Instructional gestures can resolve the fundamental tension between making and breaking common ground during classroom discourse

Words = 446

The need to manage common ground in classrooms is great: Learning necessitates a *break* in the common ground shared by students and their teachers, so that something genuinely new and unfamiliar can be apprehended. As a result, effective instruction must continually strive to re-establish common ground to advance student learning (Nathan & Alibali, 2011). Our central claim is that gestures are especially crucial at moments surrounding these intentional breaks in common ground in order to re-establish shared understanding during instruction so successful learning may occur.

As expected from the experimental literature (e.g., Holler & Stevens, 2007; Kelly, Byrne & Holler, 2011), teachers exhibit high gesture production rates when introducing new ideas during instruction (Alibali et al., 2014), and when responding to students' trouble spots (Alibali et al., 2013), while these gesture rates decline as new material becomes more familiar.

We present two cases of moment-to-moment instructional interactions to illustrate how gestures are used to re-establish and maintain common ground following intentional breaks.

In **Case #1**, a teacher introduces 6th grade students to the idea of algebraic equations, with letter symbols standing for objects, and operators representing the relationships among objects. This is a major topic in mathematics education that sets the stage for nearly all mathematics to come. The teacher attempts to forge common ground by pre-emptively connecting the new, symbolic representation to a familiar physical system—a pan balance scale. The teacher notes that a balanced scale implies that the weights on both sides are equal even when the specific objects placed in either pan are not identical, and remarks about the special role of the exact midpoint – the fulcrum is much like the equal sign. The teacher repeatedly performs gestural catchments on the symbols to match the actions performed on the objects. For example, "If I take away a sphere on each side, does this still balance like <Name> said?" (lines 124-125) is followed by "So, I'm gonna [take away an *s* here], which is like crossing [that one off]" (lines 134-135) while she writes "– s" under both sides of the equation.

In **Case #2**, a teacher extends 8th grade students' (ages 13-14) understanding of multiplication to polynomials by linking it a familiar idea: computing the area of a rectangle. Through detailed linking gestures that depict specific mappings of symbolic terms to elements of the familiar representation, the teacher draws on students' wealth of prior knowledge about computing area. Through these links, the teacher makes the conceptual breach of a new mathematical idea both incremental and tractable to the students.

The cyclic nature of breaking and making common ground creates a fundamental tension within pedagogical discourse that can be resolved through instructional gestures.

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