
Early Math in California

Deborah Stipek
Stanford University

Alan Schoenfeld
University of California, Berkeley

Conference Participants

Catherine Atkin, President, Preschool California

Mindy Brookshire, Senior Program Associate, WestEd Center for Child & Family Studies

Lori Burns, Director, Santa Clara County Partnership for School Readiness

Jill Cannon, Policy Fellow, Public Policy Institute of California

Elaine Chin, Dean, College of Education, San Jose State University

Lynn Karoly, Director, Office of Research Quality Assurance, Rand Corporation

Yolanda Garcia, Director of WestEd, Excellence in Early Education Institute

Sandra Giarde, President, California Association for the Education of Young Children

Deanna Gomby, Vice-President, Education, Heising-Simons Foundation

Jeanne Herrick, Assistant Superintendent, Educational Services, Monterey County Office of Education

Cory Jaspersen, Principal Consultant, Office of State Senator Joe Simitian

Mike Kirst, Chair, California Board of Education

Susanna Loeb, Professor, Stanford University School of Education

Peter Mangione, Co-Director, WestEd Center for Child & Family Studies

Camille Maben, Director, Child Development Division, California Department of Education

Deb Meng, California Kindergarten Association Board Member & Teacher

Judith Miner, President, Foothill Community College

Scott Moore, Senior Policy Advisor, Preschool California

Kris Perry, Executive Director, First 5

Linda Platas, Specialist, Institute of Human Development, U.C. Berkeley

Andee Press-Dawson, Executive Director, California Afterschool Network

Heather Quick, Principal Research Scientist, American Institutes for Research

Alan Schoenfeld, Elizabeth and Edward Conner Professor of Education, U.C. Berkeley

Liz Simons, President, Heising-Simons Foundation

Deborah Stipek, Professor, Stanford University School of Education

Matthew Rosin, Senior Research Associate, EdSource

Marcella Klein Williams, California STEM Learning Network, Chief Education Officer

Marcy Whitebook, Director, Center for the Study of Child Care Employment, U.C. Berkeley

Joyce Wright, Assistant Superintendent, Instructional Support Services, Sacramento County Office of Education

Staff assistance from Stanford graduate students, Juliet Lee and Kathy Liu Sun

Early Math Teaching & Learning: An Opportunity for California

The jury is in: math matters for young children. Recent research demonstrates that children's level of mathematics knowledge before entering school is critical to their subsequent academic achievement and even predicts high school graduation. Given the significant achievement gap in math skills at kindergarten entry and the abysmal performance of California students relative to other states (8th-grade math scores rank 47th on the National Assessment of Education Progress), California policy makers and educators have compelling reasons to improve young children's opportunities to develop mathematics skills.

The new Common Core State Standards have created a clear and uniform target that can inform policies and practices for early childhood education.¹ Now adopted by 46 states, including California, the Common Core Standards will determine the curriculum, instruction, and assessments from kindergarten through high school. They do not address standards for preschool-age children, but they provide clear direction for the educational experiences that young children will need to succeed in elementary school. Ideally, we should aspire to a seamless and developmentally appropriate progression in math learning opportunities for children from preschool through the early elementary grades. Transitional kindergarten, if implemented in California, could make that easier to achieve.

On January 19-20, 2012, early education leaders and decision makers in California gathered at Stanford University to examine current California policy and practice, and to recommend strategies to increase the state's capacity to provide a solid foundation for learning mathematics in early childhood (preschool – grade 3). This California-focused conference was funded by the Heising-Simons Foundation, and informed by a previous meeting of national experts in mathematics teaching and learning held at the University of California, Berkeley, in November 2011 (see www.earlymath.org). This document summarizes the discussion of the California-focused meeting which addressed four issues: standards, assessment, professional development, and curriculum.

The California Context

Standards

Published in 2008, *California's Preschool Learning Foundations* describes the knowledge and skills that 48- and 60-month-old children are expected to attain in high-quality preschool programs. The information is intended to inform parents' and teachers' expectations, instruction, planning, and professional development. The Learning Foundations include five areas related to mathematics: number sense, algebra and functions (classification and patterning), measurement, geometry, and mathematical reasoning.

¹ <http://www.corestandards.org>

An initial examination of the California Foundations suggests that they align fairly well with the new kindergarten Common Core standards in terms of content areas.² They may not, however, convey fully the expectations for deep conceptual understanding, problem-solving and application, reasoning, and modeling that are contained in the Common Core standards, or lay the foundation needed for students to succeed on the Common Core standards assessments being developed.³ The Common Core sets a high bar for mathematical proficiency, and thus for school readiness.

