LOST IN TRANSLATION: THE 'BEAN SNARE' AS A CASE OF THE SITUATED–SYMBOLIC DIVIDE

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The NCTM Standards (2000) recommend that instructional programs enable all students to create, use, and translate between mathematical representations. Yet, students are apt to fail in transferring between situated and symbolic notation (Martin & Schwartz, 2005). We propose that this transfer failure is due to critical shades of meaning being lost between media. Also, we explore the pedagogical value of having education researchers and practitioners analyze such semiotic breakdown.

The third author designed the *Bean Snare* (Figure 1) to spark discussion of the complexity of constructivist design, teaching, and learning, i.e., subtle interactions of content and context as well as multi-media, multi-modal, and multi-representational aspects of collaborative reasoning about a situated mathematical problem. Note how the presentation surreptitiously leads us down the garden path to a mathematically incorrect statement.

What is lost in translating between this situation (combining groups of white/black beans) and the standard mathematical notation (adding fractions)—our group concluded after a semester of lively debates—is a crucial fragment of meaning implicit within the ostensive statement ("…2 *of them* are black") and accompanying deictic gesture (indicating each *whole group*). Thus, in inscribing the combining action, the multiplicand (the cardinality of each group of beans) is inadvertently omitted (so it should be $2/3 * 3 + 3/5 * 5 = 5/8 * 8$). Alternatively, the paradox lies in shifts between 2 frames of meaning—proportionality (*a/b* or *a:b*) and sets (*a + b*).

Situated mathematics can help ground mathematical meaning. Yet, if designers and/or teachers fail to recognize potential pitfalls inherent in mathematization, then the concrete contexts may constitute a disservice. The Bean Snare is a case of an activity that can generate insight into the intricacies of situated-mathematics curricula, i.e. the nature of mathematical reasoning and learning, challenges of pedagogy, didactics, and design, and issues of policy making around the "math wars." In future work, we will interview in-service teachers, using the bean snare, to investigate potential tension between their pedagogical beliefs (e.g., constructivist) and their formative-assessment practices (see edrl.berkeley.edu).

Figure 1. The Bean Snare

References

Martin, T., & Schwartz, D. L. (2005). Physically distributed learning. *Cognitive Science, 29*(4), 587-625.

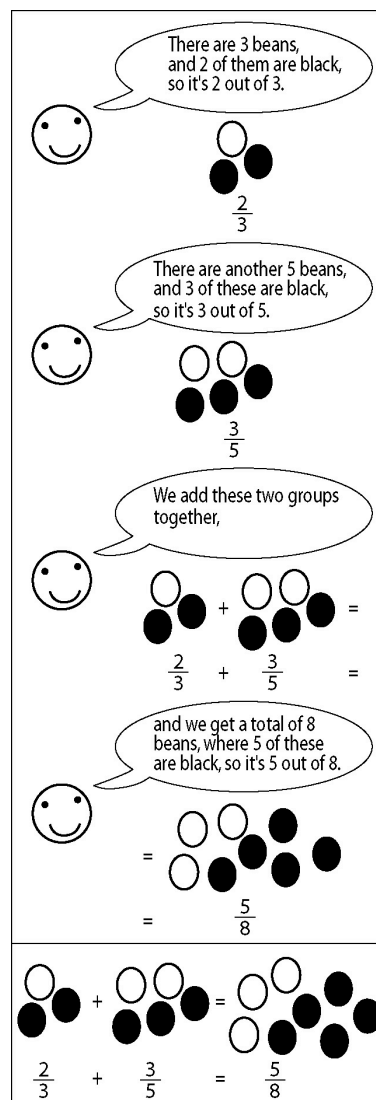National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM. http://standards.nctm.org/document/chapter3/rep.htm