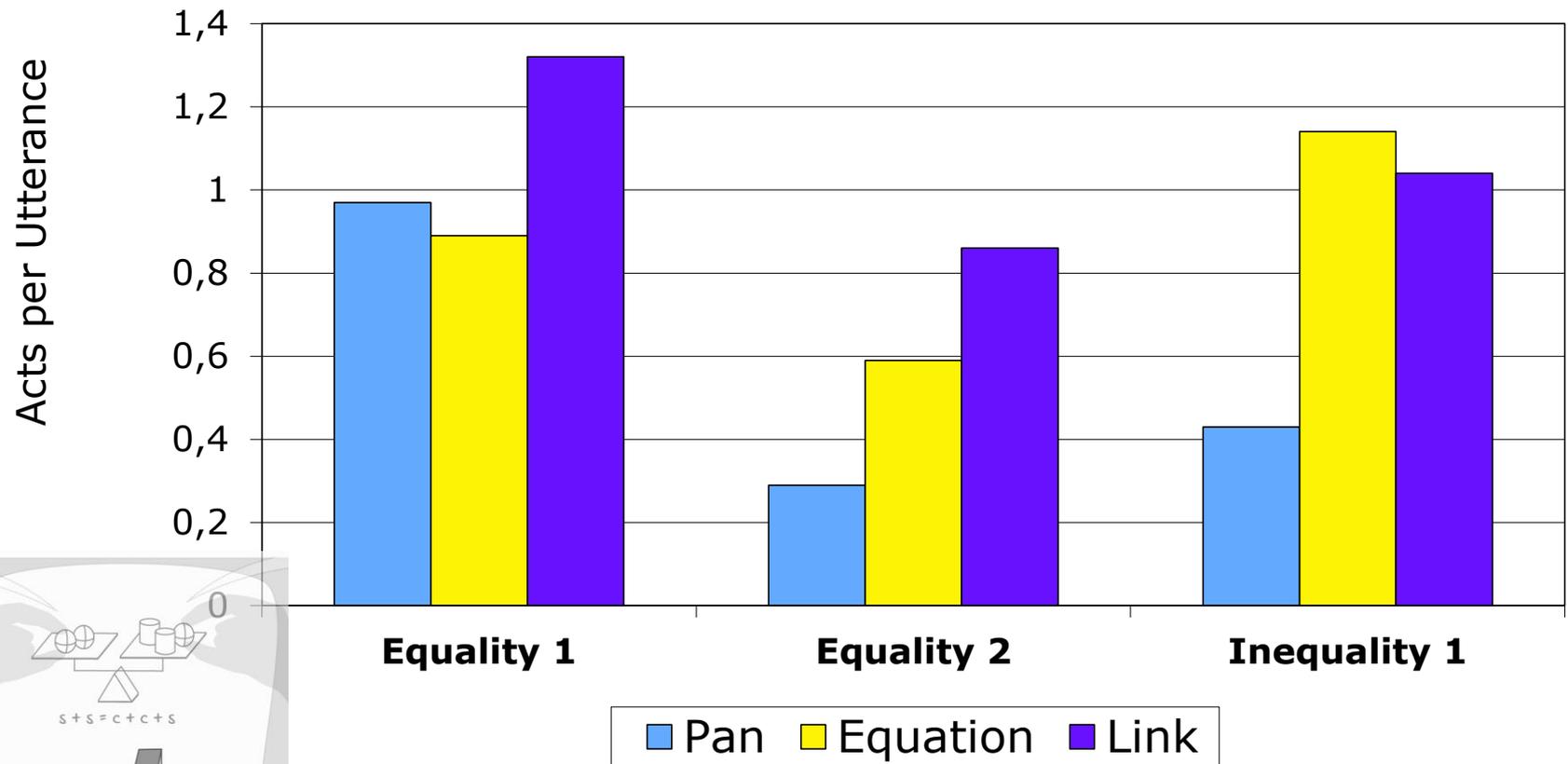
- Classroom learning depends on effective communication
- Learning occurs when students connect new information to something familiar
- Common ground is essential for communication and learning



