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ABSTRACT

During the past decade, the federal government, alongside the efforts of state, local, and private-sector groups, has promoted initiatives in the search for ways to improve the teaching of mathematics and science in the nation's schools. This report summarizes a 2-year study of the largest of such federal initiatives, the Dwight D. Eisenhower Mathematics and Science Education Program. Included are: (1) an introduction of the framework and methodology of the program and its relationship to national concerns about science and mathematics education; (2) Part One, which contains highlights of the findings at the state level and an overview of the collaboration strategies for both the elementary/secondary components and the higher education components at the state level; (3) Part Two, which contains the operations of the program at the local level, and findings about the special issues related to local-level agencies; (4) Part Three, which contains participation figures, strategies, impacts, and special issues regarding the operation of the higher education component of the program; (5) Part Four, which contains the overarching themes and contributions of the program as a whole to the reform movement in mathematics education; and (6) a conclusion that the program occupies an otherwise unfilled niche among reform initiatives, that the program expands the array of professional development opportunities for students, that the program supports leadership at all levels, but does not create it, and that the program provides a necessary, but insufficient, resource for promoting sustained change in mathematics and science teaching practices. A 41-item bibliography is followed by three appendices: the Title II Eisenhower legislation, the survey instruments and a description of the survey methodology. (JJK)

National Study of the
Education for Economic Security Act (EESA) Title II Program
(Now the Eisenhower Mathematics
and Science Education Program)

THE EISENHOWER MATHEMATICS AND SCIENCE EDUCATION PROGRAM: AN ENABLING RESOURCE FOR REFORM

Technical Report

February 1991

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U.S. DEPARTMENT OF EDUCATION • OFFICE OF PLANNING, BUDGET & EVALUATION

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HIGHLIGHTS OF THE REPORT

The National Study of the Title II/Eisenhower Program

This report summarizes the findings and conclusions of the National Study of the Title II/Eisenhower Mathematics and Science Education Program (State and Local Grants), a federal initiative supporting professional development of the nation's mathematics and science teachers.*

The overall conclusion of the study is this: The program provides a critical enabling resource that supports current efforts to reform mathematics and science teaching.

Size and Scope of the Program

- *Program size.* Relative to other federal education initiatives, the program is modest in size: approximately $100 million was available for state and local grants in the fourth year of the program (1988-89 school year), the time period to which most of the National Study data apply; for the 1991-92 school year, approximately double that amount will be allocated to the program.

- *What the funds pay for.* The money pays for various costs associated with professional development activities--participant stipends, travel costs, consultant fees, training staff salaries, materials used in training, and so forth.

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* The study was conducted by SRI International in collaboration with Policy Studies Associates and Inverness Research Associates, under contract to the Office of Planning, Budget and Evaluation of the U.S. Department of Education (Contract Number LC88029001). The views expressed in this report are the authors' own and do not necessarily reflect the views of the U.S. Department of Education. For a lengthier summary of the findings in this volume, the reader is referred to the Summary Report (with the same overall title).

- *Who participates in the program.* Virtually all school districts in the nation (93% in 1988-89) receive program funds either directly or through an intermediate unit or consortial arrangement. In addition, across the first four years of the project, approximately 20% of all degree-granting institutions of higher education received one or more Title II grants. The number of teachers who participate in program-sponsored activities is large: an estimated one-third of all mathematics and science teachers in the nation (including elementary-level teachers) took part in some kind of Title II-supported activity in 1988-89.

Program Components and Their Operation

There are three components to the program: state leadership activities, "flow-through" funding to school districts, and grants to institutions of higher education.

State leadership activities. State set-aside funds represent a small percentage (currently 4%) of program funds for states and districts under the program.

- These funds enable state agencies for elementary and secondary education (SEAs) and higher education (SAHEs) to exercise leadership by (1) assessing and setting priorities for the improvement of mathematics and science education, (2) offering technical assistance to school districts and others engaged in reform activities, and (3) supporting various "Demonstration and Exemplary" projects.

- State agencies are funding various activities, including conferences, teacher support networks, revision and dissemination of state mathematics and science frameworks, and the promotion of national reform agendas (e.g., as represented by the *Curriculum and Evaluation Standards* of the National Council of Teachers of Mathematics).

- Program funds represent a large percentage--half or more, on average, in 1988-89--of all discretionary funds available to state agencies for mathematics and science improvement.

Flow-through funding to school districts. Currently, two-thirds of the program's state and local grant funding is allocated through SEAs by formula to school districts, to support professional development activities determined at the local level.

- The majority of these funds pay for low-intensity inservice training, averaging six hours of training per participant per year (1988-89).

- A substantial fraction of the flow-through funds also supports out-of-district professional development, including widespread participation in professional associations.

- LEA-sponsored training under the program is highly varied: at one end of the spectrum are focused, well-designed staff development events that have clear impact on teachers' thinking and classroom practice, while at the other are *ad hoc* training experiences that appear to contribute little to improved practice.

Grants to institutions of higher education (IHEs). The remainder of the funds (24% under the current formula) are awarded competitively by SAHEs to institutions of higher education, to support professional development projects of several kinds.

- The great majority of projects provide inservice teacher education, while a small percentage (12%) concentrate on, or include, preservice preparation of teachers (a few projects are concerned primarily with curriculum development or direct services to students).

- By comparison with district-sponsored activities, these projects are typically more intensive, averaging 60 hours per participating teacher, pay more attention to content in addition to pedagogy, and are more frequently focused on the needs of underrepresented groups (women and minorities).

- On the whole, higher education grant projects appear more consistently well designed than the activities in school districts and on average are more likely to have impact on classroom practice.

Major Themes in the Study Findings

Four themes summarize what the National Study learned about the program and its place among current initiatives aimed at the reform of mathematics and science education:

The program occupies an otherwise unfilled niche among reform initiatives. The design of the program and the way it has been implemented give it a unique function among current federal, state, and local reform initiatives. In particular, the program has especially wide reach, enabling it to serve all states and school districts in the nation, in addition to involving a substantial fraction of the nation's higher education

institutions; the funding is flexible and easy to obtain; and the program targets the K-12 and higher education systems simultaneously and encourages their collaboration in efforts to improve mathematics and science education. No other reform initiatives have these attributes. Those that come closest (e.g., the teacher preparation and enhancement grant programs of the National Science Foundation) emphasize the development of national models through relatively large grants to smaller numbers of grantees. The Title II/ Eisenhower program, by contrast, emphasizes small grants to state, regional, and local institutions to support the implementation of reform ideas developed by other means.

The program expands the array of professional development opportunities. Title II/Eisenhower grants to school districts and institutions of higher education have substantially increased the array of professional development opportunities available to mathematics and science teachers. These opportunities are of mixed quality, but at a minimum they offer large numbers of teachers the chance to become aware of reform ideas, make connections with colleagues, and revive or expand their interest in mathematics and science teaching. Although there is no easy way to estimate incidence, a great number of these opportunities--perhaps the majority of higher education grant projects, but less than half of all school-district-sponsored activities--offer much more than this to teachers and are designed in ways that promise to have some lasting impact on teachers' thinking and classroom practice.

The program supports leadership but does not create it. Although it has mechanisms that encourage the focusing of funds on high-priority needs, the program does not chart the course for efforts to reform mathematics and science education. Rather, it offers a key resource to state, regional, and local leaders to implement reform ideas on a wide scale. In this way, the program depends on the environment of reform activity that surrounds it. Thus, in school districts with well-focused agendas for improving mathematics and science education, the funds are likely to be spent well, while in other districts, the funds are less effectively used. At all levels, the program and the resources it offers appear to have empowered subject-area leadership.

The program provides a necessary but not sufficient resource for promoting sustained change in teaching practice. What the program offers is necessary to the success of reform efforts in several ways: it addresses a function (professional development in mathematics and science) that must compete for scarce local staff development dollars with other subject areas and with generic inservice, yet is key to the widespread adoption of new approaches to teaching. Among large numbers of teachers at all levels of K-12 schooling, the program builds awareness and a sense of rejuvenation--an essential first step in the reform process. For a smaller but substantial number of teachers, the program takes them farther along the road to reform.

But the program cannot revolutionize teaching practice on its own. Title II/Eisenhower funds are not great enough to support professional development of sufficient intensity and for large enough numbers of the nation's teachers to make the deep and lasting changes in teaching practice that are currently called for. Furthermore, and perhaps more important, the program is not designed to address the elements besides professional development that must also be improved for lasting changes to occur--among them, facilities, teacher salaries, curriculum, assessment procedures, and the overall organization of school programs.

