

PREFACE

BROADENING THE CRITICAL CONVERSATIONS

Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations is part of the Catalyzing Change Series, a collection of three books intended to initiate the critical conversations on policies, practices, and issues impacting mathematics education. In 2018, the first book in the series, *Catalyzing Change in High School Mathematics: Initiating Critical Conversations*, was published and provided the framework to engage stakeholders in initiating critical conversations for transforming high school mathematics education to ensure that every student has the mathematical experiences necessary for personal and professional success. The conversations and work initiated by *Catalyzing Change in High School Mathematics* suggested a need to broaden the critical conversations to include early childhood, elementary, and middle school mathematics. For example, the recommendation for a common shared pathway in high school mathematics must take into consideration the mathematical experiences at the other levels. That is, it is essential to consider what must happen in early childhood and elementary mathematics for a common shared pathway to become a reality in middle and high school mathematics.

Several organizations have contributed to the conversation and have pushed for changes in policies in mathematics education. These conversations have focused on examining the purpose of school mathematics, policies on the tracking of students and teachers, support for equitable teaching practices, and policies impacting students' access to mathematics pathways that prepare them for future endeavors. Just Equations, a project of the Opportunity Institute, contributed to the conversation in their report *The Mathematics of Opportunity: Rethinking the Role of Math in Educational Equity* (Burdman 2018). The report focused on four interconnected dimensions: (1) Content students should know for their future endeavors; (2) Instruction that employs equitable instructional practices; (3) Assessment and unpacking the impact of high-stakes assessments; and (4) Readiness and structures that focus on mathematics pathways. *The Opportunity Myth* (TNTP 2018), a report on data from elementary grades through high school, found that differences in exposure to mathematics content and high-quality mathematics teaching lead to different mathematics learning experiences. Students who are marginalized (students of color, those from low-income families, emergent bilinguals, and students with disabilities) are less likely to have opportunities for an optimal amount

of time engaged in mathematical reasoning and sense making. Similarly, *Checking In: Do Classroom Assignments Reflect Today's Higher Standards?*, a report from the Education Trust (2015), found that roughly three-fourths of mathematics assignments given to students have low cognitive demand, overemphasize procedural skills and fluency without understanding, and provide little opportunity for students to communicate their mathematical thinking. This tendency was worse in schools with higher poverty levels.

Much has been learned from the work and conversations initiated by *Catalyzing Change in High School Mathematics* and other reports. The high school recommendations are not exclusive to high school; rather, they overlap with other grade bands in significant ways. This overlap led to thinking about how the recommendations for high school have implications for early childhood, elementary, and middle school mathematics. Several questions arose:

- How is the purpose of early childhood, elementary, and middle school mathematics similar and different from that of high school mathematics?
- How are equitable structures across early childhood, elementary, middle school, and high school mathematics similar and different?
- How are the needs of young children, elementary-aged children, young adolescents, and high school-aged students addressed through equitable mathematics teaching practices supportive of building positive mathematical identity and a strong sense of agency in mathematics?
- How does a common shared mathematics pathway across early childhood, elementary, and middle school education support a common shared pathway focused on essential mathematical concepts in high school?

Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations recognizes that the strengths and needs of young children and elementary-age students must be considered in conversations that address the continuity and alignment of mathematics education across the early childhood and elementary school levels. Young children bring a sense of curiosity and wonder to their learning environments. Consequently, learning environments in mathematics must be responsive to their sense of curiosity and wonder. Early childhood and elementary mathematics should be related to children's questions, interests, and lives, and build on family, community, and cultural funds of knowledge. Students should investigate mathematics within contexts that are interesting and relevant to them. Meaningful contexts provide opportunities for young children to apply important mathematical ideas to make sense of everyday life, and students should have ample opportunities to engage in mathematics through relevant contexts.

The 2018 National Survey of Science and Mathematics Education (NSSME+; Banilower et al.) report by Horizon Research suggests that many mathematics

teachers believe that mathematics teaching and learning should be consistent with some of the practices highlighted in NCTM's Mathematics Teaching Framework (Huinker and Bill 2017), which supports the development of positive mathematical identities as well as implementing equitable instructional practices. At least 85 percent of teachers surveyed believed that (1) teachers should ask students to justify their mathematical thinking, (2) students should learn mathematics by doing mathematics, (3) most class periods should provide students opportunities to share their thinking and reasoning, and (4) students learn best when instruction is connected to their everyday lives. These findings suggest that student discourse (justifying, sharing thinking, and reasoning), using representations by doing mathematics, and making mathematics relevant to students' lives are significant practices for mathematics teaching and learning.

Grouping students by similar abilities is a serious challenge that needs critical conversations. The NSSME+ report found that 49 percent of elementary school teachers agree with the statement "Students learn mathematics best in classes with students of similar abilities." Grouping students by abilities for instruction in mathematics segregates students of different backgrounds into separate experiences on pathways leading to different outcomes. Too often, marginalized students are segregated into groups in which they are routinely exposed to instruction that is focused primarily on rote skills and procedures that do not stretch students' higher-order thinking and that gives limited attention to developing their conceptual understanding, while other students are sequestered into groups who experience mathematics according to the four beliefs (e.g., focus on mathematical justification, doing, reasoning, and connections) described above. The belief in grouping students by similar abilities causes tensions and calls for a much needed critical conversation.

The key recommendations for *Catalyzing Change in Early Childhood and Elementary Mathematics* continue the conversations initiated in *Catalyzing Change in High School Mathematics*. Similar to high school, critical conversations in early childhood and elementary mathematics should center on the following serious challenges:

- Broadening the purpose of school mathematics to prioritize development of deep conceptual understanding so that children experience joy and confidence in themselves as emerging mathematicians
- Dismantling structural obstacles that stand in the way of mathematics working for each and every student
- Implementing equitable instructional practices to cultivate students' positive mathematical identities and a strong sense of agency
- Organizing mathematics along a common shared pathway grounded in the use of mathematical practices and processes to coherently develop a strong foundation of deep mathematical understanding for each and every child

The Catalyzing Change Series, with books focused on early childhood and elementary, middle school, and high school mathematics, is part of an ongoing long-term collaborative process among stakeholders interested in making sure that each and every student has access to high-quality mathematics teaching and learning. NCTM will continue to support collaborative efforts through professional learning opportunities and additional publications that will provide vignettes and further examples to clarify and illustrate the recommendations put forward in the Catalyzing Change series.

The Catalyzing Change Series is intended to foster dialogues on how best to support learners from early childhood through high school. This is critical work and we invite all stakeholders to undertake the endeavor. There appears to be widespread agreement that the need for change in school mathematics is urgent. We can no longer afford to allow school mathematics to advantage the privileged few while disadvantaging and underserving a significant portion of learners. We must engage in the necessary critical work to nurture a democratic society where all can use, know, and understand mathematics to comprehend and critique the world through mathematics and to experience its wonder, joy, and beauty.

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President 2018–2020

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