Common Ground: Gesture use changes with new info



Common Ground: Gesture use changes for new info and more abstract ideas





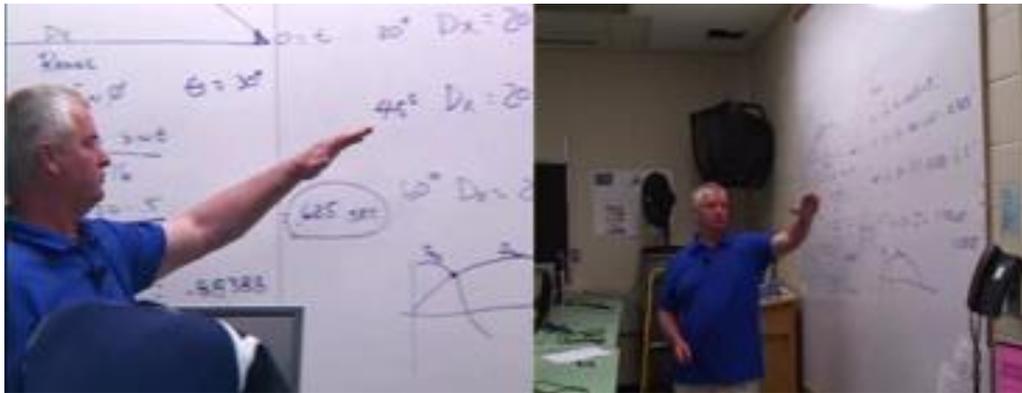
Gestures change with trouble spots

“Trouble spots” are events in a lesson where understanding is compromised

- Student-initiated questions
- Incorrect responses
- Disfluencies
- No response

Common Ground

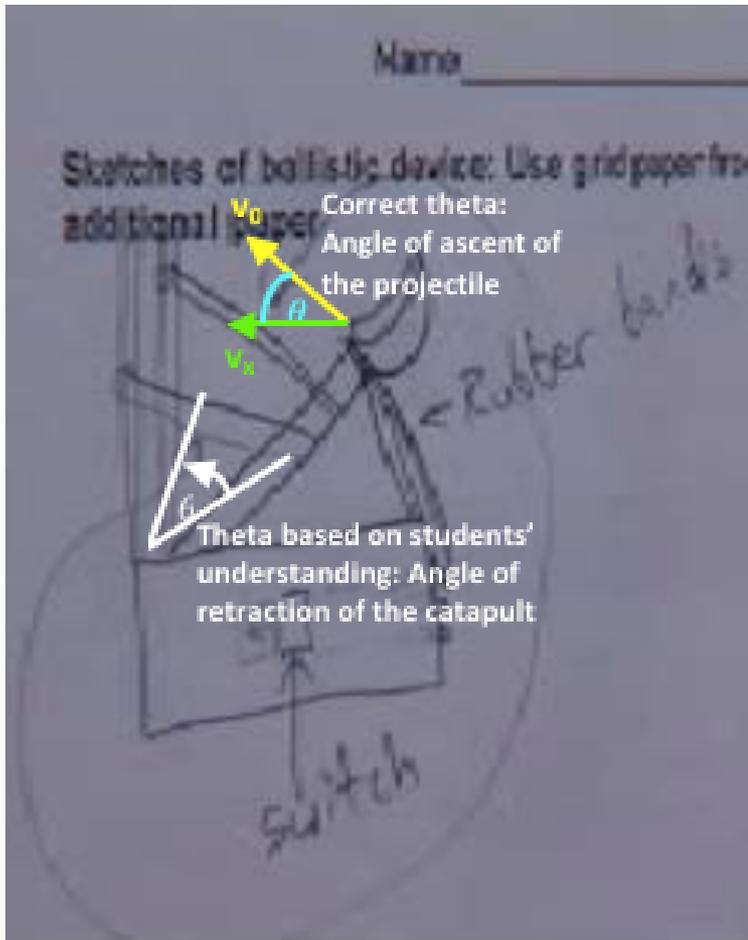
An Example “Trouble Spot”