Implications for the Program and Its Future

The findings of the National Study have implications for changing and improving the program, for example, when the program is next reauthorized at the federal level. Three broad implications are as follows:

(1) *The three-component strategy of the program should be maintained.* The components serve different but complementary functions that are each essential to the overall success of the program as a professional development strategy. The generally low-intensity and short-term training offered by school districts is an effective means for building widespread awareness and rejuvenating large numbers of teachers; it also allows districts with well-developed improvement agendas to do more for their teachers. The higher education grant component offers a richer set of training experiences to teachers than what is available through most district-sponsored activities. The state leadership activities give

direction to both of the other components and build an additional layer of support in terms of teacher networks, topical conferences, and other forms of information dissemination.

(2) *The program's funds should be allocated differently among the three components.* Study findings suggest that there is an imbalance in the current allocation formula, which was in fact exacerbated by the recent reauthorization of the program: the component (flow-through funding to districts) offering the lowest intensity and widest variety in quality of training receives the lion's share of the resources, whereas the state leadership component, which is providing direction and support to large numbers of districts, operates with an extremely small share of the resources. A better balance can be struck by proportionately increasing the share allocated to state leadership activities and grants to institutions of higher education.

(3) *A variety of additional leadership activities at the federal, state, and local levels would strengthen the program.* Because the program depends on the vision or sense of direction of those who receive the funds, further steps should be taken to strengthen leadership at all levels of the program. Additional leadership and direction need not involve extensive regulation and can be accomplished without reducing the program's flexibility and administrative simplicity--for example, by exhortation, dissemination of information, and similar means.

ACKNOWLEDGMENTS

The authors wish to acknowledge the support provided by the Office of Planning, Budget and Evaluation of the U.S. Department of Education (ED), which not only sponsored the National Study but also provided the study team wide latitude in the details of designing and conducting the study. ED deserves particular credit for encouraging the use of a comprehensive approach combining accurate national estimates based on statistically valid national samples together with an in-depth understanding of the operation and impact of the program based on nearly 50 site visits.

The authors would also like to acknowledge the assistance of many individuals who have contributed to the National Study. Within SRI, these include: Joan Ruskus, Lucy Omo, and Kathy Valdes, who worked on the surveys; Harold Javitz, the project's statistical expert; Carolyn Estey, project secretary; Dorothy Stewart, project administrator; Choya Wilson, who conducted site visits; and Klaus Krause, editor.

Site visits were also carried out by a number of other individuals (besides the authors of this report). Thanks to each for their excellent work: Mary Louise Bellamy, Christene Petry, Steven Schneider, and Burr Tyler. A special thanks to the sites that hosted us.

An expert Advisory Panel met three times during the National Study to comment on the study design, the preliminary findings, and the draft final report. Their assistance was invaluable. Members of the panel were: William Aldridge, Gary Allen, Deborah Ball, Rolf Blank, Audrey Champagne, James Gates, Vinetta Jones, Robert Kenney, Susie Oliphant, Harold Pratt, Susan Snyder, and Linda Stehr. Nancy Walters also provided advice useful to the study team.

INTRODUCTION

The science and mathematics program created in 1984 by Title II of the Education for Economic Security Act (EESA) is primarily intended to support training and retraining of elementary and secondary science and mathematics teachers. The program was reauthorized in April 1988 by the Dwight D. Eisenhower Mathematics and Science Education Act. From October 1988 through September 1990, SRI International conducted the National Study of the EESA Title II Program, the first comprehensive study of the Title II/Eisenhower program, under a contract with the Office of Planning, Budget and Evaluation of the U.S. Department of Education. This document describes the study and reports on its findings.*

Most of the data that were collected pertain to the 1988-89 school year, the last year of the EESA Title II program. However, because in most respects the Eisenhower and Title II programs are one and the same, many of the findings of the National Study apply equally well to the Eisenhower program. Also, because the law had already been reauthorized by the time the study was conducted, the study team was able to pay particular attention to key aspects of the program to be affected by the new law.

Federal and National Concern About Science and Mathematics Education

The Education for Economic Security Act came into being in response to a widely perceived crisis in science and mathematics education related, in part, to deficiencies of the teaching force. The staying power of the

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* The study does not address the national component of the program--that is, the federal set-aside (9% of the total appropriation under Title II, 4% under the Eisenhower program)--which supports a variety of research and demonstration activities.

nation's attention to education improvement in general, and to science and mathematics education in particular, has been remarkable. In 1989, for the first time in the nation's history, the president and the governors adopted a series of national education goals. Prominent among these is one related to science and mathematics with two objectives: to upgrade the teaching force in science and mathematics, and to raise student achievement in these fields to first in the world.

As concern mounted during the 1980s, federal appropriations for science and mathematics education climbed. Among federal science education programs, the Title II/Eisenhower program is currently the largest. **A national study of the program is particularly appropriate, not only because of the program's size and because national concerns about science and mathematics remain great, but also because there is little data available to assist federal policymakers with decisions about federal teacher training programs** (General Accounting Office, 1984; Knapp, Zucker, St. John, Shields, & Stearns, 1988). Furthermore, the study is timely and important because it can clarify the interaction between recent state reform activity, of which there has been an enormous amount, and the Title II/Eisenhower program, which has several components that allow a large degree of discretion to the states.

Congress raised questions about the Title II program that the state needs assessments, which were not uniform and could not be aggregated at the national level, were unable to address; the U.S. Department of Education was unable to provide summary information of such basic statistics as the number of teachers involved in Title II training. Therefore, the Department decided to commission a national study to be based on both nationwide surveys and a large number of site visits. The study's broad scope and large samples mean not only that reliable national estimates can be made about many dimensions of the program's operation, but also that intensive site visit data can illuminate questions of program impact in considerable detail.

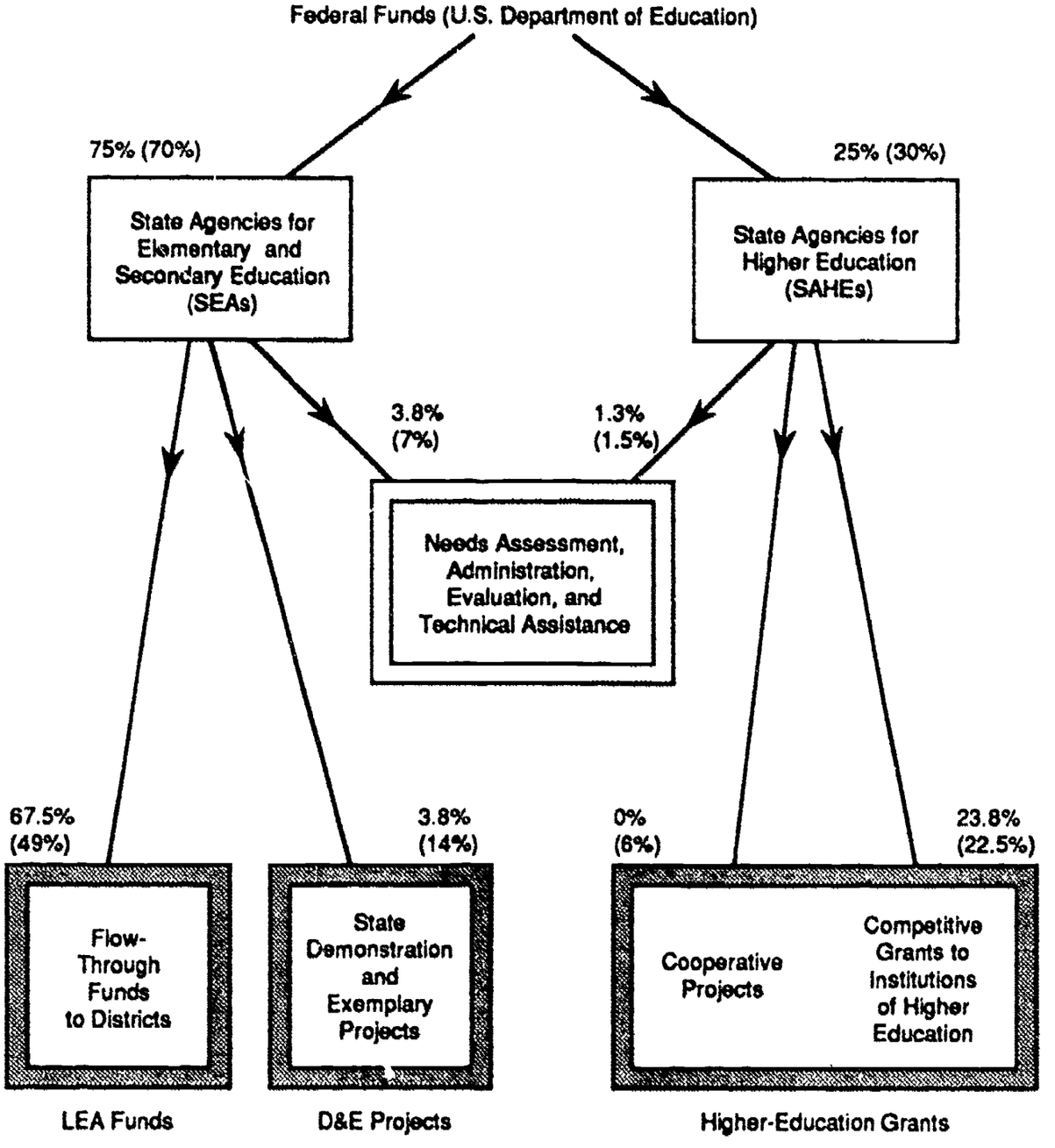
The Title II and Eisenhower Programs

The Title II and Eisenhower programs are more complex than many federal formula programs. This section reviews the flow of funds and operation of the two programs, beginning with Title II.

