Reforming the Third R: Changing the School Mathematics Curriculum—An Introduction

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This special issue of the *American Journal of Education,* "Reforming the Third R," arose from the feeling that readers of this journal, who tend to be interested in ideas, issues, research, and practice in education broadly conceived, might benefit from a more detailed look at one particular area, the changing mathematics curriculum. Its goal is to provide to the education scholar community a picture of the motivations for, theories behind, work of, results from, and implications of the current wave of curriculum reform in mathematics education.

The last era of major curriculum reform in mathematics, the "new math" era, the roughly 15 years from 1957 to 1972, has been called by some "the Golden Age" (Kilpatrick 1992). Then there were perhaps eight large projects (National Council of Teachers of Mathematics 1963), the most comprehensive by far being the School Mathematics Study Group (SMSG). The SMSG authors and staff prepared and tested materials for all grade levels, conducted the National Longitudinal Study of Mathematics Achievement, the largest evaluation study in the field until the recent Third International Mathematics and Science Study, reprinted earlier research, and started a short-lived review journal of research in the field. A by-product of the massive teacher training to implement the ideas of SMSG and other projects was the expansion of graduate programs in mathematics education, which itself helped to spawn increased research in the field.

In general, the influence of curriculum on educational research is natural. The planning stages of curriculum involve the subject matter,

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the learners, and the delivery system. When a new curriculum is to be implemented in a classroom or school, the school board, parents, teachers, and administrators all have vested interests in what the proposed changes entail, why they are being instituted, and what is expected to occur as a result. Changes in the mathematics curriculum have a tendency to raise additional questions, because mathematics—unlike history or science or literature, for example—supposedly deals with ideas that do not change over time. Successful curriculum development requires a detailed knowledge of the subject matter and pedagogy, applies many aspects of educational philosophy and psychology (either overtly or covertly), is aided by a knowledge of the history of similar attempts, and forces the use of a variety of evaluation techniques.

All multiyear curriculums must deal with the question of what is basic. In mathematics this seems to be an easy question to answer. Yet, ever since the back-to-basics movement arose in the 1970s as a reaction to the new math, there has been a conflict between, on the one hand, the desire within most of the mathematics education community to expand the meaning of what is basic to include other areas of mathematics such as geometry and statistics and general forms of thinking used in problem solving and mathematical reasoning and, on the other hand, a vocal minority of educators and some of the public who see this desire as eroding the paper-and-pencil arithmetic and algebraic skill work they feel is necessary before other aspects of mathematics should be considered or technology used. In 1980, in an effort to raise the performance of students, the National Council of Teachers of Mathematics took a strong position on this issue, urging its members to organize the mathematics curriculum not around basic arithmetic or algebraic skills but around problem solving. That did not end the issue; indeed, the conflict between problem solving and rote skills may never be answered, for it is endemic to the subject, mathematics being the embodiment of both the noble aspects of problem solving and the broad range of applications of automatic skills.

The general education alarm sounded by *A Nation at Risk* in 1983 extended the halls of discourse on these issues beyond mathematics education and helped to create a climate for the inauguration of a committee of the National Research Council, the Mathematical Sciences Education Board (MSEB), to examine what might be done to coordinate efforts nationally to improve the state of mathematics education in schools. The MSEB soon commissioned the writing of a report to describe the philosophy behind the changes it felt were needed and almost as quickly found itself unable to agree on what such a report should contain. It took five years for a document summarizing the philosophy, *Re-*

newing School Mathematics, to be published (Mathematical Sciences Education Board 1990).

By that time, the National Council of Teachers of Mathematics had published the first of its three *Standards* documents, the *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics 1989). This document presented a framework broad enough to be endorsed by practically the entire mathematics and mathematics education communities. Almost immediately, the National Science Foundation (NSF) announced a request for proposals for large curriculum development projects at the elementary, middle school, or high school levels that would implement these standards.

The result has been an amount of activity in the mathematics curriculum that dwarfs that of the new math era. The NSF itself funded 13 curriculum development projects, each spanning several years of schooling. Throughout the nation, state and local school boards, some of them working with "systemic initiatives" also funded by NSF, have created their own frameworks adapting the *Standards,* and a couple have created their own curricula. Simultaneously, many states and local school systems have raised the stakes of achievement by instituting tests to monitor the performance of students and schools and sometimes creating tests that students must pass in order to graduate. Additional individuals and groups have created significant curriculum in research projects funded under different auspices.

In this flurry of activity, it was clear that we could not ask principals of all the existing projects to contribute papers for a special volume. For the structure of this issue, and to illustrate the wide range of perspectives that have informed these projects, we turned to *Renewing School Mathematics.* Six types of changes are identified there as affecting the context of mathematics education, and we invited papers that would roughly parallel each of them.

1. Changes in the need for mathematics:
   Zalman Usiskin, "Applications in the Secondary School Mathematics Curriculum: A Generation of Change."
2. Changes in mathematics and how it is used:
   Andrew Isaacs, Philip Wagreich, and Martin Gartzman, "The Quest for Integration: School Mathematics and Science."
3. Changes in the role of technology:
   M. Kathleen Heid, "The Technological Revolution and the Reform of School Mathematics."
4. Changes in American society:
   Lynne Alper, Dan Fendel, Sherry Fraser, and Diane Resek, "De-

signing a High School Mathematics Curriculum for All Students."

5. Changes in understanding of how students learn:
   James G. Greeno and the Middle-School Mathematics through Applications Project Group, "Theories and Practices of Thinking and Learning to Think."
6. Changes in international competitiveness:
   Thomas A. Romberg, "The Influence of Programs from Other Countries on the School Mathematics Reform Curricula in the United States."

A seventh paper in this issue deals with implementation, a continual concern of all curriculum projects.

Glenda Lappan, "The Challenges of Implementation: Supporting Teachers."

We are grateful to these authors for taking time out from projects that have almost continual deadlines in order to write these papers.

References

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