Teacher relates trigonometry to the laws of kinematics

The arm gesture signals the angle of ascent of a projectile

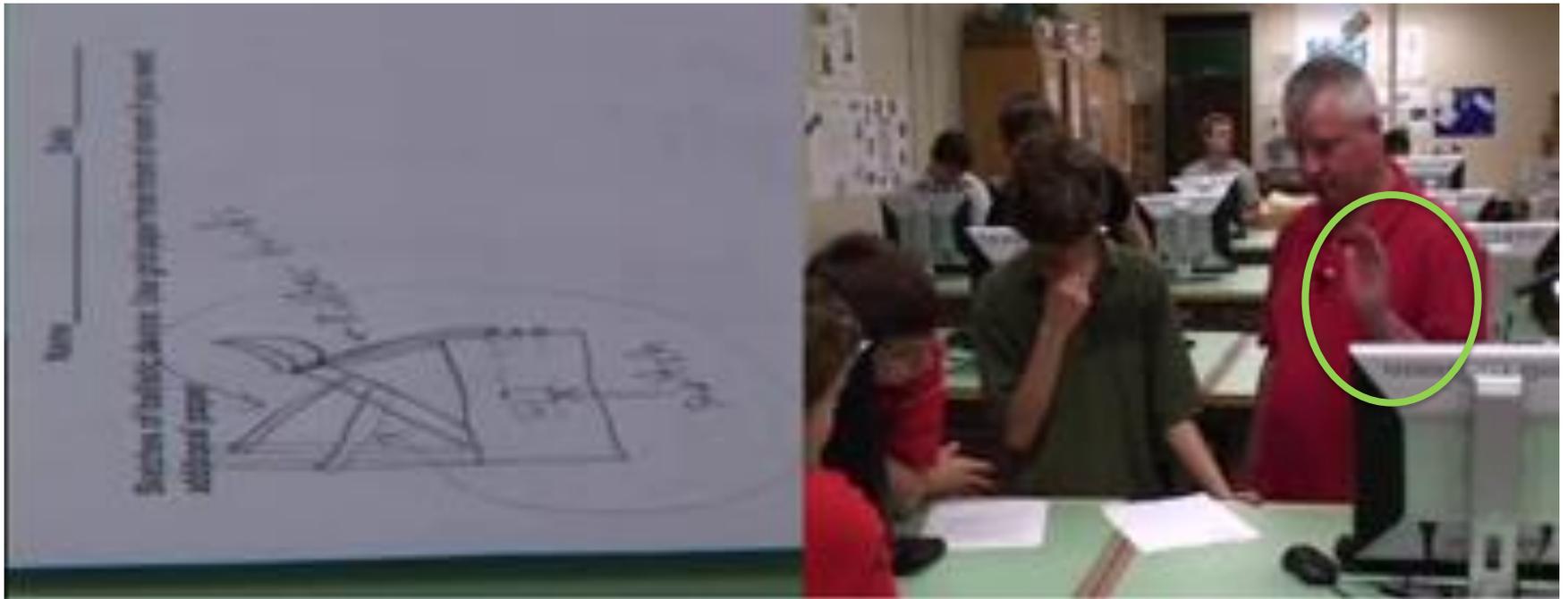
Example Trouble Spot



