

Executive Summary

Background

In the spring of 1998, the California Department of Education (CDE) awarded a contract to WestEd, in partnership with the RAND Corporation and Management Analysis and Planning, Inc. (MAP), to study mathematics instruction in California. The study was designed to examine the instructional practices used in teaching mathematics in grades 4 and 8, the relationship between instructional practices and student achievement, and the influence of state and local policies on instruction. In addition to instructional practices, primary focuses of the study included curriculum materials, standards, assessment, professional development, and structural and student influences on instruction.

The key data-collection activity of the study was the spring 1999 administration of an extensive survey about teachers' mathematics instructional practices, professional development, and professional background to 800 fourth-grade and eighth-grade teachers in 11 California school districts. Researchers then statistically correlated the survey responses with mathematics achievement data of the responding teachers' students to look for associations between practice and achievement, controlling for prior year achievement and demographic factors. The student mathematics achievement data were from the Stanford Achievement Test, Version 9 (SAT-9). Classroom observations and interviews conducted with teachers, school administrators, and district personnel supplemented the quantitative analysis by providing depth to and context for the findings.

Major Findings

Instructional Practices and Effectiveness. The analysis linking instructional practices, as reported by teachers on the survey, and the SAT-9 scores of the students in the classes of the surveyed teachers found very few relationships between specific instructional practices and student achievement, and those that were found were very weak. Classroom observations, similarly, found a wide range of practices among teachers of both higher-achieving classes and lower-achieving classes. While these findings do not necessarily prove that no strong relationship between practice and achievement exists, they do suggest that at the very least, the relationship is complex and not easily identified. There does not appear to be a particular instructional method that, even if widely implemented, would improve student mathematics achievement throughout the state.

Teachers themselves identified several different types of practices—and the use of a variety of practices *per se*—as contributing the most to their instructional effectiveness in mathematics. Most teachers appear to value an approach that balances computational

mastery and conceptual understanding, and they seek further ideological and practical support for the implementation of this type of balanced approach.

Curriculum Materials. Although curriculum materials often play the major role in shaping instruction, many teachers expressed grave concerns about the programs their districts have adopted and said that they often use other programs—such as those from earlier adoptions or materials intended to be supplementary—instead of or in addition to the adopted programs. Teachers’ main concerns about the adopted programs (most of which were from the state’s 1994 adoption list) were that they are difficult to use, lack balance between computational skills and conceptual thinking, or are not aligned with current standards and assessments. Teachers who had engaged in materials-related professional development were more likely to use the adopted materials.

Standards. While most teachers liked the *idea* of standards as a guide to instruction, many thought that the currently adopted state standards are too ambitious. Teachers’ familiarity with particular standards documents was highly variable, and there was considerable confusion, and some frustration, about different sets of standards (e.g., district, state, national). In general, as of the 1998–1999 school year, content standards had not yet made a consistent, significant impact on instruction at the classroom level.

Assessment. In contrast to standards, the SAT-9 has made a significant impact on schools and teachers, frequently appearing as a major driver of instruction. The test has, however, been the cause of much anxiety at the school level, partly because of a perceived lack of alignment with content standards and with curriculum. Many teachers feel that they are being compelled to “teach to the test” and think that this may not be in students’ best long-term interests.

Professional Development. Unsurprisingly, fourth-grade teachers reported having had much less mathematics-related professional development than eighth-grade teachers. Moreover, very few fourth-grade teachers who were surveyed reported having strong background in mathematics, and some identified a lack of familiarity with mathematics as being an obstacle to their instructional effectiveness. Many teachers at both grade levels indicated that professional development activities had helped their mathematics teaching, and said they would like more professional development and collaborative opportunities. Providing effective professional development for all teachers of mathematics is, however, a major challenge.

Structural and Student-Related Influences on Instruction. Many teachers identified structural factors, such as those relating to time and class size, as obstacles to their instruction. Teachers’ concerns about class size, however, appeared to be as much about variation in student ability as about large classes *per se*. Additional factors identified as obstacles included students’ lack of preparation, particularly in basic mathematics skills, poor student behavior and motivation, and lack of parent involvement or support.

Recommendations

The main recommendations that emerge from the findings are as follows:

1. At present, the State Board should not attempt to support a particular methodological approach through its selection of professional development activities or curriculum materials, other than a general advocacy of a “balanced” instructional program. Further research, preferably taking a longitudinal approach and using multiple measures of achievement, is needed to investigate the relationships between instruction and achievement. The State Board and the Legislature should recognize the need for more in-depth, high-quality research and should commit the necessary funds.
2. The State Board should establish a procedure for periodically reviewing the mathematics standards and framework in light of implementation problems, with input from classroom teachers. Districts should provide all teachers with a single set of unambiguous standards, including both content standards and performance standards.
3. The State Board and the Curriculum Commission should ensure that the curriculum materials that are available to teachers are aligned with standards, accommodate the wide range of student needs, and enable the presentation of a balanced instructional approach. To maximize the actual use of the materials and the effectiveness of their implementation, teachers should be provided with opportunities and incentives to engage in professional development related to the use of materials.
4. The State should provide sufficient resources for every California teacher of mathematics to participate in high-quality, sustained professional development. Professional development should attend both to mathematics content and to pedagogy. In addition to the use of materials, professional development should relate to the instructional implementation of the standards and framework in the classroom.
5. The State should continue to improve and augment the STAR program so that its components are properly aligned with state standards.
6. The State should “stay the course.” Planning should take a long-term view, focusing on developing and revising policies based on feedback and research; the first hint of less-than-desired student performance should not be considered cause for an abrupt change of direction. The State Board and the Legislature should also take care to ensure that all of the current state education policies are aligned with and support one another.
7. The State Board should set a positive tone for professional discussion and policy debate. Representatives of all stakeholder groups should be “at the table,” and a wide range of perspectives should be considered.

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