

PREFACE

THE PURPOSE OF *CATALYZING CHANGE*

The last three decades have seen significant progress in the teaching and learning of mathematics in the United States. The standards-based reform era began in 1989 when the National Council of Teachers of Mathematics (NCTM) published *Curriculum and Evaluation Standards for School Mathematics*, which introduced standards promoting rigorous mathematics content and the development of important mathematical processes and practices. NCTM soon followed this publication with closely related ones that outlined the teaching and assessment practices needed to support those standards (NCTM 1991, 1995). Subsequent iterations of Standards publications, including *Principles and Standards for School Mathematics* (NCTM 2000), *Curriculum Focal Points for Prekindergarten through Grade 8 Mathematics* (NCTM 2006), and *Focus in High School Mathematics: Reasoning and Sense Making* (NCTM 2009), continued to promote this focus on content and practices, and the Common Core State Standards for Mathematics (National Governors Association Center for Best Practices and Council of Chief State School Officers [NGA Center and CCSSO] 2010a) later built on them. Collectively, NCTM's body of Standards work has served as the foundation for mathematics education in the United States and Canada over the past three decades and has had an enormous impact on the development of state and school district standards, curriculum materials, professional development for teachers, and new approaches to assessment.

Much of the discourse surrounding mathematics education and standards has centered on students' preparation in mathematics and statistics for postsecondary education or a career. Although these goals are clearly important and will remain so, *Catalyzing Change in High School Mathematics: Initiating Critical Conversations* underscores the fact that other purposes of mathematics education are also important. Students should leave high school with the quantitative literacy and critical thinking processes needed to make wise decisions in their personal lives. Students should be able to determine whether or not claims made in scientific, economic, social, or political arenas are valid. Students should have an appreciation for the beauty and usefulness of mathematics and statistics. And students should see themselves as capable lifelong learners and confident doers of mathematics and statistics. Never have the broader aims of mathematics education been more important than they are today when mathematics underlies much of the fabric of society, from polling and data mining in politics, to algorithms targeting advertisements to groups of people on social media, to complex mathematical models of financial instruments and policies that affect the lives of millions of people.

The need for change in mathematics education at the high school level is particularly critical. Rigorous standards, along with increased knowledge and implementation of research-informed instructional practices summarized in *Principles to Actions: Ensuring Mathematical Success for All* (NCTM 2014) have contributed to a positive long-term trend since 1990 in mathematics learning at both the elementary and the middle school levels, as measured by the National Assessment of Educational Progress (NAEP); (National Center for Education Statistics [NCES] 2015). However, the steady improvement in mathematics learning seen at the elementary and middle school levels has not been shared to the same degree at the high school level.

Despite the increase in the percentage of high school students enrolling in upper-level mathematics courses over the last three decades (Dossey, McCrone, and Halvorsen 2016), high school NAEP scores have remained essentially flat for the past decade (NCES 2016), and fewer than 50 percent of U.S. high school graduates in 2016 were considered ready for college-level mathematics work, as measured by their ACT mathematics scores (ACT 2016). Even more disturbing, the Programme for International Student Assessment (PISA) showed that U.S. high school students trailed their international peers, on average, in mathematical literacy, defined as the “capacity to formulate, employ, and interpret mathematics in a variety of contexts ... to describe, explain, and predict phenomena (Organisation for Economic Co-operation and Development [OECD] 2016b, p. 28). Clearly, there is room and need to improve the mathematics learning experiences and outcomes for many of our high school students. The system of high school mathematics is complex, and it is the system and its structures—school and district policies, practices, and conditions that either support or impede student learning of mathematics—that need to be critically examined and improved.

Mathematics education at the high school level is part of a complex system of policies, traditions, and societal expectations. Therefore, improvements to high school mathematics will necessitate the engagement of all stakeholders to reexamine long-standing beliefs, practices, and policies that are impeding progress. *Catalyzing Change in High School Mathematics: Initiating Critical Conversations* is written to engage all individuals with a stake in high school mathematics in the serious conversations that must take place to bring about and give support to necessary changes in high school mathematics. These individuals include classroom teachers; counselors, instructional coaches, specialists, and instructional leaders; school, district, and state administrators; curriculum and assessment developers; and policy makers at all levels. *Catalyzing Change* identifies and addresses critical challenges in high school mathematics to ensure that each and every student has the mathematical experiences necessary for his or her future personal and professional success. Critical conversations need to begin, centering on the following serious challenges:

- Explicitly broadening the purposes for teaching high school mathematics beyond a focus on college and career readiness
- Dismantling structural obstacles that stand in the way of mathematics working for each and every student
- Implementing equitable instructional practices to cultivate students' mathematical identity and high sense of agency
- Identifying Essential Concepts that all high school students should learn and understand at a deep level
- Organizing the high school curriculum around these Essential Concepts in order to support students' future personal and professional goals

Catalyzing Change must be viewed as the beginning of a long-term process. Progress toward the vision that it sets out will require sustained effort by the Council and numerous other groups over many years. NCTM will continue to support this collaborative effort through professional learning opportunities and additional publications that will provide vignettes and further examples to clarify and illustrate the recommendations put forward in this publication. Although *Catalyzing Change* focuses primarily on mathematics education in U.S. high schools, it is informed not only by effective practices in the United States but also by those in other countries as well. Likewise, it is our hope that its recommendations may also inform work being done in other countries as part of a larger, international dialogue about how best to prepare high school mathematics students.

This work is critical for all of us to undertake. The need for change and improvement is urgent. We owe this effort not only to our students but also to ourselves as we work together to create and nurture the society we wish to inhabit.

Matt Larson

President, 2016–2018

National Council of Teachers of Mathematics