Project-based STEM classes are very rich settings

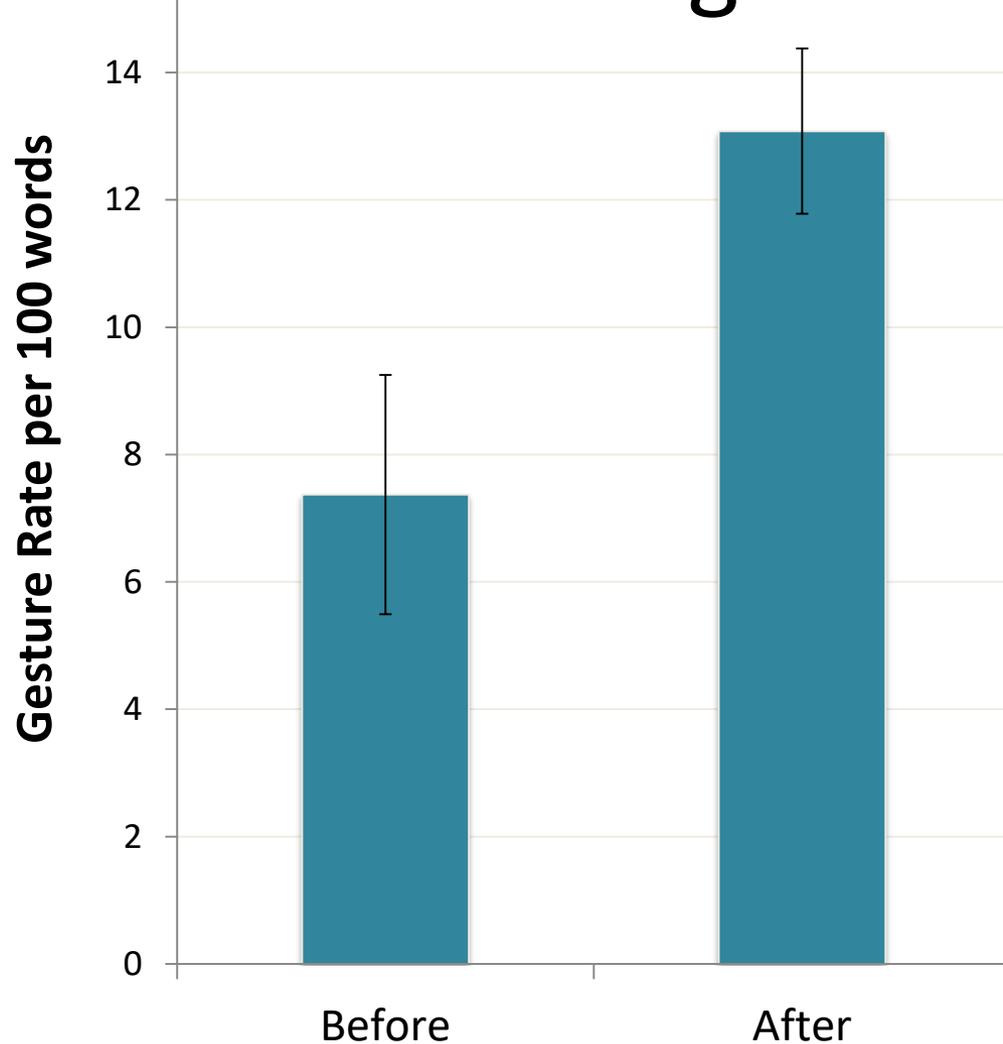
Trouble spots can arise from confusion in the math, science, and engineering design