Conceptually, the flow of Title II funds can be traced (in somewhat simplified form) through the intergovernmental system as shown in Figure 1. The flow is through the states, principally to districts (LEAs) and to institutions of higher education (IHEs); the three major "pieces" of the program are shown as boxes at the bottom of the diagram. The flow begins with separate grants by the federal government to the state agency for elementary and secondary education (SEA) and the state agency for higher education (SAHE) in each state. (In this figure, the discretionary activities administered at the federal level are ignored, as are set-asides for U.S. territories and for Indian education; those activities were not included in the study.)

The influence of Title II could be illustrated in a way that closely parallels the flow of dollars. **Although the ultimate effect of Title II (and Eisenhower) is intended to be increased student achievement and participation, most of the program funds are not spent directly on students, curricula, or materials, nor are they meant to be. The preponderance of the funds are spent on training, conferences, and other activities for teachers that are collectively called professional development.** In other words, the program affects education improvement primarily indirectly, through its effects on elementary and secondary teachers.

This characteristic of the program has important implications for the study because--more than is the case with federal programs aimed directly at students, such as ECIA Chapter 1--there is no feasible way to attribute changes in student achievement unambiguously to the program (rather than to ongoing changes in curriculum, testing, new certification requirements, other state and federal programs, or other changing characteristics of the education system or of students themselves).



Explanation of Figure: The current percentage for distributing Eisenhower funds is shown first, based on the formula used in the reauthorized version of the legislation. In parentheses are shown the corresponding percentages for EESA Title II, the predecessor. Actual distribution of funds may differ slightly from the target percentages.

Funding Levels: Total program funding for the activities shown has varied year by year. For the first 5 years, beginning in school year 1985-86, the funding levels (in millions) for the 50 states (plus the District of Columbia) were: $87.4, $38.0, $70.6, $105.7, and $124.0. The last of these amounts, for school year 1989-90, was the level for the first year of the Eisenhower program with its revised formula for allocating the funds.

FIGURE 1 THE DISTRIBUTION OF PROGRAM FUNDS

Four other characteristics of the program also have had important implications for the way the program influences the field, and hence for the study design:

- The program strikes a balance between focus and discretion. Both Title II and Eisenhower have focused on a limited set of problems identified by the federal government (primarily science and mathematics education improvement)--but both are designed to allow a wide range of state and local discretion.

- The program is more an enabling resource than a defined and targeted program. Program funds can be used to address many different priorities and, in fact, are used very differently in different states and localities (e.g., for different subjects or grade levels).

- The program is a modest investment that maximizes breadth of coverage rather than depth. Because of the modest funding levels (far less than originally envisioned) and the many set-asides established by law, the Title II/Eisenhower program has typically provided small amounts of service for many people.

- The program includes multiple strategies for improving science and mathematics education. A variety of strategies are embodied in the various set-asides, including competitive state grants to institutions of higher education and school-district projects funded by formula allocations.

These characteristics of the Title II program form part of the conceptual framework that guides the study. They apply as well to the Eisenhower program, which, however, introduced some modifications first implemented during the 1989-90 school year. The flow of funds under the Eisenhower program is also illustrated in Figure 1. The reauthorization changed the flow of funds by combining two different kinds of higher education grants (requiring that all of them be awarded by a competitive process in each state), and by changing the formulas for allocating the program funds to the states and within each state. The reauthorization also eliminated foreign languages and computer education as focal areas of the program. Another change was the elimination of a separate set-aside for technical assistance by the SEAs. (This summarizes major changes in the law; there were others.)

Figure 1 shows the percentages of the funds allocated for the various components of the program under the corresponding legislation. For example, the minimum "flow-through" funds to school districts were set by Title II at

49% of the total, but that proportion was increased to 67.5% under the Eisenhower program. The amount of funds allocated to the different components depend on the appropriation level as well as the formula, and Figure 2 shows the levels of funding for the major pieces of the program for each of the first five years. The large dip in the appropriation for the second year is evident.

A Framework for the National Study

Basic features of the program itself, such as those sketched out above, dictated approaches to the National Study. Other considerations played an important role in shaping the study design:

- The relationship of the program to other initiatives. Because the Title II/Eisenhower program is a small to modest-size program in states and districts, the program expenditures were viewed as part of a larger picture including other federal funds, state and local funds, and state and local reform efforts. Also, the statutes require that the funds "supplement" and not "supplant" state and local efforts.

- Changes in the program over time. The fact that the program has evolved in significant ways over its first years has been an important consideration for study. The significant changes in funding levels across years also provided a "natural laboratory" for understanding impacts due to differing levels of investment.

- The indirect nature of the program. Effects on students cannot be detected directly, in most cases. Instead, study efforts concentrated on the program's effects on teachers and classroom practice, as well as on state, local, and IHE capacities for providing professional development activities to teachers.

Survey instruments, site-visit guides and other aspects of the study were designed with these considerations in mind.

The study was designed both to describe the operations of the program and to assess its impact. The program has the following five categories of impact. The first three types of impact include the most direct and visible effects of this federal investment.

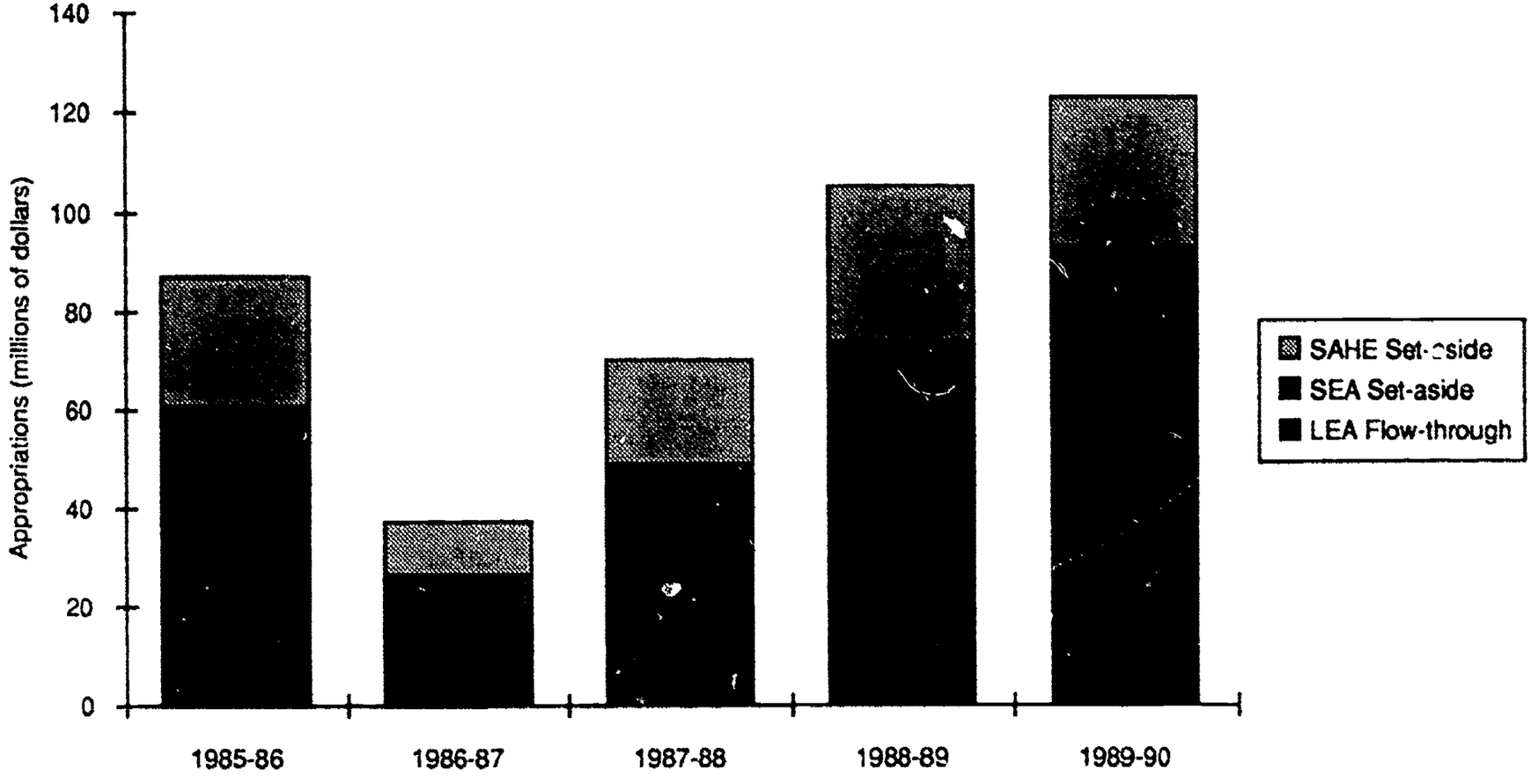


FIGURE 2 THE FLOW OF PROGRAM FUNDS TO STATES AND DISTRICTS — TITLE II AND EISENHOWER FUNDING LEVELS

- Impact on the state and local infrastructure for mathematics and science education improvement. The program can exert a direct influence on the attention that state and local organizations pay to mathematics and science education improvement, the leadership they exert for improvement, their relationships with one another as partners in improvement initiatives, and the resources they invest.