The new standards and accompanying assessments will require elementary school children to: (1) make sense of problems and persevere in solving them; (2) reason abstractly and quantitatively; (3) construct viable arguments and critique the reasoning of others; (4) model with mathematics; (5) use appropriate tools strategically; (6) attend to precision; (7) look for and make use of structure; and (8) recognize and apply mathematical patterns in problem solving. Children will not simply be asked to get the answer to mathematical problems, but rather they will be asked to describe how and why they reached their answer.

The California Preschool Curriculum Framework, a document that accompanies the California Preschool Learning Foundations, offers a range of strategies teachers can use to engage young children, and suggests some of the greater depth of understanding and mastery of skills that will be required by the Common Core standards and the new assessments. Nevertheless, it too, may not be sufficiently detailed or as closely aligned with the Common Core standards as it could be.

Given that the Common Core standards and the related assessments will demand much more than current standards and assessments, the California Preschool Learning Foundations and the California Preschool Curriculum Framework may need to be expanded. Any revisions should be informed by research that identifies the skills that typically developing preschool-age children, with appropriate instructional support, can demonstrate.

Assessment

Children

California requires the use of the Desired Results Developmental Profile (DRDP), a teacher assessment of preschool students' skills, in all state-funded, center-based programs and Family Child Care Home Education Networks. The DRDP is also used in about half of California's Head Start programs. The DRDP-School Readiness (SR), designed to assess school readiness at the beginning of kindergarten, is currently being piloted. Both the DRDP and DRDP-SR are closely aligned with the Preschool Learning Foundations.

Three constraints to the effective implementation of the DRDP-SR are: (1) the amount of training needed to use it effectively; (2) the amount of time required to observe and assess students; and (3) teachers' lack of awareness of the value of the DRDP as a formative assessment tool that can be used to guide practice.

² Analysis by Sacramento County Office of Education, June 22, 2010, Addendum A.

³ States adopting the Common Core standards have signed on to one of two consortia that are developing assessment systems — the Smarter Balanced Assessment Consortium and the Partnership for Assessment of Readiness for College and Careers (PARCC). California is part of the Smarter Balanced consortium (<http://www.cde.ca.gov/ta/tg/sa/smarterbalanced.asp>)

Math items on the DRDP/SR could be improved by fine-tuning descriptions of children’s learning outcomes and by providing clearer directions on evidence needed to support attainment. If changes are made in the DRDP (or the DRDP-SR), they need to be made in conjunction with changes made to the Preschool Learning Foundations.

Programs

A Quality Rating and Improvement System (QRIS) is used in a few California regions to assess early childhood program quality and to make those quality ratings publicly available. A coalition of 16 Early Learning Challenge Regional Leadership Consortia will use new federal Race-to-the-Top Early Learning Challenge funds to create or improve their individual QRIS systems and, potentially, to achieve greater alignment among them. There is no current plan to create a state-wide, uniform QRIS.

The only component of any California QRIS that specifically assesses children’s opportunities to develop academic skills is the classroom observation assessment known as the CLASS. The CLASS includes three ratings that concern general instruction, but none that is specific to mathematics. Most early childhood education settings function outside of a QRIS system, and if they use any measure of program quality, it is likely to be an Environmental Rating Scale that does not directly assess instruction.

Currently California programs are not assessed with regard to the opportunities they provide for children to develop a foundation in mathematics. Given the importance of early mathematics for children’s school careers, some thought should be given to the creation of appropriate program assessments.

Professional Development

In K-3 education, California teachers must obtain a bachelor’s degree, pass written and performance tests, and be credentialed before they can teach. Their college coursework includes student teaching opportunities. Qualifications required for working with young children are based on sector (e.g., home- or center-based care), funding sources, and licensing status. At the lowest level, no early childhood-specific coursework or training is required. At the highest level, master teachers in Title V state-contracted programs are required to have completed only 16 semester units in general education, 24 units in early childhood education, and 175 days of experience in an instructional capacity in a child care and development program, or an associate degree in early childhood education or child development. There is no requirement related to the teaching of mathematics. Most California community and four-year colleges that offer an associate degree have signed on to the eight courses recommended by the Curriculum Alignment Project⁴ and adopted by the California Department of Education’s Child Development Division. Math teaching is not specifically mentioned in any of the eight courses, although some colleges offer courses that include math teaching. The teaching of mathematics is also barely mentioned in the California Early Childhood Educator Competencies, which are designed to serve as a guide to training and professional development.