Example Trouble Spot

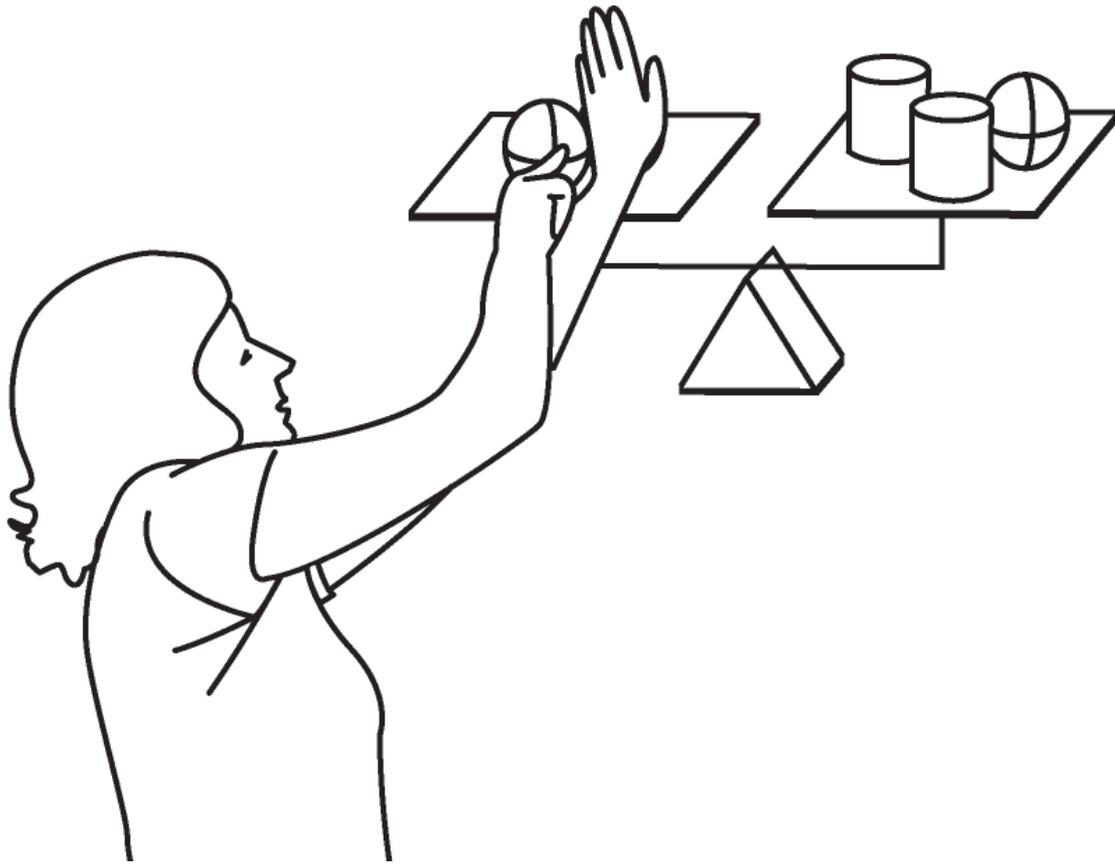


Teacher's reuse of the "angle gesture" reminds students of the trigonometry discussed at a prior lesson

16 Gestures change with Trouble Spots



Teachers gesture more after trouble spots than moments before.