- Impact on the quantity and quality of teachers' professional development. The primary use of program funds is for various forms of professional development--principally inservice training, but also teacher retraining, preservice preparation, and other activities such as attendance at conferences.

- Impact on teachers. As a result of their participation in Title II- or Eisenhower-supported professional development, teachers may know more in their content areas, get ideas for curriculum and instructional approaches, or change the way they view the subjects they teach (e.g., by viewing science as a process for learning about the world, rather than merely a collection of facts and principles).

- Impact on classrooms. Teachers may change what they teach, or how, as a result of the previous impacts. In some instances, LEAs can use funds to improve the materials or equipment available to classrooms.

- Impact on student learning and participation. Ultimately, changes in classroom practice or content can affect (1) what students learn, (2) how students view mathematics and science, and (3) how enthusiastically students participate in instruction related to these subjects (or, in later school years, how frequently they select mathematics and science courses).

The latter two types of impact are the most indirect and the most difficult to document, especially since the program typically serves only a minority of the teachers in any particular school or district, often for short periods of time, and frequently with very different goals for different teachers. The National Study collected extensive information about impact on teachers, but could not document direct impact on students except in the small number of cases where program funds supported direct service to students.

Study Methodology

The National Study has two major goals, which are:

(1) To document what the Title II funds have been spent for, and how they have been spent.

(2) To understand the impact of the Title II/Eisenhower program expenditures on the education system.

To achieve these goals, two complementary approaches have been used for data collection: sample surveys and site visits. Each contributes unique information to the twin goals of the study. On the whole, however, more data to support the first goal (documentation) come from surveys than from site visits, while more data to support the second goal (impacts) come from the site visits. The final data set includes responses from approximately 2,000 mail surveys (representing statistically valid national samples from four surveys). Interviews were also conducted in seven "intensive study states" with more than 300 individuals from about 50 school districts, institutions of higher education, state agencies, and other organizations. Over 100 teachers were interviewed as part of the National Study.

The study design includes seven separate samples, as follows (and as shown in Figure 4). The first four were survey samples:

(1) A mail survey administered to 1,600 local education agencies (LEAs)--more than 10% of all LEAs. This stratified, random sample included some LEAs that received services through "intermediate units" (such as state Education Service Centers), as well as some that did not participate in the Title II program.

(2) A separate mail survey was conducted for program-funded projects in institutions of higher education (IHEs) or other nonprofit institutions, such as science museums. This sample consisted of 700 projects funded by the state agencies for higher education (SAHEs), or nearly one-half of all the projects funded by the SAHEs in 1987-88 and 1988-89 (Years 3 and 4 of the program).

(3) A mail survey was sent to state education agencies for elementary and secondary education (SEAs) in all states and the District of Columbia.

(4) A similar survey was conducted covering all the SAHEs.

The next three samples made it possible to collect intensive data through site visits:

(5) Seven "intensive study states" were selected to represent a wide range of conditions. Interviews were conducted with state agency personnel in the SEA and the SAHE in each of these seven states (Arkansas, California, Iowa, New York, North Carolina, Vermont, and Wyoming).

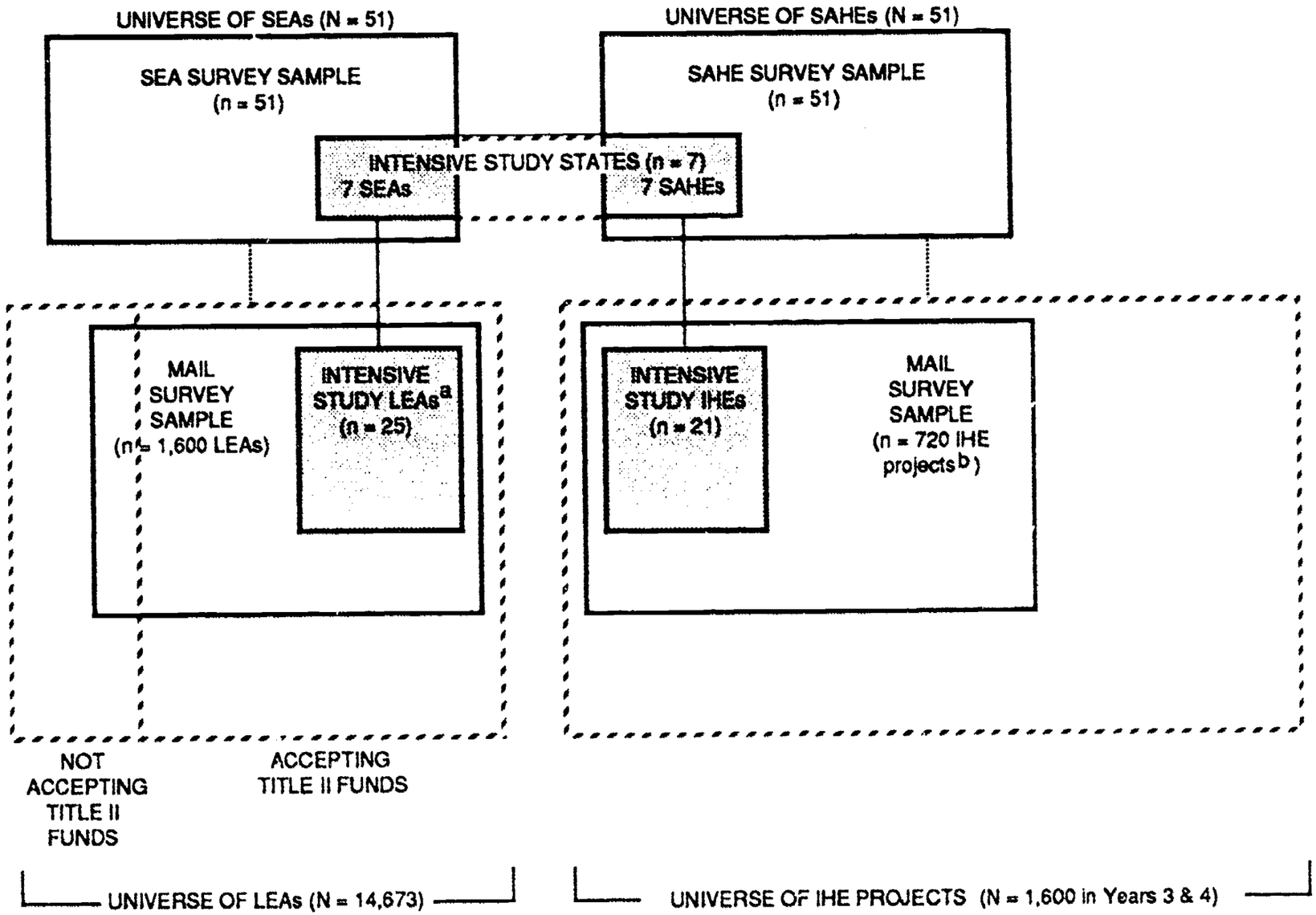
(6) Site visits were made to 18 school districts and 7 intermediate units (serving LEAs) within the 7 states selected for intensive study. Table 1 provides information about these sites. To bolster this sample with respect to small LEAs, phone interviews were conducted with an additional 10 sites.

(7) A similar set of site visits was made to 21 higher education projects in the 7 intensive study states. Several of these projects were located in museums and other nonprofits, as authorized under the law, but most were in institutions of higher education. Table 2 provides information about these sites.

The surveys and site visits were closely related in terms of topics, analyses, and the relationships among respondents. Figure 3 illustrates the relationships by displaying the nested nature of the samples (and the universes of which the samples are a part), as well as the institutional relationships among them.

