SOUND off!

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The High School Mathematics Curriculum—What Can We Learn from History?

"History is who we are and why we are what we are."

—David McCullough

Debate over what mathematics should be learned, by whom it should be learned, and when it should be learned has long been a focus of educational reform initiatives in the United States (Jones 1970; Romberg 2010). *Common Core State Standards for Mathematics* (CCSSM) is the latest effort to reform and improve K–12 mathematics education (http://www.corestandards.org/the-standards/mathematics). As educators and others examine and discuss the CCSSM, it seems appropriate to review some earlier efforts to influence the high school mathematics curriculum.

A glimpse into more than one hundred years of the history of mathematics education reveals that many different professional groups have offered pronouncements, recommendations, goals, and standards for school mathematics. An examination of these reports reminds us that many current problems and issues are not new:

- In 1894, the National Education Association's *Report of the Committee of Ten on Secondary School Studies* offered suggestions for standardizing the secondary school curriculum. It stimulated a movement to establish a standard secondary school mathematics course sequence (algebra-geometry-algebra) that continues in many high schools today.
- In 1918, the Commission on the Reorganization of Secondary Education issued *Cardinal Principles of Secondary Education*. The principles included health, command of fundamental processes, worthy home membership, vocation, civic education, worthy use of leisure time, and ethical character. The absence of specific attention to mathematics put educators on the defensive for more than a decade and served as a vivid reminder that there was disagreement about whether mathematics played a critical role in becoming a successful citizen.
- In 1923, the National Committee on Mathematical Requirements published a report entitled *The Reorganization of Mathematics in Secondary Education*. It called for more unification and integration of the high school mathematics curriculum and proposed the concept of function as a central unifier of algebra and geometry.

A common emphasis of each of these early reports was the focus on secondary schools. During these decades (1890 to 1930), more students were attending secondary schools, and the mission of secondary school expanded to serve an increasingly diverse population. In 1890, less than 5 percent of students graduated from high school; by 1930, in contrast, about 30 percent did (Kliebard and Franklin 2003). This changing demographic meant that many of these high school students had no intention of going to college and that high schools began to examine how their mathematics program could better serve the needs of a broader student body—hence, the genesis of new courses such as general mathematics.

Fast forward to the 1950–1960s—the "new math" era. Reform efforts during this time were spurred by a general dissatisfaction with the level of mathematics knowledge that students possessed

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on leaving high school (UICSM 1957). Some recommendations of these years included the following:

- In 1959, the College Entrance Examination Board charged the Commission on Mathematics with examining the secondary school mathematics curriculum with the goal of improving preparation for college. The CEEB called for high school students to receive "strong preparation, both in concepts and skills."
- In 1963, the Cambridge Conference convened a group of recognized scholars to focus on a K–12 mathematics curriculum that would not be restrained by practical considerations "such as educational psychology, pedagogy, mathematical knowledge of teachers or real classrooms" (Educational Services Inc. 1963, p. 3). The report, *Goals for School Mathematics*, outlined ambitious mathematics curricular goals for K–12 students that would accelerate the breadth and depth of mathematics to be learned.

The "new math" era was followed by a "back to the basics" push. The National Council of Teachers of Mathematics responded by calling for an increased focus on problem solving:

- In 1980, NCTM released *An Agenda for Action,* which called for greater attention to problem solving and more mathematics study for all students, including at least three years of mathematics for all high school students. This recommendation, together with later national concerns about education in America (National Commission on Excellence in Education 1983; National Research Council 1989), served as a stimulus for many states and school boards to raise the number of years of mathematics needed for graduation from high school.
- In 1989, NCTM pushed the envelope in the direction of national standards by outlining specific goals for the K–12 mathematics curriculum. In *Curriculum and Evaluation Standards for School Mathematics* and later in *Principles and Standards for School Mathematics* (2000), K–12 mathematics content strands and processes were outlined by grade bands. These documents also encouraged integration of content, providing a new vision for the organization of high school mathematics.

Today's classrooms are likely to be shaped by the most recent curriculum effort—the release of *Common Core State Standards for Mathematics* in 2010. The rapid adoption of these standards by more than forty states represents a watershed moment in the history of mathematics education in the United States.

