

National Science Foundation, US Department of Education, and National Institute of Health  
(10/1/00-8/14/04)

**“*Science Instruction for All*”:  
Promote Science and Literacy for Linguistically Diverse Elementary Students**

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## **“Science Instruction for All”: Promote Science and Literacy for Linguistically Diverse Elementary Students**

### **Project Goal and Research Questions**

This study implements instructional intervention to promote achievement and equity in science and literacy, particularly focusing on science inquiry, for linguistically diverse as well as mainstream students. The study also emphasizes mathematics and technology as critical supporting areas. In a longitudinal design, the research includes grades 3 through 5 elementary students and their teachers at six school sites in each of two school districts, including Miami, Florida and San Francisco, California. The research addresses the following questions:

1. What are developmental trajectories in conducting science inquiry by linguistically diverse elementary students?
2. What is the process of instructional intervention as teachers provide effective instruction by considering:
  - a. the nature of science and literacy with students’ language and cultural experiences and
  - b. the teacher explicit to student exploratory continuum?
3. What is the impact of the instructional intervention on teacher change and student achievement over time that can be sustainable and scalable across diverse groups of students and teachers?
4. How do state and district policies influence the implementation of the intervention?

### **Research Design and Implementation**

#### **Research Sites and Participants**

**States, districts, and schools.** The study will be conducted at two sites: Miami, Florida, and San Francisco, California. The student and teacher participants include bilingual Hispanic/Latino (mostly Mexican and Central American in San Francisco, and South American and Caribbean in Miami), bilingual Haitian (Miami), bilingual Asian American (San Francisco), and monolingual English-speaking students (Anglo and African American in both sites) in inner-city and suburban settings.

**Students and teachers.** Using a longitudinal design, the study will involve elementary students across grade 3 through 5 and their teachers. The project will involve 2 cohorts of students completing grades 3 through 5 and 2 cohorts completing grades 4 and 5 (see Table 1).

Table 1. Student Participants

students	Year 1 (10/1/01-8/14/01)	Year 2 (8/1/15-8/14/02)	Year 3 (8/15/02-8/14/03)	Year 4 (8/15/03-8/14/04)
Grade 3	Cohort 2	Cohort 3	Cohort 4	-----
Grade 4	-----	Cohort 2	Cohort 3	Cohort 4
Grade 5	-----	-----	Cohort 2	Cohort 3

During years 1 and 4, we expect about 60 teachers (6 schools x 2 grade levels x 5 teachers) and 1,800 students in each school district, for total of 120 teachers and 3,600 students in the two districts. During years 2 and 3, we expect about 90 teachers (6 schools x 3 grade levels x 5 teachers) and 2,700 students in each school district, for a total of 180 teachers and 5,400 students in the two districts (see Table 2).

Table 2. Summary of Research Sites and Participants

states	Districts	Schools/Classrooms	Teachers	Students
Florida	Miami-Dade	a. 2 bilingual Hispanic b. 2 bilingual Haitian c. 2 monolingual English	Y1: 60 Y2: 90 Y3: 90 Y4: 60	Y1: 1,800 Y2: 2,700 Y3: 2,700 Y4: 1,800
California	San Francisco	a. 1 bilingual Korean b. 2 bilingual Cantonese c. 2 bilingual Spanish d. 1 monolingual English	Y1: 12 Y2: 18 Y3: 18 Y4: 12	Y1: 360 Y2: 540 Y3: 540 Y4: 360
Total: 2	Total: 2	Total: 12 Schools	Total: Y1/Y4: 72 Y2/Y3: 108	Total: Y1/Y3: 2,160 Y2/Y3: 3,240

### Instructional Units

Instruction will focus on two units at each grade level:

Grade 3 – (a) measurement and (b) changes of states of matter

Grade 4 – (a) the water cycle and (b) weather

Grade 5 – (a) ecosystem and (b) the solar system.

### Teacher Professional Development

Collaboration between teachers and project personnel will be critically important in sharing insights, reflections, and suggestions. Professional development activities will occur through regular whole group meetings, school-level activities, and individual teachers. Each year, teachers from all school sites will meet at 6 full day meetings (3 summer days and 3 school

days). We will meet with teachers at each school site to address specific needs and concerns. After classroom observations, we will briefly interview teachers to gather feedback and insights about the lessons.

**Data Collection**

**Students.** The instruments are designed to assess students’ knowledge of science and literacy (see Table 3). First, at each grade level, two science tests measure: (a) key science concepts and big ideas of patterns, systems, and models and (b) science inquiry using more structured inquiry tasks and more open-ended inquiry tasks in which students generate questions, design investigations, and plan procedure. Second, prompts for expository writing samples are used as a measure of literacy. These prompts are consistent with state-wide writing assessment called “Florida Writes!” at grade 4. Third, public release items from the National Assessment of Education Progress (NAEP) and Third International Mathematics and Science Study (TIMSS) will be used.

**Teachers.** Classroom observations look at how teachers promote science learning and literacy development by integrating students’ languages and cultures and by promoting science inquiry. Focus group interview protocols and questionnaires are designed to examine teachers’ beliefs and knowledge about students’ languages and cultures, effective science instruction, and effective literacy instruction for students from diverse backgrounds.

Table 3. Data Sources Each Year

	<b>States &amp; Districts</b>	<b>Schools</b>	<b>Teachers</b>	<b>Students</b>
All Participants	<ul style="list-style-type: none"> <li>• review of state &amp; district data</li> </ul>	<ul style="list-style-type: none"> <li>• review of school data</li> </ul>	<ul style="list-style-type: none"> <li>• class observations</li> <li>• focus-group interviews</li> <li>• questionnaires</li> </ul>	<ul style="list-style-type: none"> <li>• unit test in science (pre/post)</li> <li>• writing samples (pre/post)</li> <li>• NAEP/TIMSS science (post)</li> <li>• state-wide assessments</li> </ul>
California	<ul style="list-style-type: none"> <li>• interviews with state and district administrators</li> </ul>	<ul style="list-style-type: none"> <li>• interview with school administrators</li> </ul>	<ul style="list-style-type: none"> <li>• extended observ. of selected teachers</li> <li>• individual interviews of selected teachers</li> </ul>	<ul style="list-style-type: none"> <li>• elicitations with selected students (pre/post)</li> </ul>