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FEATURE

Psychology's role in math and science

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Editor's note: APA President Sharon Stephens Brehm, PhD, has invited the chairs of her presidential task forces to summarize their work. In this column, Nora Newcombe, PhD, discusses the Task Force on Math and Science Education.

At a meeting held at the National Research Council headquarters teams from 40 school districts participated in professional development workshops outlined in the council's workbook, "Global Perspectives for Local Action: Using TIMSS To Improve U.S. Mathematics and Science Education." Using the 443-page workbook, participants learned what is taught in the United States and 41 other countries where the examinations are administered, how the subjects are taught in those countries, and what U.S. districts can do to emulate the classroom practices of the most successful countries.

The activity described above represents a vigorous and exciting effort to transform mathematics education, correct? Well, yes, but there's a "but." The meeting was held eight years ago, in the fall of 1999. Over the past few decades, there has been an outpouring of spirited attempts to diagnose why American children lag behind students in other countries in their learning of mathematics and science. Have we succeeded? Unfortunately, the Trends in International Mathematics and Science Study found no measurable change in the performance of American fourth graders between 1995 and 2003 (although there were some indications of improvement among eighth-graders).

Can psychology play a role in changing the situation? Addressing this question is the charge of APA's Presidential Task Force on Math and Science Education, initiated by APA President Sharon Stephens Brehm, and jointly sponsored by the Society for Research in Child Development (SRCD). Our work is currently in midstream. Here is a distillation of our thinking at this point.

We know some things, but much of what we know is more in the natures of principles than recommendations of specific educational packages. For example, we know that actively generating a fact or generalization produces better recall of important information or of useful algorithms than does passive reading, but this general principle would apply to almost any classroom learning situation, not an element of any particular educational package. The current trend toward evidence-based education sometimes entails evaluation of textbooks or curricula, rather than component principles or specific techniques. This disconnect creates ambiguity about what evidence is, and how evidence can be used to improve mathematics and science education

Diagnosing what works in mathematics and science education requires thoughtful assessment--we need better tests. Discussion of the No Child Left Behind Act has highlighted the controversial role of testing in the improvement of education. Critics argue that "teaching to the test" has had a pernicious influence on teaching, while supporters emphasize the need for evidential standards and accountability. Both sides are right. We need tests of achievement in mathematics and science that are worth teaching to. Psychology has an important role to play in devising them.

We don't know everything and we sometimes disagree. As researchers, we are comfortable with the idea that knowledge is evolving. We are also familiar, if not always comfortable, with the fact that experts disagree. But the consumers of such information who must deal every day with how to teach mathematics and science--teachers, administrators, policymakers, parents--may feel confused or betrayed when experts disagree or recommendations change.

Building on the last observation, we need a new model of interdisciplinary practice. The relation of psychology to mathematics and science education may be analogous to the relation of the biological sciences to medicine, or, arguably, more analogous to the relation of the physical sciences to engineering. Either way, we need closer interconnections between psychology departments and colleges of education. This would, however, require radical changes in university structure.

We are also grappling with actions to recommend that would address these issues. Two possibilities include the following:

APA needs to foster intellectual exchange among subdisciplines of psychology that all are parts of this puzzle . APA is uniquely situated to do this, together with other societies such as SRCD and the American Educational Research Association. APA has a broad base that includes school psychologists,educational psychologists, quantitative and psychometric psychologists, cognitive and social development researchers, and so on.

APA needs to advocate for funds to support educationally relevant psychological research. We all need research dollars, but policymakers particularly need to know more about assessment and evaluation, currently the orphans of funding despite their central importance to policy-relevant research. Another specific need is to safeguard, reinstate or augment funding for interdisciplinarity, for example, grants for PhDs in mathematics or bioengineering to pursue postdoctoral work or sabbaticals centered on education.