

# Preface

The population of the United States is approximately 323,996,000. Approximately 18% of these individuals are formally enrolled in a public or private elementary or secondary school or are homeschooled, while nearly another 7% are enrolled as students in a degree-granting postsecondary institution. In the entire U.S. population in 2014, about 66% were 25 years or older, and of those adults, 88% had completed high school or its equivalent, and about 30% had at least a bachelor's degree (Snyder and Dillow 2011; U.S. Department of Commerce 2014).

No single government agency controls public education in K–grade 12 in the United States. Rather, authority for most educational decisions lies with education agencies in the 50 individual states, which in turn share decision making with the individual school districts within their borders. In the 2015–16 academic year, U.S. public schools educated approximately 50,773,000 students, private elementary and secondary schools contributed another 5,183,000 students, and homeschooling accounted for another 1,775,000 students (Snyder and Dillow 2015). Similarly, both public and private institutions exist at the college and university level, with authority for state institutions residing at a mixture of state and local levels for public institutions and at the institutional level for most private institutions. In the 2012–13 academic year, 4,726 accredited institutions offered degrees at the associate's level or above. These included 1,623 public institutions, 1,652 private not-for-profit institutions, and 1,451 private for-profit institutions. Of the total of 4,726 institutions, 3,026 awarded degrees at the bachelor's level or higher, and 1,700 offered associate's degrees as their highest degree (Snyder and Dillow 2015).

Determining what is happening in such a large and complex country as the United States is quite difficult, even for those in the United States and others who are familiar with U.S. education. Many at conferences of the International Congress on Mathematical Education (ICME) are unfamiliar with education in the United States. Consequently, in 1999, the U.S. National Commission on Mathematics Instruction recommended that the National Council of Teachers of Mathematics (NCTM) request funds from the National Science Foundation (NSF) to bring together available data

about mathematics education in the United States for a document to be distributed at the Ninth International Congress on Mathematical Education (ICME-9), held in 2000, to provide mathematics educators throughout the world with information about this complex system. This process was repeated for subsequent ICMEs, held in 2004, 2008, and 2012. The present publication now extends the series with information available as of the end of 2015.

This report begins with some general information about education in the United States. It then describes the three kinds of curricula identified in the Second International Mathematics Study—intended, implemented, and attained (McKnight et al. 1987)—and gives special attention to the emergence of a common K–grade 12 curriculum that has been adopted by 43 states and the District of Columbia. This curriculum, the Common Core State Standards for Mathematics (CCSSM), was developed by a consortium consisting of state governors and chief state education officers (National Governors Association Center for Best Practices and Council of Chief State School Officers [NGA Center and CCSSO] 2010a, 2010b). The adoption of such a set of common outcomes, matching assessments, and similar instructional materials is expected to bring a new level of uniformity and coherence to U.S. mathematics education. This report examines the current state of adoption, adaptation, and implementation of those new standards and surveys the resulting shifts in expectations, content, instruction, and learning opportunities emanating from attempts to align school mathematics programs with them. The report also examines the Every Student Succeeds Act, the federal education law passed by the U.S. Congress at the end of 2015 to revise, update, and reauthorize the No Child Left Behind Act, which had defined the U.S. government's role in public elementary and secondary education from 2002 to that time.

This report on mathematics education in the United States consists of nine chapters. A brief survey of their focus and content may help readers orient themselves and navigate through them.

Chapter 1 presents a general overview of public and private educational opportunities in the United States, including the movement of U.S. students

through the K–12 school years and on to admission to postsecondary education. It also looks at the recent passage of the Every Student Succeeds Act of 2015.

Chapter 2 gives an overview of the history and current status of the intended curriculum for school mathematics—its origins and goals. This portion of the report gives a listing and discussion of the documents and movements that have given U.S. mathematics education its current shape and have influenced the forces that are currently acting on it.

Chapter 3 examines what is known about the actual implemented K–12 curriculum, instructional approaches, and materials in use and considers evolving changes in the postsecondary curricula.

Growing naturally out of Chapter 3, Chapter 4 addresses the attained curriculum. It examines the extant outcomes from national and international assessments of student achievements in mathematics and problem solving. The national assessments survey state- and national-level performances on the National Assessment of Educational Progress (NAEP). Chapter 4 ends with an examination of student performance on college entrance examinations.

In Chapter 5, the focus is on U.S. student achievement outcomes in international comparative studies—Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA). Such results give a glimpse of how the performance of U.S. students compares with that of their international peers and provide a basis for asking questions about the impact of various factors in education and social environments that may offer explanations for differences in international student achievement in mathematics.

The remaining chapters of the book examine the following:

- Chapter 6: The Common Core State Standards for Mathematics (NGA Center and CCSSO 2010a, 2010b), with an emphasis on current professional development efforts and resources for teachers
- Chapter 7: Changes in school formats (charter, private religious, private nonreligious, and home-schooling) and their challenges for transitions between levels of schooling; mathematics teacher education and professional development programs; and new resources for teachers and professional

development focusing on data and statistics and on weaving them into school curricula

- Chapter 8: Special programs for accelerated students at the K–12 school and postsecondary levels, as well as national and international competitions in mathematics for students
- Chapter 9: Professional organizations and resources for teachers of mathematics

One message that comes through repeatedly in this report and its descriptions is that the variety of education programs available in the United States is very great, and thus the possibility of characterizing them adequately in a brief document like this one is very small. Another message is that all levels of the U.S. educational system exhibit great flux, and even though we have attempted to provide the latest information available, we realize that the content that we present in this report will quickly become dated. By listing our sources, we hope to enable interested readers to obtain updated information.

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