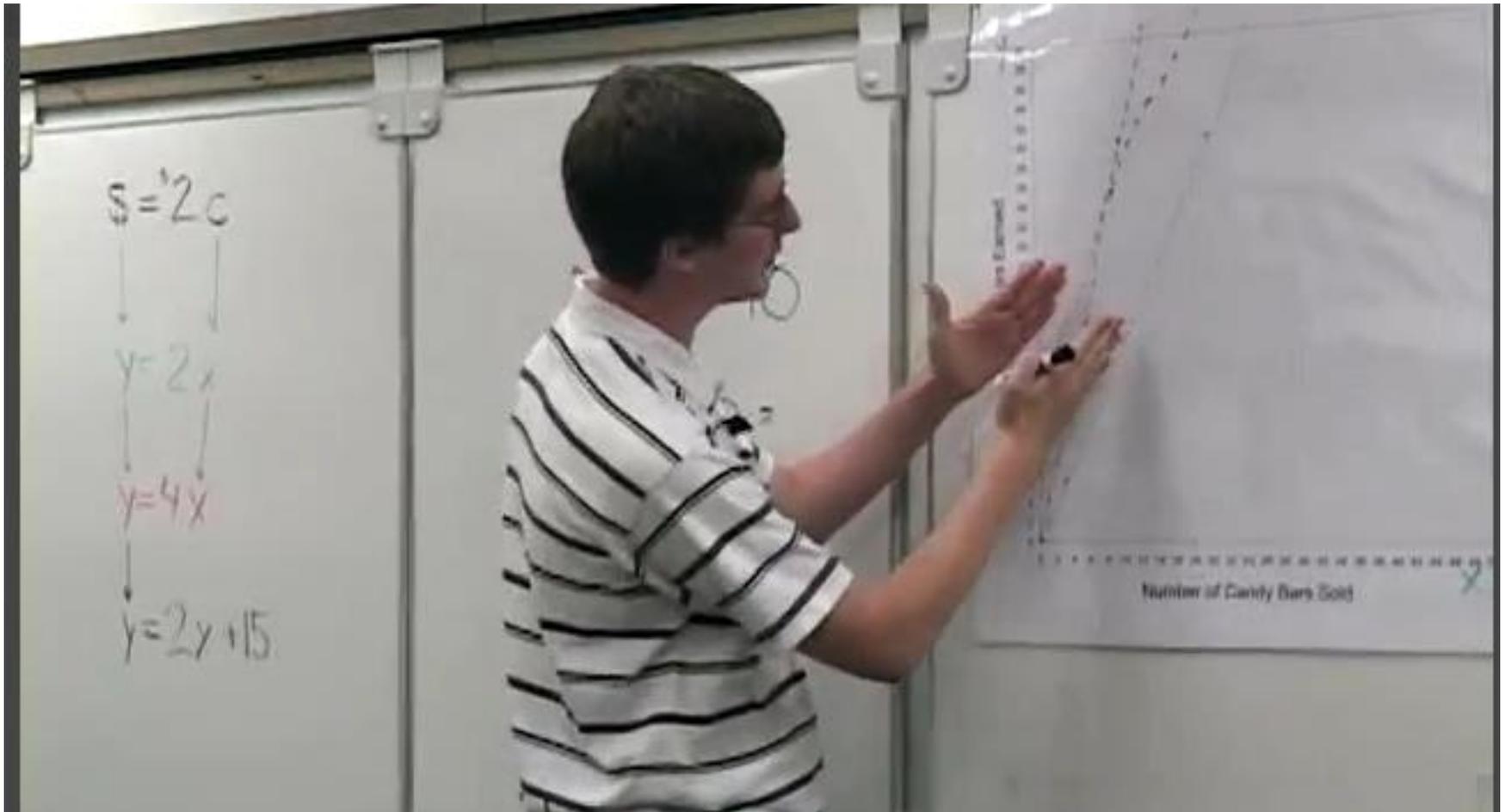


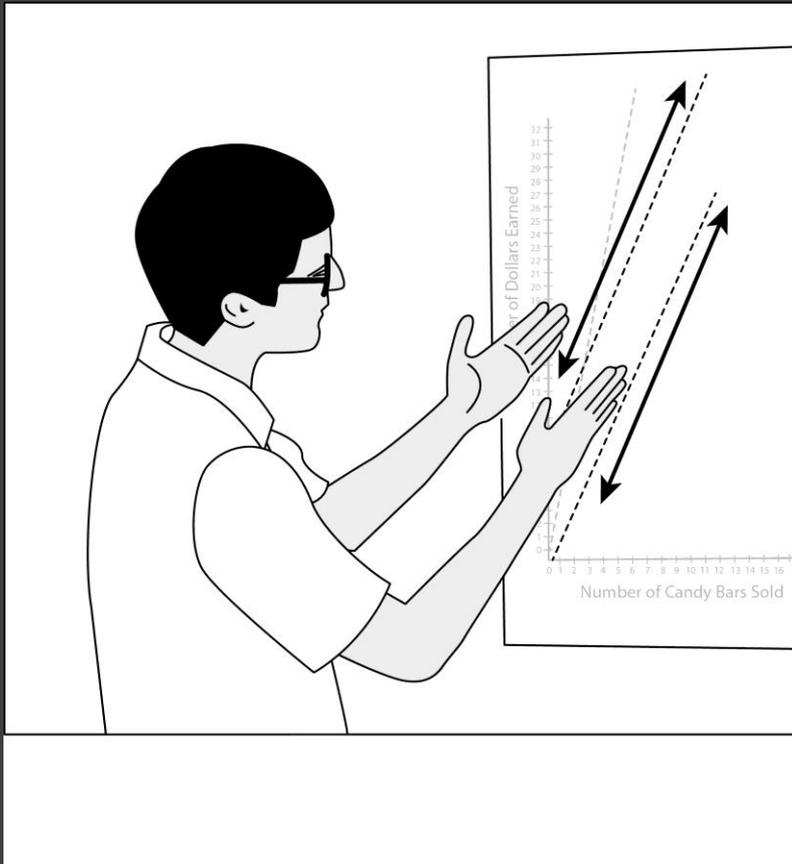
Can we Change Teachers' Gestures?