Early on, the study team prepared research questions to guide its work toward the two major goals listed above. Rather than listing all of the many research questions here, we have summarized them in the introduction to each of the four parts of the report, along with highlights of the major findings.

Further information about the study methodology can be found in the appendices.



[a] The intensive study sample consisted of 18 LEAs and 7 intermediate units (such as Education Service Centers) that predominantly serve small LEAs.

[b] "IHE projects" include some funded at science museums or other nonprofit institutions.

FIGURE 3 RELATIONSHIP AMONG STUDY SAMPLES

Table 1

ELEMENTARY/SECONDARY SITES SELECTED FOR VISITS

State	Site No.	Administrative Organization	District Size	Poverty Level	Metropolitan Status	Percent Nonwhite
Arkansas	1	Intermed. unit	*	High	Rural	High
	2	Intermed. unit	*	High	Suburban	High
	3	LEA	Medium	High	Urban	High
	4	LEA	Medium	Low	Rural	Low
California	5	LEA	Very large	Medium	Urban	High
	6	LEA	Very large	Low	Suburban	Low
	7	LEA	Medium	Low	Suburban	Low
	8	LEA	Medium	High	Suburban	High
Iowa	9	LEA	Large	Low	Urban	Low
	10	Intermed. unit	*	High	Rural	Low
	11	Intermed. unit	*	Medium	Urban	Low
New York	12	LEA	Very large	High	Urban	High
	13	LEA	Large	High	Urban	Medium
	14	LEA	Medium	Low	Suburban	Low
	15	LEA	Small	Medium	Rural	Low
North Carolina	16	LEA	Very large	Medium	Urban	Medium
	17	Intermed. unit	*	Medium	Rural	Low
	18	LEA	Large	High	Rural	Medium
Vermont	19	Intermed. unit	*	Medium	Rural	Low
	20	Intermed. unit	*	Medium	Rural	Low
	21	LEA	Medium		Rural	Low
Wyoming	22	LEA	Large	Low	Rural	Low
	23	LEA	Small	Medium	Rural	Low
	24	LEA	Small	Low	Rural	Low
	25	LEA	Medium	Low	Rural	Low

* Intermediate units predominantly serve small LEAs.

Key:

District Size (Number of students)

Very small = Less than 600
Small = 600 - 2,499
Medium = 2,500 - 9,999
Large = 10,000 - 24,999
Very large = 25,000 or more

Poverty Level (Orshansky Percentile)

Low = Less than 10%
Medium = 10% - 19%
High = 20% or more

Percent Nonwhite

Low = Less than 20%
Medium = 20% - 39%
High = 40% or more

Table 2

HIGHER EDUCATION PROJECTS SELECTED FOR VISITS

State	Site No.	Type of Institution[a]	Grant Size	Grant Type	Subject Area	Grade Levels Served
Arkansas	1	Comprehensive univ.	Medium	Competitive	General science, mathematics	Elementary
	2	Liberal arts college	Medium	Competitive	General science	Elementary
	3	Comprehensive univ.	Medium	Cooperative	Mathematics	Elementary
California	4	Comprehensive univ.	Very large	Competitive	General science	Elementary
	5	Non-IHE	Large	Competitive	Mathematics	All
	6	Non-IHE	Very large	Cooperative	Physical science	Secondary
Iowa	7	Comprehensive univ.	Large	Competitive/ cooperative	General science, mathematics	Elementary
	8	Research university	Large	Competitive/ cooperative	General science, mathematics	Elementary
	9	Research university	Medium	Competitive/ cooperative	General science	Elementary
New York	10	Research university	Large	Competitive	General science	Elementary
	11	Research university	Medium	Cooperative	General science, mathematics	All
North Carolina	12	Comprehensive univ.	Medium	Competitive	Mathematics	Elementary
	13	Comprehensive univ.	Medium	Competitive	Physical science	Secondary
	14	Research university	Small	Cooperative	General science	Elementary
	15	2-yr. college	Small	Competitive	Biological science	Secondary
Vermont	16	Research university	Very large	Competitive/ cooperative	General science, mathematics	All
	17	Liberal arts college	Small	Competitive	General science	Elementary
	18	Liberal arts college	Medium	Competitive	General science, computer educ.	Elementary
Wyoming	19	Research university	Large	Competitive	General science, mathematics	All
	20	2-yr. college	Small	Competitive	General science, mathematics	All
	21	2-yr. college	Small	Competitive	General science, mathematics	Elementary

[a]Institution types are based on the Carnegie Foundation's classification scheme; see Chapter VII for details.

Key: Grant Size

Small = Less than $20,000
Medium = $20,000 - $39,999
Large = $40,000 - $99,999
Very large = $100,000 or more

PART ONE: THE PROGRAM AT THE STATE LEVEL

During the first four years of the program's life, while it was known as EESA Title II, the states had discretion over a majority of the funds that were distributed from Washington. Fewer than half (49%) of the dollars were "flow through" funds for districts; moreover, the states had important responsibilities for these, too (such as reviewing and approving districts' applications). As a result, states, and in particular the program coordinators at the state level, have played a key role in implementing the program.

In the states, responsibility for administering the program is typically shared between the state education agency responsible for elementary/secondary education (the SEA) and the agency responsible for higher education (the SAHE). The involvement of the latter agencies is very unusual; a majority of those agencies administer no other grant programs, either state or federal, aimed at improving elementary and secondary education.

We begin Part One by focusing in Chapter I on some of the common features of the agencies administering the program. We then shift to an examination of the separate components at the state level: the SEA in Chapter II and the SAHE in Chapter III. Throughout, our attention in Part One is on what state agencies do, and the impacts of their actions.

Highlights of Findings About the Program at the State Level

Each chapter sets out to answer several key research questions. Brief highlights of the questions and pertinent findings for Part One are summarized below.

Summary: Overview of the Program at the State Level (Chapter I)

(1) How large is the program compared with other state resources for improving science and mathematics education?

Although the Title II program is a tiny fraction of state education budgets overall (which come to more than $70 billion per year), in 1988-89 the program supplied about half of the SEA and 80% of the SAHE budgets specifically targeted toward improving science and mathematics education. Because the overall state share of funding going to the state agencies has declined (from 51% to 32.5%) under Eisenhower, the importance of the program in terms of state agency budgets has also declined, especially in the SEAs.

(2) What is the nature of collaboration between the SEAs and the SAHEs?

Collaboration, including joint funding of projects, is common. At the same time, there is little evidence that SEA-SAHE collaboration typically extends beyond administering the program itself.

(3) What was the general approach to administering Title II in the states?

States welcomed the program, because many were already beginning to implement reforms in science and mathematics education. The approaches of the SEAs and the SAHEs have shown many similarities, including focusing most program funds on science and mathematics (rather than foreign languages or computer education), putting the highest priority on inservice teacher training, and taking a fairly "open" stance toward funding with a majority of the funds.

Summary: The Elementary/Secondary Component at the State Level (Chapter II)

(4) Which staff members in the SEA are involved in administering the program?

Most states assign several staff members to administer the program, who typically have other responsibilities as well. In almost all states, the state science or mathematics supervisor is involved in administering the program, but it is rare for the chief state school officer to participate in decisions about it.

(5) How do SEAs conduct the needs assessments, and are they useful?

The needs assessments were perceived as useful, partly because so much relevant information had not been compiled in a single document before. Data were obtained from existing sources and from new surveys of LEAs and IHEs.

(6) **How much direction, and what kinds of direction, do SEAs provide to LEAs regarding the flow-through funds?**

States gave districts wide latitude to use flow-through funds as they saw fit (within the limits of the law). However, some states were more directive, requiring LEAs to get waivers for activities the state did not encourage, and other states encouraged (but did not require) a particular approach to using the funds, such as focusing only on specified grade levels.

(7) **What is the nature of the Demonstration and Exemplary (D&E) project component of the program?**

In 1988-89, more than 700 different D&E projects were supported by the states. Nearly half of them were based in school districts. Inservice teacher education was the major focus. State conferences were another major activity, often in support of specific state goals for reform of science and mathematics education.

(8) **What is the nature of technical assistance and evaluation activity conducted by the SEA?**

Technical assistance commonly involved dissemination activities such as conferences, but varied widely among the states. Formal evaluation of the program (e.g., by a third party) was rare, but many states gathered data from districts. Final reports to ED sometimes include more elaborate assessments of D&E projects.

(9) **What impact has the program had on the capacity of SEAs to provide leadership and technical assistance in science and mathematics?**

The program accounted for a high percentage of SEA funding for mathematics and science education improvement (before the reauthorization reduced the SEA set-aside). Program funds (notably the monies for D&E projects) have served to increase state leadership and technical assistance significantly.