SOME COMMON THREADS

The reports described here document continued efforts to change and improve the mathematics curriculum. So what can be gleaned from this brief historical review? Here are a few observations.

The role and expectation of a high school education has continued to evolve. As more students from increasingly diverse backgrounds and interests attend high school, the focus of school mathematics has had to shift. Schools have responded by expanding their course offerings and examining both organization and content of these courses.

Efforts to improve school mathematics are continuous. Concern about lack of mathematical knowledge and low performance has been expressed for more than one hundred years by varied sources, including colleges and employers. Regardless of where these concerns originate, new challenges for improvement drive the relentless efforts to change and improve the mathematics curriculum.

The learning of mathematics has been accelerated. In an effort to improve performance, some schools have pushed up the point at which students are introduced to some mathematical topics. Algebra is the poster child for this acceleration. Once the sole domain of college mathematics, algebra began to be included in high school during the late 1800s. Since then, algebra has served as the initial stepping-stone for continued study of mathematics and has advanced from an elective to a required mathematics course for every high school student. In many schools today, students begin a more formal study of algebra as early as sixth or seventh grade.

Different organizational paths for high school mathematics exist. Although the specific subject sequence of algebra-geometry-algebra is deeply engrained in U.S. high schools, recommendations over the years have called for unifying and integrating mathematical topics and engaging students in problem-solving experiences that use a range of mathematical knowledge rather than calling for isolated courses.

Helping students understand and make sense of mathematics remains a central goal. Concerns about learning mathematics with understanding and sense making were reflected in the 1894 Committee of Ten report and all subsequent reports.

Improving the teaching of mathematics is central to any successful reform initiative. With the exception of the Cambridge Conference Report, all the reports noted earlier acknowledge the important role that teachers play in helping students learn. Scholars agree that significant curriculum change in mathematics will not occur in a vacuum. Mathematics teachers will direct and determine the extent to which any curriculum changes in mathematics affect student learning. Therefore, the preparation of mathematics teachers must be strengthened, and the professional growth and development of practicing mathematics teachers must be continuous.

WHERE TO FROM HERE?

Recommendations are one thing; making them happen is another. Each report summarized earlier contains recommendations for action. Although the reports addressed significant curricular and instructional issues, their impact has varied. It is difficult to trace the immediate or long-term effect of these reports on mathematics curriculum. However, we need only compare mathematics curricula over several decades to see that significant changes in mathematics textbook materials have indeed taken place, and some of them can be linked to these major reports (Donoghue 2003; Jones 2004). However, although some changes occur, they are usually much less grandiose than the recommendations that have been offered. In other words, when

everything is said and done, generally much more is said than done.

We should also recognize the possibility of unintended consequences from seemingly worthwhile recommendations. Consider, for example, the numerous recommendations for students to study more mathematics courses in high school (*Agenda for Action* recommended three courses in high school mathematics). Spurred by this recommendation, some states increased high school graduation requirements to include three years of mathematics, and others have since increased their requirements to four years. This action has significantly increased the number of students taking mathematics in high school. That is the good news. However, this action has also created a greater demand for mathematics teachers. Yet there has long been a shortage of secondary school mathematics teachers. Thus, this recommendation, although it did not produce the mathematics teacher shortage, has made it more acute.

As the second decade of the twenty-first century begins, we are clearly in the midst of an era of dramatic change. It is likely that the Common Core State Standards for Mathematics will influence high school mathematics curriculum, assessment, and teaching in the immediate future. In addition, new common assessments specifically tailored to CCSSM will be in place by 2014–15. This two-pronged effort will likely increase CCSSM's effect on the mathematics curriculum. How significant will be its effect on textbooks? On student learning? Will CCSSM be maintained for this decade? Will these standards have a longer life? How long before they are revised or updated? Will they join the throng of old curriculum reports?

If we have learned anything from the history of mathematics education, it is that the mathematics curriculum will continue to evolve—perhaps as a result of CCSSM but certainly as a result of other factors, including the needs of society, the interests and expectations of students and future employers, and the pressures on schools to be accountable for student learning.

Now is clearly an interesting and exciting time to be a mathematics teacher. And the mathematics teacher who knows a bit of history will be better armed and better prepared for whatever is in store.

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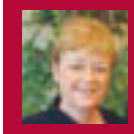

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