Teachers can alter their instructional gestures

- How do teachers' gestures change?
- What is the impact on learning?

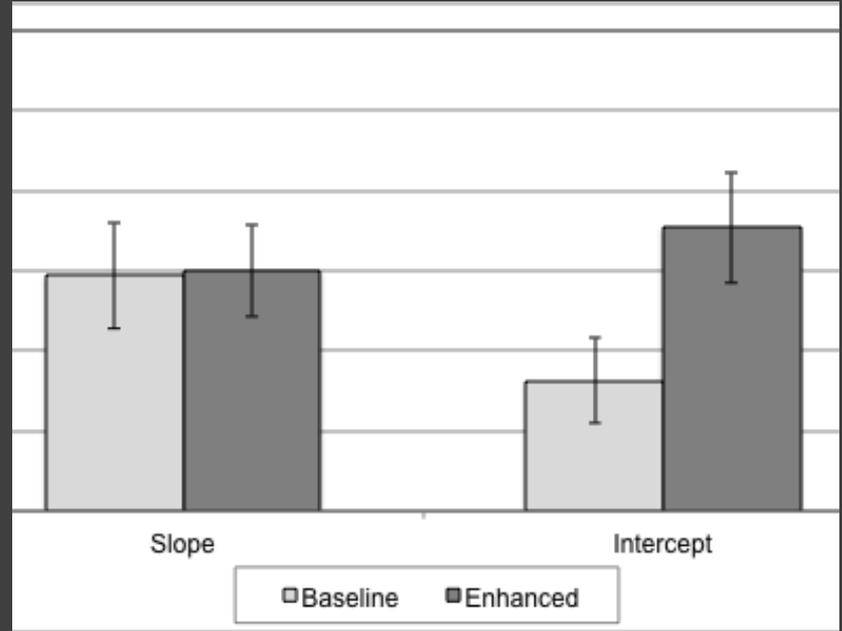
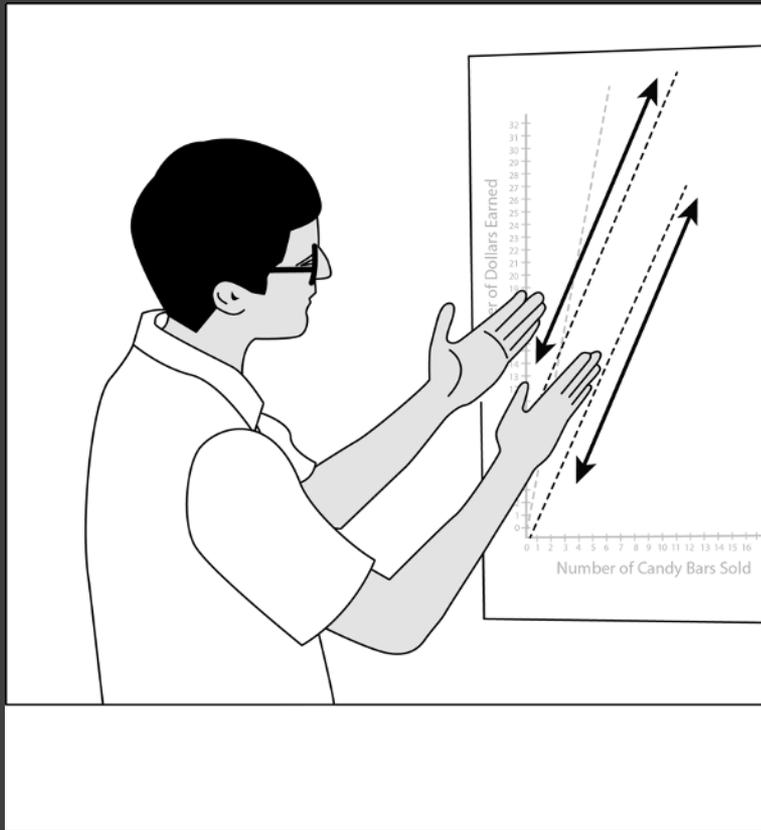
Students learn more when their teacher has learned to gesture effectively





How did the tutorial affect instruction?