⁴ http://www.childdevelopment.org/cs/cdctc/print/htdocs/services_cap.htm

Professional development opportunities for early childhood educators are varied and typically limited, although a few statewide programs exist. For example, California offers some early childhood educators opportunities to develop their skills through CARES Plus, funded by First 5, and through the California Preschool Instructional Network (CPIN). But CARES Plus does not focus on math, and CPIN is available only to Title V programs. Both provide only occasional programs focused on the teaching of mathematics. Many early childhood educators have difficulty with the general math community college requirements, lack confidence in their own math skills, and are reticent about teaching the subject. Strategies to develop math teaching effectiveness, therefore, need to include efforts to help early childhood educators develop math skills and the confidence to teach math.

Curriculum

Early childhood programs in California are free to use any curriculum they wish. There is no official review in California of the math curricula that are available for preschool-aged children, and there is considerable variability as to which curriculum is used or whether one is used at all.

Recommendations

The participants at the meeting made the following recommendations to improve young children's opportunities in California to develop a strong mathematics foundation.

Policy and Advocacy

1. Re-establish the California Early Learning Advisory Council, with broad membership from the practice and academic communities.
2. Launch a communications campaign to inform multiple audiences (e.g., parents, teachers, community college faculty) about the critical importance of math in the early years.
3. Explore the creation and implementation of an age 3-8 teaching credential.
4. Create or appoint an existing state panel to evaluate preschool and transitional kindergarten math curricula, and provide guidance for adopting and implementing them.

Standards and Assessment

5. Re-evaluate the Preschool Learning Foundations, DRDP, and DRDP-SR to ensure their comprehensive alignment with the rigorous Common Core assessments that children will encounter in elementary school.
6. Expand training in the use of the DRDP/DRDP-SR, help program directors and principals create time for teachers to do the assessments, and provide guidance for using them as formative assessments that guide instructional planning.

Teacher Training and Support

7. Improve pre-service training by requiring a course in math teaching for an associate or bachelor's degree in early childhood education, and requiring a focus on math instruction in the context of courses for the Child Development Teacher permit. Develop model course syllabi, lesson plans, and videos to facilitate the implementation of course content focused on the teaching of mathematics to young children.
8. Develop a pipeline of early math specialists who can serve as faculty in colleges that prepare preschool and early elementary school teachers.
9. Develop math teaching experts who can serve as mentors and coaches in early childhood education programs.
10. Develop a web-based, math-related resource center, with materials, information about curricula, and videos illustrating effective teaching and assessment.
11. Improve access to in-service training that: (1) ensures early childhood educators' knowledge of the Preschool Learning Foundations; (2) provides resources related to math teaching (e.g., curricula materials, activities, games); and (3) develops skills in providing meaningful, developmentally appropriate math learning opportunities. Training opportunities need to vary for different segments of the workforce (e.g., preschools, and center and family child care).
12. Support districts, schools, and early childhood programs in their efforts to engage parents and families of young children and to provide parents with math materials and activities they can do at home with their children to complement the math learning that the children are receiving in their programs and schools.

Evaluation

13. Include an evaluation component in all innovative policies and programs.

Reasserting California's Leadership

California has, in the past, led the country in early childhood education quality and innovation. The value of early educational experience is well established now. The importance of a strong foundation in mathematics for later academic success is clear. California could once again become a leader by developing policies and supports to ensure all young children's opportunities to develop that strong foundation.

Deborah Stipek has a Ph.D. in developmental psychology from Yale University. She is currently a professor and the former dean of the School of Education at Stanford University, a fellow of the American Educational Research Association, and a member of the National Academy of Education. She directed the UCLA laboratory elementary school for 10 years while she was a faculty member at UCLA, and has conducted many studies related to early childhood education and elementary mathematics instruction, focusing on motivation.

Alan Schoenfeld is the Elizabeth and Edward Conner Professor of Education and Affiliated Professor of Mathematics at the University of California at Berkeley. He is a Fellow of the American Association for the Advancement of Science and of the American Educational Research Association, and a Laureate of the education honor society Kappa Delta Pi. Alan has served as President of the American Educational Research Association and vice president of the National Academy of Education. In 2011 he was awarded the Felix Klein medal for lifetime contributions to mathematics education by the International Commission on Mathematics Instruction.

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The report is available at www.earlymath.org