CHAPTER ONE
Background

Introduction

In 1976, in order to get a better idea of the status of science, mathematics, and social studies education in the United States, the National Science Foundation (NSF) commissioned three large studies. These included: (1) a major review of the science, mathematics, and social studies education research literature, coordinated by Stanley Helgeson at The Ohio State University; (2) a national survey of teachers, principals, district, and state personnel, directed by Iris Weiss, then at the Research Triangle Institute; and (3) intensive case studies in 11 districts, coordinated by Robert Stake and Jack Easley at the University of Illinois. The results of these three studies, collectively known as "the NSF needs assessment," were disseminated widely and used extensively in program decision making. Follow-up national surveys of science and mathematics education were conducted in 1985–86, 1993, and 2000. Information provided by respondents included teacher and student demographics, teacher background and beliefs, instructional materials, and classroom practices. A number of reports and research syntheses using these data have been produced since the late 1970s.

While survey data are very important, the research and policy communities are interested in learning about classroom practice not only from the perspective of the classroom teacher, but also through the eyes of external observers. Previous research has demonstrated that teachers' self-report on the *frequency* of reform-oriented instructional practices meet reasonable standards of validity and reliability, but teachers are clearly not in a position to judge the *quality* of their own instruction (Mayer, 1999).

For example, researchers in one study observed 25 teachers who reported reform-oriented practice on a survey questionnaire and found evidence of such practice in all of the classrooms, e.g., an emphasis on mathematical problem-solving, using manipulatives, and making connections to the real world. However, only 4 of the 25 teachers were implementing these practices consistent with the reform vision, where "mathematical tasks were set up to help students grasp and grapple with principled mathematical knowledge that represented *doing* mathematics as conjecturing, problem-solving, and justifying ideas [and where discourse norms] supported attention to principled mathematical knowledge and represented mathematical work as more than computation" (Spillane and Zeuli, 1999, p.19).

The need for information on the nature and quality of K–12 lessons is particularly acute given the current emphasis on mathematics and science education reform, yet there have been no

national efforts along these lines since the Stake and Easley case studies of 1976.[1] *Inside the Classroom* was designed to help fill the gap in information on what transpires inside the nation's mathematics and science classrooms.

Purpose of the Study

The major purpose of *Inside the Classroom* is to provide the education research and policy communities with snapshots of mathematics and science education as they exist in classrooms in a variety of contexts in the United States. These snapshots include both the instruction that takes place and the factors that shape that instruction. The study was designed specifically to complement and extend findings from the 2000 National Survey of Science and Mathematics Education, the most recent of the surveys mentioned above.

As part of the core evaluation of NSF's Local Systemic Change Initiative, Horizon Research, Inc. (HRI) field-tested, revised, and demonstrated the reliability of a classroom observation instrument for assessing the quality of the design and implementation of mathematics and science lessons.[2] For *Inside the Classroom*, HRI adapted the observation instrument and developed an interview protocol to use with observed teachers in order to gather data on the factors that shape instruction.

Among the questions addressed by the study:

1. How does mathematics/science instruction "look" in the nation's classrooms? To what extent are mathematics/science portrayed as inert collections of facts and algorithms, as opposed to dynamic bodies of knowledge continually enriched by conjecture, investigation, analysis, and proof/justification?

2. Are students actively engaged in pursuing questions of interest to them, or simply "going through the motions," whether they are doing individual "seatwork" or working in groups?

3. To what extent do mathematics and science lessons engage students intellectually with important mathematics and science disciplinary content?

4. Is teacher-presented information accurate? Do teachers display an understanding of mathematics/science concepts in their dialogue with students?

---

[1] The Third International Mathematics and Science Study (TIMSS) included examination of a national sample of mathematics lessons (videotaped in 1995) and of grade mathematics and science lessons (videotaped in 1999), but both studies were limited to the 8th grade. The mathematics findings are reported in Stigler, et. al., 1999 and Hiebert, et. al., 2003; the science findings have not yet been released.

[2] "Validity and Reliability Information for the LSC Classroom Observation Protocol." Horizon Research, Inc., Chapel Hill, NC, 2003.

5. When teachers ask questions, are they posed in a way that is likely to enhance the development of student conceptual understanding?

6. Are adequate time and structure provided for student reflection and sense-making?

7. To what extent is there a climate of respect for students' ideas, questions, and contributions? Are students encouraged to generate ideas, questions, and conjectures?

8. To what extent does each of the following factors shape teachers' decisions about curriculum and pedagogy:
    - Teacher beliefs about how students learn;
    - Student characteristics;
    - School and district administration; and
    - School, district, and state policies regarding curriculum, textbook adoption, testing, and professional development.