- Tutorial changed *how links were expressed*
- More links expressed multimodally, using speech + gestures
- More likely to use gestures that reduce students' cognitive load



Students learned
more from the
enhanced-gesture
lesson

Learning gains were
specific to the
conceptually difficult
topics



EMIC Virtual Panel #1: Instructional Gest...



Online and Asynchronous Considerations

Gestures need to be seen

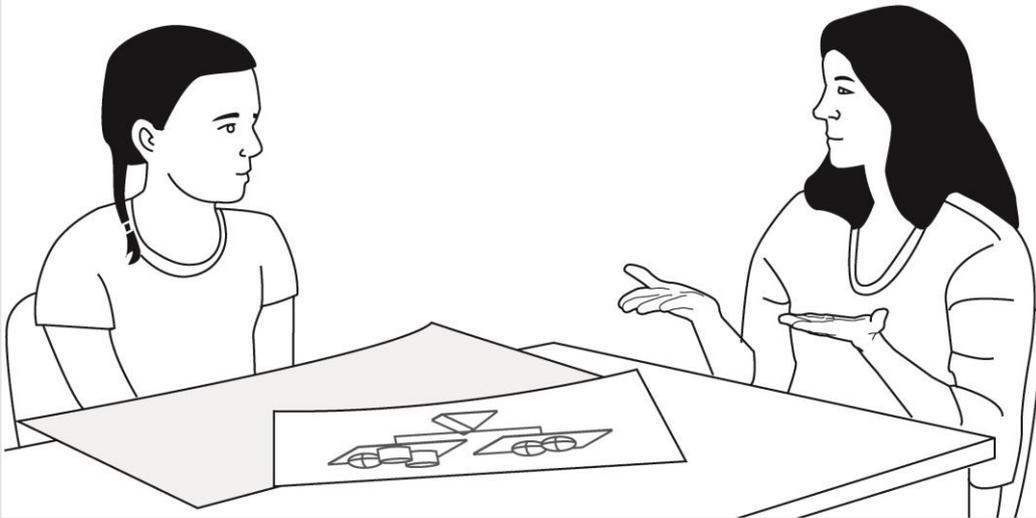
*Shared screens are often a
problem*



Accessibility Considerations

Gestures can help those needing attention support, and learners with limited language proficiency

Noticing learners' gestures can support teachers' formative assessment practices



Conclusions

- Instructional gestures aid comprehension & learning
- Teachers can regulate gesture production to suit learner needs
 - Connect ideas & representations
 - Forge common ground
 - Respond to trouble spots
- Teachers can learn to alter gestures when shown how



Take-home message

Don't teach with one hand tied behind your back

*Want to
Know
More?*

References & Readings

- Alibali, M. W. & Nathan, M. J. (2012). Embodiment in mathematics teaching and learning: Evidence from learners' and teachers' gestures. *The Journal of the Learning Sciences*, 21(2), 247-286. DOI: 10.1080/10508406.2011.611446.
- Alibali, M. W., & Nathan, M. J. (2019). Managing common ground in the classroom: teachers use gestures to support students' contributions to classroom discourse. *ZDM—International Journal on Mathematics Education*, 51(2), 347-360. DOI: 10.1007/s11858-019-01043-x
- Alibali, M. W., Young, A. G., Crooks, N. M., Yeo, A., Wolfgram, M. S., Ledesma, I. M., Nathan, M. J., Church, R. B., & Knuth, E. J. (2013). Students learn more when their teacher has learned to gesture effectively. *Gesture*, 13(2), 210-233.
- Goldin-Meadow, S. (2005). *Hearing gesture: How our hands help us think*. Harvard University Press.
- Hostetter, A. B. (2011). When do gestures communicate? A meta-analysis. *Psychological Bulletin*, 137(2), 297.

Online Resources

www.embodiedmathematics.com

Contact me at MagicLab@wcer.wisc.edu