WHY SOCIAL SCIENCE?

Because It Is Central in Guiding Efforts to Foster Success in STEM in Our Children and Youth

By Martha Zaslow, Ph.D., Director for Policy and Communications, Society for Research in Child Development

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The social sciences are key to informing and supporting our national priorities. One such priority is having a strong workforce in science, technology, engineering, and math (STEM). As in the era of Sputnik, we are realizing that we need to catch up in this area. Reports like *Rising Above The Gathering Storm* sounded an alarm, calling for investments to foster a strong science and technology workforce in order for the United States to maintain competitiveness globally.

Developmental science, or research on how children learn and develop, is helping to *grow the roots of STEM*—stimulating interest and competence in STEM in children and youth from all backgrounds in our country. The full set of social science "tools" is proving important in this effort, from looking at factors that influence and predict student achievement in large longitudinal datasets, to conducting evaluation studies looking at what works best in encouraging the roots of STEM to grow, to insights from smaller focused studies diving more deeply into mastery of specific concepts.

Below are a few examples that illustrate how social science research is contributing to this important national goal. Even in this small set of examples focusing on only one aspect of STEM, math skills, it is clear how important federal funding has been to the development of this body of research and how critical it is in assuring that the research is summarized and made accessible to educators and policy makers (for example, Educator's Practice Guide on Improving Mathematical Problem Solving in Grades 4 Through 8). Foundation funding is also contributing in important ways—for example, the DREME (Development and Research in Early Math Education) Network convened by the Heising-Simons Foundation.

The Role of Early Math in Children's Achievement Trajectories

Studies following children's development over time point to the central role of math skills in providing a foundation for later achievement. Coordinated analyses conducted by Duncan and colleagues of data from six longitudinal studies found that children's math skills at school entry were the most powerful predictor of later achievement. While reading skills and attention also predicted later achievement, math surpassed these.

Yet we do very little early on to develop interest and competence in math. Some of this lack of focus on early math has to do with a belief that instruction in math is not appropriate for young children—that it would require didactic approaches in which teachers impart concepts lecture-style and through practice using work papers. Young children need engaging, hands-on activities in order to extract important concepts, and they need physical activity. Yet a growing body of evidence from developmental science is making clear that children are interested in math concepts very early and can be supported in age-appropriate ways in fostering growth in this area.

Developmental scientists have developed and carefully tested early math curricula that tackle these issues (as recently reviewed by Clements and Sarama).Watching videos of young children learning to count by jumping the right number of times or learning about patterns using brightly shaped objects will quickly convey how engaging early math activities can be. The evaluations show that such approaches are effective in helping young children learn not just the obvious math concepts, but

more complex ones that will help them on their way towards competence in STEM. These approaches have been tested with children from a range of backgrounds including those from low-income families.

It is not only what happens in school settings that matters. Mothers' early support is also important. Mothers can guide and support their young children's early math skills during play in a variety of ways, for example, helping their children count objects, identifying written numbers, and labeling the size of sets of objects. Children whose mothers supported them in labeling quantities performed better on math tests later during preschool and on addition and subtraction problems as late as first grade. The roots of STEM grow at home as well as at early care and education and at school.

Math Concepts *and* Math Self-Concepts

Very recent research is zeroing in on the specific math concepts and skills that are important for children to master. Better developed math skills in preschool support math skills in first grade, which helps to predict math knowledge in fifth grade. However, the specific skills that predict first grade success (such as counting objects and comparing quantities) were not necessarily the same early skills that predicted longer-term success. For example, an early ability to understand written numbers and perform calculations predicted fifth but not first grade math success. These findings are important for targeting specific concepts in math instruction.

But interestingly, it is not only the specific content of instruction that appears to be important. It is also the way children feel about themselves as learners. Looking at children's development between ages 5 and 18 in three large datasets (of British and American children), researchers found that children's beliefs about their math abilities, together with their mastery of skills in this area, are important to later math achievement. These findings suggest that we need to engender the mastery of specific concepts *and* a belief in students about themselves as competent learners of math.

Engaging Children and Youth from the Full Range of Backgrounds

Rising Above the Gathering Storm emphasized that in order to retain global competitiveness in STEM, the United States needs to support interest, engagement, and achievement in STEM among children and youth from a full range of backgrounds. Developmental scientists have been active participants in research aimed at identifying effective approaches to assuring that the full diversity of children in the U.S. have access to and can progress towards careers in STEM. The challenge is a critical one. According to the National Academy of Sciences Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline, underrepresented minority groups make up more than a quarter of the U.S. population, but less than 10 percent of college-educated Americans in science and engineering occupations. Much needs to be done to assure that representation in STEM occupations for key demographic groups is proportionate to the national population.

Why Social Science? Because social sciences play a critical role in helping to ensure all of our children have the appropriate nutrients to grow the roots of STEM.

***Martha Zaslow, Ph.D.**, is Director for Policy and Communications at the Society for Research in Child Development (SRCD) and a Senior Scholar at Child Trends. As Director for Policy and Communications at SRCD, Dr. Zaslow directs the SRCD Policy Fellowship program, facilitates the dissemination of research to decision- makers and the broader public, and keeps the SRCD membership apprised of social policy and science policy developments related to children and families. As a Senior Scholar at Child Trends, Dr. Zaslow conducts research focusing on professional development of the early childhood workforce, and approaches to improving the quality of early care and education.*