(10) **What impact has the program had on state institutional networks and relationships?**

The program has had a very positive impact on the strength of professional associations for mathematics and science teachers, both through direct funding (grants) and through support for teachers to attend state and national conferences. The program has also increased the capacity of intermediate units in many states to provide training and technical assistance in these fields.

Summary: The Higher Education Component at the State Level (Chapter III)

(11) **Which staff in the SAHE are involved in administering the program?**

In at least seven states, the SEA takes responsibility for administering both the elementary/secondary and the higher education components. It is even more unusual for SAHEs to designate an individual to work full time on the programs than for SEAs to do so. Typically, the SAHE staff are not otherwise involved with teacher education.

(12) **How do SAHEs conduct and use the needs assessments?**

The SAHEs perceived the needs assessments as useful, and 36 indicated that they were used to help write grant announcements. A combination of existing data and data from surveys of LEAs and IHEs was used to develop the needs assessments.

(13) **How much direction, and what kinds of direction, do SAHEs provide to applicants regarding the higher education funds?**

The SAHEs often limited the size of the grants to increase the number, type, and geographic spread of awards. Some SAHEs were very specific about the types of projects to be awarded (e.g., limiting them by grade level), but many competitions had few restrictions.

(14) **What is the nature of the higher education projects supported under the program?**

In many respects, the "competitive" and "cooperative" projects are quite similar. In 1988-89, both were typically about the same size ($30,000), duration (12 months, median), and nature (primarily for inservice training in science and mathematics). (Part Three provides more detail about the projects.) Increases in the appropriation for higher education projects (in 1988-89) did not lead to correspondingly large increases in grant size.

(15) **What impacts has the program had on the capacity of SAHEs to provide leadership and technical assistance in science and mathematics?**

Few SAHEs support any other programs to improve K-12 education. The Title II/Eisenhower program has therefore meant that SAHEs have become far more active in K-12 education improvement.

(16) **What impact has the higher education component had on state institutional networks and relationships?**

SAHEs perceive increased ties not only with SEAs, but with a wide variety of other institutions, including school districts and nonprofit educational institutions. Links with faculty in science and mathematics, and with private-sector firms, also increased.

I OVERVIEW OF THE PROGRAM AT THE STATE LEVEL

In the introductory section, the four major pieces of the original Title II program were identified, as well as the amounts of funding for each. (See Figure 1.) The SEAs administer the flow-through funds to districts, and directly manage the funds for Demonstration and Exemplary (D&E) projects. During the first four years of the program, SAHEs administered two types of grants ("competitive" and "cooperative"); however, under Eisanhower, the SAHEs now have less flexibility to fund cooperative projects, because of new requirements that SAHE grants be awarded competitively and through an institution of higher education.

The Relative Size of the Program

A sense of the size or scale of the state components is important in order to understand the program. Consider the funds available during the first four years:

- SEAs. Together, the SEAs spent an average of more than $15 million of Title II funds annually during the first four years of the program--not counting the flow-through funds for districts. Since state governments now spend more than $70 billion annually on K-12 education. this is a tiny fraction of their education budgets. **Yet, according to SEA respondents, Title II constituted about half of the agency budget earmarked for improving science and mathematics education in fiscal year 1988.**

- SAHEs. During the first four years of the program (fiscal years 1985-1988), the SAHEs together spent an average of more than $22 million of program funds annually. **This is far more money than those agencies had to spend on improving K-12 mathematics and science education from any other source (by about four to one nationally, and by much greater proportions in most states).** Yet, in comparison with annual national expenditures on K-12 education during the same period, the amount is very small.

Thus, whether this program is "large" or "small" depends on one's perspective. Certainly, in comparison with other federal education programs that

allocate monies to states and districts by formula (e.g., Chapters 1 and 2), the program is a small one. However, because Title II (and now Eisenhower) is quite narrowly focused, within the particular domain of science and mathematics education, the importance of the program at the state level is far larger than the dollar figures alone might indicate. We will elaborate on this point in Chapters II and III.

Under the reauthorized program (the Eisenhower program), the proportion of the funds allocated to state agencies decreased from 51% to 32.5%. Most of the decrease in the state funding was in the portion allocated to the SEA--a dramatic reduction of almost two-thirds. As a result, one key issue that we will examine throughout the report is what the formula funding shift--which greatly increased the funds going to districts, while reducing the funding for SEAs--means for the effectiveness of the program.

Collaboration Retween SEAs and SAHEs

Each state designates the recipient agency for the elementary/secondary and the higher education portions of the program. (The federal government actually makes two distinct grant awards to each state.) In the former case, the organizations (SEAs) may have different names (e.g., State Department of Public Instruction, State Department of Education), and may report to different entities (e.g., directly to the Governor or to the Board of Regents)--but the similarities from state to state outweigh the differences.

State agencies for higher education are more disparate in form and function. Typically, however, they deal with federal and state student aid programs and with certain aspects of state university and college systems. More than half of the SAHEs do not administer other funds that are directly targeted at improving K-12 science and math education--although, in about 20 cases, the SAHE does administer such programs. These improvement programs, which are independent of Eisenhower, include, for example: special fellowship programs for current (or future) teachers, state high schools for

science and mathematics education, and networks of higher education centers aimed at improving K-12 science education.

In a few cases (New York, for one), a single state agency routinely handles both the elementary/secondary and higher education programs, including Eisenhower. In a few other cases (Vermont and Wyoming are examples), there is a separate agency for higher education, but the elementary/secondary agency (the SEA) has been designated to administer both portions of the Eisenhower program. Still, to simplify discussion, we will refer to the agency administering the higher education portion of the program as the SAHE (except where we give specific examples that exemplify a different approach).

It is the norm, then, for two distinct state agencies to administer the Eisenhower program. **Nonetheless, collaboration between the two agencies--and the two components of the program--is encouraged by the legislation, and is common.** For example, in about 20 states, monies earmarked for elementary/secondary Demonstration and Exemplary (D&E) projects and for higher education grants have been pooled for certain purposes (e.g., grant competitions) (see Table 3). A notable example is California, where most of the D&E funds were pooled with higher education "cooperative" funds throughout the first four years and used to support unusually large, long-term projects aimed at fundamental changes in science and mathematics education.

The individuals in the SEAs and the SAHEs who administer the Eisenhower program believe that the program has increased collaboration between the two agencies (see Tables 17 and 27, showing that more than 80% of the 48 respondents believe this). Joint funding of projects is the most tangible way that collaboration takes place. Other forms of collaboration include joint planning, sharing lists of awards, and working together on the needs assessments required for the federal applications in fiscal years 1985 and 1989. The next section provides more information about the needs assessments.

Table 3

HOW SEAs AND SAHEs COORDINATE UNDER TITLE II

Type of Coordination	Number of Respondents[a] Reporting Each Type of Coordination: SEAs	SAHEs
Little or no coordination	2	0
Sharing results	31	34
Joint planning	33	34
Pooling funds	20	17
Working together on needs assessments	33	36

[a]Based on responses from 48 SEAs and 47 SAHEs.

State-Level Planning for the Use of Program Funds

The Title II legislation was framed with an intent that a thoughtful "assessment of the status of mathematics, science, foreign language, and computer education within [each] State" would contribute to the effective use of the new funds (P.L. 98-377). Various pieces of evidence (including responses to the state surveys) suggest that the state assessments were, indeed, useful (see Tables 6 and 19).

Nonetheless, the contribution of the needs assessments to state planning for using program funds was in most cases modest. Few states first assessed their needs, then adopted a "strategic plan" for education improvement, and finally carried it out--all in a linear fashion, while carefully calculating the percentages of federal, state, and local funds to be used years ahead of time. More often, even in advance of the needs assessment, state agencies were satisfied that they had clear perceptions of what the needs were.

After all, states had become very active in education reform before Title II was created. Some low-cost steps to improving science and

mathematics education--most notably, raising high school graduation requirements and requiring districts to use a variety of new tests for "accountability"--were being widely implemented (Firestone, Fuhrman, & Kirst, 1989). In many states, a variety of other initiatives were being taken, including more expensive steps (such as residential high schools for science and mathematics, or large-scale revisions to existing curricula). The newly created Title II program therefore was thrust into a policy arena that was already very complex--and that remains so to this day. The range of reforms being implemented is tremendous. (See Chapter XI for additional information about state reforms.)

Title II entered this active policy environment--and state after state has reported that the timing for initiating Title II activities was fortuitous. Ideas were already on the drawing board and were beginning to be put in place. The need for a brand-new needs assessment was somewhat less than it might have been five or ten years earlier (before Educating Americans for the 21st Century or A Nation at Risk). At the same time, Title II provided vital implementation money where often there was little or none beforehand.

