

Empirical Study of the Effects of Professional Development on Improving Mathematics and Science Instruction

MSP Goal 3 NSF/ RETA grant to CCSSO/AIR/WCER

Project Summary--January 2003

In Fall 2002, the National Science Foundation (NSF) announced 24 major grants to establish Mathematics and Science Education Partnership (MSP) programs across the U.S. The overall program objective is to “increase the capacity of preK-12 educational systems and institutions of higher education to provide the requisites for learning to high standards in mathematics and science, and particularly to reduce the achievement gaps among student populations.” In addition, a specific goal of MSP is “to contribute to the national capacity to engage in large-scale reform through a network of researchers and practitioners that will study and evaluate educational reform and experimental approaches to the improvement of teacher preparation and professional development (Goal 3, NSF 02-061 program announcement).”

GOALS AND DESIGN OF STUDY

The Council of Chief State School Officers (CCSSO), in collaboration with the American Institutes for Research (AIR), and the Wisconsin Center for Education Research (WCER), has been awarded a grant under the Goal 3 program. We have launched a three-year empirical study to test an objective, reliable methodology for measuring the effects of professional development on improving instruction in mathematics and science education. Specifically, the study is driven by *three primary research questions*:

- 1) To what extent is the quality of the professional development (defined broadly) supported by MSP activities consistent with research-based definitions of quality?
- 2) What effects do teachers’ professional development experiences have on instructional practices and content taught in math and science classes? Are high-quality professional development activities more likely than lower-quality activities to increase the alignment of instructional content with state standards and assessments?
- 3) How can MSP projects use study findings to improve professional development and the content and instruction of mathematics and science classes?

The major steps in the three-year longitudinal study will measure instructional practices of math and science teachers, track professional development provided, and compare the effects of professional development between teachers involved with MSP-supported programs with other teachers. The study team will: (a) Measure the subject content and instructional practices teachers are employing in math and science instruction, prior to MSP implementation, using the Surveys of Enacted Curriculum (year 1, Spring 2003); (b) Identify the characteristics of professional development activities in which teachers participated through MSP, and other activities to improve teacher preparation, over 18 months (through Fall 2004); and, c) Re-survey subject content and instructional practices (year 3, Spring 2005), to determine change in practices after participation in the broad range of MSP-supported professional development activities.

Schools in five MSP projects are selected for the study. In each project, we will be collecting data with teachers and program administrators in middle schools or middle grades about their professional development in mathematics and science education. Our study model, instruments, data and reports will benefit each of the five participating sites, and we hope that all of the MSP projects will be able to incorporate some aspects of this evaluation model.

Benefits to Schools and Educators

The design for data collection and analysis in the study is based on a set of tools developed under prior studies, with support from NSF. The tools are called “Surveys of Enacted Curriculum,” and they are designed to collect and report information about instructional practices, curriculum content, and professional development experiences. The information will assist teachers and administrators with planning for instructional improvement in several ways—including alignment analysis, indicators for monitoring change,

evaluating reform initiatives, and combining curriculum data and achievement data to guide instructional improvement.

Responsibilities of MSP Projects and District/School Partners

The timeline for the Empirical Study we have planned has the following key steps:

- A. Survey of Enacted Curriculum administered to teachers on site (Spring 2003, 2005)
- B. Survey of Enacted Professional Development administered by follow-up activity logs and telephone interviews with teachers (Fall 2003 and Fall 2004)
- C. Interviews with local staff to obtain information about standards, curricula, professional development, and MSP design (site visits, Spring 2003)
- D. Workshops for teachers and administrators on the Evaluation Model through SEC, and the uses of data from the surveys and evaluation results (Fall 2003; Fall 2005)

NEED FOR THE STUDY AND MODEL FOR EVALUATION

For decades educators and policy-makers have seen statistics that demonstrate the lackluster performance of American students in the areas of mathematics and science. Recent results from the National Assessment of Educational Progress (NAEP) show that although scores have improved in the 1990s, a majority of our students score below the proficient level in mathematics and science. In addition, the results from the TIMSS study highlight the problems of wide variation in student performance in mathematics and science across our schools and lower performance of U.S. students in the higher grades relative to other systems.

The TIMSS findings provide strong evidence that predominant teaching practices do not enable students to acquire the understanding or flexible skills for problem solving in mathematics or science. Of equal concern is the persistent gap between the achievement levels of poor and minority students with their more advantaged peers. The recent No Child Left Behind Act/ H.R. 1 codifies the national goal of closing the achievement gap of poor, minority, and limited English students with more advantaged students in our schools.

One major strategy for improving student performance and reducing the achievement gap is to set challenging content standards for *all* students. This strategy reflects a new kind of equity in education—one that has slowly shifted from equality of educational inputs to equality of educational outputs. But achieving this form of educational equity requires fundamental changes in what students are taught, and how they are taught. Education reforms, if they are to improve student achievement, must first change instructional practice at the classroom and school levels, and recent research has shown that one of the most powerful explanatory variables of the achievement gap between majority and minority students is the content of instruction.

This Empirical Study will directly address the lack of solid evidence on the impact of professional development on mathematics and science instruction on a large scale. This longitudinal study will probe how, through MSP, districts implement high-quality professional development, as well as the overall impact of such professional development on teachers classroom practice. If education decision makers are to invest in higher-quality teacher preparation and professional development, research and evaluation studies must be able to document and demonstrate that improved teacher preparation in math-science content and teaching skills produce improved.

For further information on the study design, the survey and evaluation tools, and the MSP projects, please contact Rolf K. Blank, PI/Project Director and CCSSO Director of Education Indicators, (202) 336-7044; rolfb@ccsso.org.