Appendixes

Appendix A

Major Nationally Representative Databases on K-12 Mathematics and Science Education and Students

Longitudinal

1972-86 (continuing)[1]

National Longitudinal Study (National Center for Education Statistics, Department of Education). The cohort studied is **23,451** high school seniors **(1972), en**rolled in a total of **1,318** high schools. Followups were conducted in **1973-74, 1974-75, 1976-77,** and **1979-80.** A fifth followup was conducted on a subsample in **1986.** In each followup, data were collected on high school experiences, background, opinions and attitudes, and life plans. Participants were subjected to a battery of achievement tests only in the first survey.

1980- **Present**

High School and Beyond Survey (Center for Statistics, Office of Educational Research and Improvement, Department of Education). This survey contains two cohorts, starting in **1980.** The first is a sample of **30,000** high school sophomores, and the second a sample of **28,000** high school seniors. These cohorts were enrolled in **1,015** public and private schools and are sampled every 2 years. The purpose of the survey is ". . . to observe the educational and occupational plans and activities of young people as they pass through the . . . system and take on their adult roles. " The 1980 and 1982 surveys consist of a questionnaire (on attitudes, educational plans, family background, socioeconomic status data, and activities outside of school) and cognitive tests. The tests were developed by the Educational Testing Service and were intended to measure cognitive growth in three domains: verbal, mathematics, and science. The most recent followup data were released in 1988. No achievement tests were administered in the 1986 surveys.

Cross-Sectional

Various Years

National Assessment of Educational Progress (NAEp) (formerly administered by the Education Commission of the States and now by Educational Testing Service, Inc. (ETS)). NAEP is a congressionally mandated program, funded by the Office of Educational Research and Improvement of the Department of Education, that assesses national achievement in education, including science and mathematics.[3] ETS now refers to it as "The Nation's Report Card. " The most recent science and mathematics assessments were in 1985-86 (published in June 1988); previous assessments were in 1981-82, 1977-78, 1972-73, and, for science only, 1969-70. Each science test measured both science attitudes and achievement. The 1981-82 and 1985-86 assessments addressed attitudes to science in more detail than before and the **1985-86** assessment, for the first time, asked for background information on science experiences out of school and on what is being taught in science classrooms. In 1985-86, teachers were also asked to provide information on their training and experience, instructional methods, and their intended curriculum. To conduct the assessment, NAEP identifies a stratified probability sample of schools and tests students in three age groups: 9, 13, and 17. Anywhere between 60,000 and 90,000 students take NAEP tests, although any given test item is taken only by 2,600 individuals. (ETS terms the technique "Balanced Incomplete Block Spiraling.") After assuming responsibility for NAEP, ETS introduced a degree of cohort matching into its assessment design.[4] Co-

[1] **Dates** refer to time of data collection. Post-1986 databases currently under construction and subject solely to primary analysis are excluded. For titles of ongoing database projects supported by the National Science Foundation, see ***Summary of Active Awards,*** *Studies and Analysis Program* **(Washington, DC: March 1988).**

[2] **General note on the two** surveys in this **category**: although they are intended to be similar and comparable, they differ. High School and Beyond includes data from parents and teachers, as well as from high school transcripts (allowing relationships between course-takings, achievement, and destinations to be estimated). The definition of "Hispanic" has also changed between the two studies, affecting comparisons of minority performance, The low response rate to the National Longitudinal Study limits its usefulness. The 1988 National Educational Longitudinal Study will reduce such limitations,

[3] The National Assessment of Educational Progress was initiated in **1969. Note that the 1981-82** science assessment was not funded by the Department of Education or conducted by the Educational Testing Service, but through a special grant from the National Science Foundation to the University of Minnesota.

[4] The purpose of cohort matching is to improve the confidence that can be placed in conclusions about changes in student achievement through time. The matching will work by applying the same sampling technique to 9-year-

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hort matching has not been applied to assessments before 1985, which limits the ability of NAEP to support conclusions about improvements or declines in science and mathematics achievement over time.

1977 and 1985

National Surveys of Science and Mathematics Education, sponsored by the National Science Foundation and conducted by Iris Weiss of Research Triangle Institute. The survey requested science and mathematics course offerings and enrollment (by race, ethnicity, and sex), science facilities and equipment, instructional techniques used, and teacher training. All data were self-reported. The 1985 survey covered 425 schools, public and private, including 6,000 teachers, and was stratified by grades: K-3, 3-6, 7-9, and 10-12. The survey was published in November 1987. The data do not address achievement.

