From the laboratory to the classroom: Creating and implementing a research-based curriculum around the use of comparison

Courtney Pollack, Harvard University

Dr. Jon R. Star, Harvard University

I. Abstract
This poster presents a research program that seeks to improve educational practice and student learning in mathematics by developing, implementing, and testing curriculum materials built on findings from cognitive science. We convey the process of conducting experimental classroom studies built on lab-based cognitive science research and the subsequent design and implementation of a supplemental first-year algebra curriculum based on comparison.

II. Learning & comparison: Cognitive science research
There is a great deal of cognitive research showing the benefits of comparison for learning in young children (e.g., Gentner & Gfeller, 2001; Oakes & Ribic, 2009) and adults (e.g., Gentner, Looewenstein, & Thompson, 2003; Namy & Gentner, 2002). Yet, little of this type of research has been done in classrooms. Building on these findings, we engaged in small-scale experimental classroom studies to explore the benefits of comparison for students’ learning of mathematics, focusing on equation solving.

III. Experimental classroom research
Our experimental research showed positive effects of comparison on student learning in controlled settings.

IV. Curriculum Design and Development
During 2008-2009, we worked with a small group of expert teachers to transform our experimental materials (see Figure 1) into a supplemental first-year algebra curriculum that embodied the principles derived from previous experimental research (see Figure 2).

V. Pilot testing
During the 2009-2010 school year, we worked with 12 middle and high school teachers to test our materials in classrooms.

VI. Randomized controlled trials
Our revised materials are currently being tested using about 80 first-year algebra classrooms across Massachusetts.

VII. Conclusion
Atkinson, Derry, Renkl, and Wortham (2000) acknowledge the gap between mathematics research in controlled laboratory settings and the relevance of its findings to classroom settings. They note that lab findings cannot alone improve classroom practice, but that controlled experimental research grounded in cognitive science has substantially improved educational practice.” (p. 184). We hope to illustrate one way that building an experimental research can improve educational practice and student learning, by extending the benefits of learning through comparison to authentic classroom settings.

References

Gentner, D., Looewenstein, J., & Thompson, L. (2003). Learning and transfer: A general role of analogical encoding. Journal of Educational Psychology, 95(2), 393-408.


Figure 1. Experimental comparison materials from Rittle-Johnson & Star (2007)

Figure 2. Worked example from comparison curriculum

Figure 3. Take-away page excerpt from the revised curriculum

We are currently finishing data collection of videos, logs, and student assessments for the first year of the RCT. We will continue to collect data during the 2011-2012 school year.

Based on our pilot year feedback, we expanded our curriculum to include 150 worked example pairs. We also added a second page for each (see Figure 3).