The initial needs assessment process (in 1985 and 1986) did, however, foster dialogue and reflection, and this was important. For example, before managing the Title II program, SAHEs typically had little knowledge of the K-12 education system in any detail. For this reason, the needs assessment process was an important source of information for them (see Table 6).

There seems little doubt that the needs assessment process has helped in many states to align more closely the perceptions of the SEA and the SAHE concerning important priorities for education improvement in mathematics, science, foreign languages, and computer education. Greater communication between the agencies was required to compile the needs assessments. For example, both the SEAs and the SAHEs believe that elementary science is the area of greatest educational need. (See Figures 4 and 5.)

Nonetheless, there are distinct differences in outlook between the SEAs and the SAHEs--as one would expect. The SEAs believe that the needs to

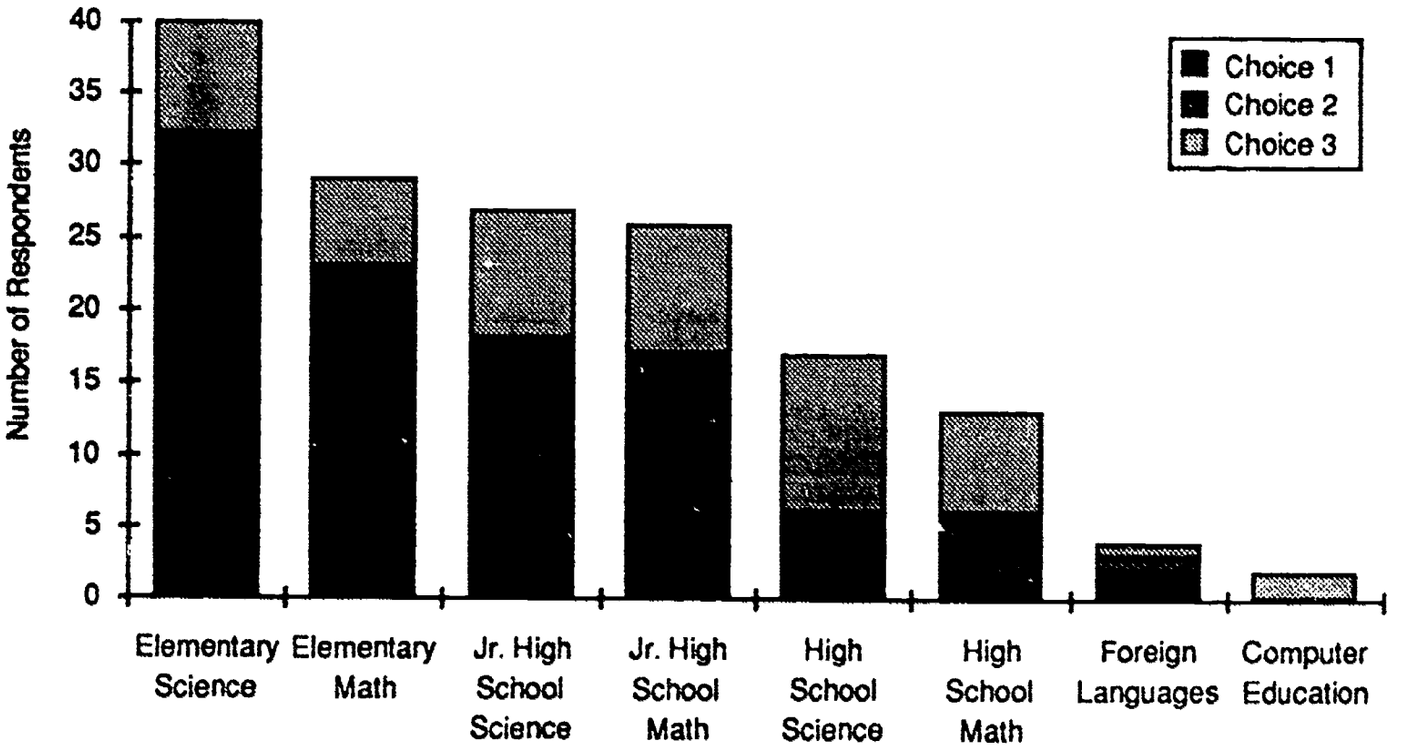


FIGURE 4 SEA RESPONDENTS' PERCEPTIONS OF NEED — TOP THREE PRIORITIES, 1988-89

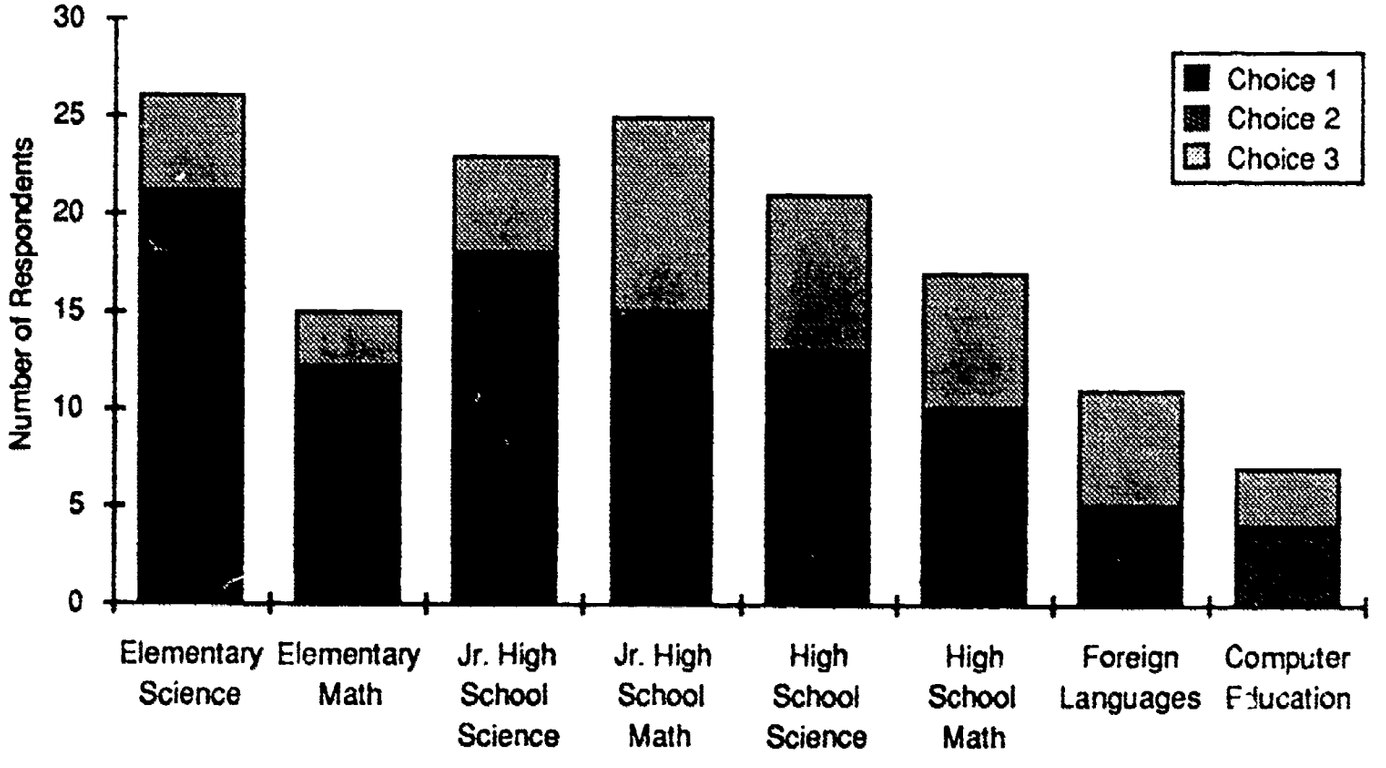


FIGURE 5 SAHE RESPONDENTS' PERCEPTIONS OF NEED — TOP THREE PRIORITIES, 1988-89

improve science and mathematics education are greatest in elementary schools, middle schools, and high schools--in that order. The SAHEs do not see the needs as so clearly ordered, nor do they put nearly as high a priority on elementary mathematics as the SEAs. Because the agencies have different missions, different cultures, and different types of expertise, it is perhaps not surprising that they see K-12 education improvement needs in a different light. For example, SEAs are heavily involved with testing and assessment issues, and believe that "better methods of assessing student learning" are a high priority for improving mathematics and science education. Respondents in SAHEs (who have no corresponding responsibilities, and little experience with these matters) place a far lower priority on this issue. Similarly, SEAs typically place a greater priority on K-12 curriculum development than do SAHEs (see Table 4).