1985

Survey of High School Teachers and Course Offerings, conducted by the National Science Teachers Association (NSTA). The survey was based on an "Official U.S. Registry of Teachers" maintained by NSTA, which is intended to list all science teachers of grades 7-12. All private and public secondary school principals were asked to name all their science teachers and the number of classes of each type of science that the teachers will teach during the coming school year. A stratified random sample of 2,211 high schools was culled from 26,000 responses, derived in turn from a total pool of 48,427 forms mailed. Stratification was by seven ranges of school size, three grade structures (K-12, 7-12, and either 9-12 or 10-12), and by public or private status. Data have been used by NSTA to estimate the number of sections of each type of science course taught, the number of high schools that offer either no physics, chemistry, or biology courses, the number of teachers teaching "in-field" and "out-of-field," and the teaching load of average physics, biology, and chemistry teachers.

Annually

The American Freshman, conducted by the Cooperative Institutional Research Program (CIRP), University of California at Los Angeles (UCLA). CIRP and UCLA's Higher Education Research Institute annually survey incoming freshmen in full-time study in colleges and universities. Some longitudinal followup studies are attempted to track students 2 and 4 years after college entry. All incoming freshmen are surveyed and the data are stratified by type of college, public or private control, and the "selectivity level" of the institution. The survey instrument solicits data on high school background, including Scholastic Aptitude Test or American College Testing program score and grade point average, intended major and educational destination, career intentions, financial arrangements, and attitudes.

Cross-Sectional and International[5]

1980-82

Second International Mathematics Study (SIMS) (U.S. Co-ordinator: College of Education, University of Illinois at Urbana-Champaign. Published as *The Underachieving Curriculum,* January 1987). Data were collected in 1980-82 and covered 20 countries. The U.S. survey covered 500 classrooms in 2 populations: grades eight and those completing secondary school and taking a large number of mathematics courses (defined as 12th graders taking college preparatory mathematics). Both SIMS and the Second International Science Study (S1SS) focused on three stages of the educational process: the intended curriculum (what is in the textbooks), the implemented curriculum (what the teacher actually does in class and how), and the attained curriculum (what the students learned). The intended curriculum is based on a content analysis of textbooks, while the implemented curriculum was measured by asking teachers to complete questionnaires. The attained curriculum was tested by multiple-choice achievement tests. SIMS attempted to study the relationship between what happens in schools and what students learn, so the achievement batteries were administered twice: once at the beginning and once at the end of each school year.

1983 and 1986

Second International Science Study (U.S. Coordinator: Teachers College, Columbia University). SISS, similarly to SIMS, attempted to address what it termed the "intended," "translated," and "achieved" curricula for science instruction in 25 countries. SISS studied

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olds in 1985-86 as will be applied to 13-year-olds in 1989-90 and 17-year-olds in 1993-94. The individuals tested will not be identical, however.

[5]The following two studies were conducted under the aegis of the International Association for the Evaluation of Educational Achievement, a nongovernmental association of educational researchers. The first international science study was in 1970 and the first international mathematics study was in 1964. Both the second mathematics and science studies are "deeply" stratified probability samples of different types of schools, made under internationally agreed on and applied guidelines. The processing and interpretation of results have been hampered by lack of funding and of a central location for performing the necessary work.

both public and private schools, and surveyed a total of 2,000 U.S. students, broken into four populations: grade 5; grade 9; grade 12 taking second-year physics, chemistry, and biology; and grade 12 taking no science (1983 only'). In the United States, 125 schools were surveyed and the tests addressed science achievement, attitudes, "a science learning inventory," and a word knowledge test. Background data on the school and about teachers were also requested. Some items common with the First International Science Study were included; at grade 5, there were 26 such items, and at grade 9, there were 33. Both grades five and nine showed an improvement over performance in *1970.* Results from the two grade 12 populations in the United States have not been published. Data from other countries are still being processed in Stockholm, funded by the Swedish Ministry of Education and the Bank of Sweden. The 1986 survey addressed process skills and content, as well as teacher activities and other factors in the school environment that might affect achievement. Data were collected from students, science teachers, and school administrators. Process and achievement skills were tested for both grades five and nine. Achievement was be tested in these groups: I0th grade biology, 11th grade chemistry, and 12th grade students with more than 1 year of study in one or more of physics, chemistry, or biology. Technical aspects of this survey, including data collection but not instrument design, were contracted to the Research Triangle Institute.

'Data for 1983 are suspect due to only a 30 percent response rate.