Overall, we found many more areas of agreement between SEAs and SAHEs about planning for and implementing the Title II program than areas of disagreement. For example, both agencies:

- Focused funds on math and science far more than on foreign languages or computer education.
- Put the largest fraction of the resources into inservice training.
- Tended to control or direct the flow of some of the monies for which they were responsible, but to allow either LEAs (in the case of the SEA) or IHEs (in the case of the SAHE) to set their own priorities with the majority of funds, within very broad guidelines.
- Became more strategic, by learning over time how best to plan for and manage the resources of this new program.
- Exchanged a lot of information across states--e.g., through Title II national conferences, through National Impact studies prepared for the Title II National Steering Committee (concerning SAHE projects), through regional networks (e.g., New York-New England) and through other means (e.g., meetings of the Association of State Supervisors of Mathematics and its science counterpart, the Council of State Science Supervisors).

Another important area of agreement is that both SEAs and SAHEs have found that funding fluctuations for the program make effective planning far more difficult (needs assessments notwithstanding). Funding changes of

Table 4

TYPES OF CHANGES NECESSARY TO IMPROVE MATHEMATICS AND SCIENCE EDUCATION IN THE STATE

Types of Change	Number of Respondents Indicating Each Type of Change as Top Priority[a] SEAs	SAHEs
Better K-12 curricula	32	22
Better professional development for current teachers	41	37
Active recruitment of qualified new teachers	12	12
Revised certification requirements	4	10
Better methods of assessing student learning	19	5
Improved access/services for underrepresented groups	18	24
More collaboration between colleges/ universities and school districts	13	17

[a]"Top priority" means ranked 1, 2, or 3 out of the above possibilities.

more than plus or minus 50% occurred every year for SEAs in the first five years, and in all but the fifth year for the SAHEs. As a result:

- More than 80% of SEA respondents indicated that increased stability in funding from year to year would be a significant change for the better--the highest percentage of any of seven response items.
- SAHE respondents also believe that increased stability in funding is the most important change they would like to see in the program (about 60% marked it as a top priority).

SEAs and SAHEs, as we have shown, approach the program and implement it with many common perceptions. They share a lot of information, both across states and across agency types (for example, one SEA used its D&E funds to disseminate widely a project initially developed with program monies in another state). At the same time, it would be misleading to imply that

collaboration between the typical state SEA and SAHE extends deeply into the agencies, beyond administering the program itself; we found little evidence that it does. For the most part, this is a natural consequence of the differences in the agencies' missions.

In the following sections, we discuss in more detail the SEA and SAHE components of the Title II/Eisenhower program. Within these sections we will provide additional details about how the agencies plan for and administer the program, the types of activities they support, program impacts, and how the agencies assess the program.

II THE ELEMENTARY/SECONDARY COMPONENT AT THE STATE LEVEL

In this chapter we discuss the SEA's role in administering the two major elementary/secondary parts of the program: LEA flow-through monies, and the Demonstration and Exemplary (D&E) projects. Technical assistance, evaluation, and planning by the SEA are also discussed.

Program Administration in the SEA

Who Administers the Funds?

State education agencies in many states are large, often having hundreds of staff members (and sometimes more than 1,000). The Eisenhower program is most often managed in an office that has responsibilities for curriculum development, testing, and related items. (However, there are exceptions, such as in New York state, where a "special programs" office is responsible for Eisenhower.) Teacher certification is typically handled by a different part of the SEA than the one that manages the Eisenhower program. Sometimes teacher training or professional development that is not subject specific is also handled in a separate unit of the agency.

Because the program is small (in comparison with total dollars administered by the SEA), a majority of states do not have even one person working exclusively on managing these resources. The median is zero full-time and two part-time staff. The total includes individuals responsible for bookkeeping and fiscal management, as well as individuals who review LEA applications (an average of over 200 applications per state) and who carry out or manage D&E projects, needs assessments, state applications and final reports, technical assistance, and evaluation. In Year 4, these staff--typically one, two, or three full-time equivalent--were managing or directing about $1.4 million per state of Title II funds, on average.

In most states, Title II is viewed as too small to involve the highest level of personnel (see Table 5). In only 14 states, for example, is the chief state school officer involved in decisionmaking. Similarly, other evidence suggests the governor's office is seldom involved with the program directly (although this was not a response option included in the SEA survey).

Table 5

PROGRAM ADMINISTRATION IN THE SEA

Staff Characteristics	Number of Respondents[a]
Number of states having an administrator with full-time responsibility for Title II	19
SEA coordinators who have been with the program for all 5 years	28
SEA Title II coordinators currently having the following responsibilities:	
Science education	26
Math education	25
Foreign languages education	3
Computer education	6
Staff development, generally	12
Chapter 2, ECIA	19
Other	22
States in which the following individuals are actively involved in making decisions about program funds:	
The chief state school officer or superintendent	14
State mathematics supervisor	40
State science supervisor	41
State staff development personnel	8
State coordinators for teacher certification	3

[a]Unless noted otherwise, SEA data in this report are based on responses from 48 SEAs.

In nearly all states (44 of the 48 that responded), either the state mathematics supervisor or the state science supervisor, or both (in 37 cases), are involved in decisions concerning the program. Because of the nature of the Title II/Eisenhower program, the involvement of mathematics and science supervisors seems highly appropriate. However, the extent of their involvement varies widely, and in a few cases they have been excluded from key decisions. For example, a survey conducted by the Association of State Supervisors of Mathematics (ASSM) found that out of 41 respondents, 8 state mathematics supervisors felt that they had no responsibilities at all concerning the SEA portion of the funds, while larger numbers indicated that they had no responsibilities for the LEA or SAHE components of the program (15 and 17 respondents, respectively).

In large states, the program can be an important source of funds for staffing; for example, in one very large state nearly half of the science-related staff are paid partly or entirely with program funds. However, this is the exception, not the norm. In the 14 smallest states, for example, the Year 4 administrative allocation for the SEA was under $20,000 (which could not possibly pay for much staff).

Our case studies showed that responsibilities for the flow-through monies and the D&E funds were often divided, with a given individual taking more responsibility for one program component than another. As one would expect, the way that these components were administered differed, with the administration of the D&E funds typically involving more active shaping of projects by SEA staff. In fact, some D&E projects were directed by SEA personnel--state conferences, for example. State science and mathematics supervisors often played a key role in managing the D&E funds.

Determining Needs

States went about determining needs in different ways (see Table 6). As we have suggested above, in many states--even without a new needs assessment--there was a perception that "the needs were clear" (as one interviewee put it). Many states had already commissioned state reports on science and mathematics education, or had been directed by legislative or

Table 6

SEA NEEDS ASSESSMENTS UNDER TITLE II AND EISENHOWER

	Number of Respondents Indicating Needs Assessment Approach and Needs Assessment Usefulness	
	Title II[a]	Eisenhower[b]
How state agencies assessed needs		
Used available data	28	35
Conducted survey/study of LEAs	42	28
Conducted survey/study of IHEs	17	12
Usefulness of needs assessment data[c]		
Helped formulate state policies for the program in general (e.g., for LEA flow-through funds)	30	
Helped specifically with guidelines for D&E projects	30	
Other ways of being useful	5	
Of little or no use	9	

[a]Initial needs assessment in Year 1 (1985-86).

[b]Follow-up needs assessment in Year 4 (1988-89).

[c]Asked about the needs assessments taken together.

administrative actions to meet perceived needs (e.g., to establish new courses or new tests). For example, in Iowa the science supervisors throughout the state had just completed a report for the Governor highlighting problems with physical sciences as a priority need. In Arkansas, new Course Content Guides were developed beginning in 1983, and a variety of new legislative initiatives were in place by 1985. In Vermont, the Public School Approval Standards had recently been established. These types of actions helped shape the use of program funds at the state level, so that frequently they were used to implement priorities that, to some extent, had already been set.

Most states nonetheless perceived the needs assessments as useful, perhaps in part because so much relevant information had not been compiled in a single document before. A first response was to pull together existing data (including data compiled for recent state reports or legislation). Many states had at least several indicators of science and mathematics education readily available (such as periodic data collected about course enrollments, test scores, or teacher certification). These types of existing data were supplemented in most states by surveys of school districts and sometimes of institutions of higher education as well. Furthermore, the many national reports on education that had been published by 1986 helped states to assess their needs in a national context. The result was often a document containing a great deal of quantitative information.

The U.S. Department of Education commissioned a study of the Title II needs assessments that characterized them as "highly idiosyncratic," but generally useful in stimulating states "to consider their needs in mathematics, science, and, to a lesser extent, computer learning and foreign languages" (Dickens, Pontzer, Shahmirzadi, & Schenet, 1987). This analysis across all the states found that "the greatest need for improvement in teacher qualifications appears to be in science teaching at the elementary level"; and as discussed in Chapter I, that conclusion is still widely shared by both SEAs and SAHEs.

The needs assessments that resulted were fairly general and were not prescriptive; for example, they did not provide the kinds of specific detail

that would create a blueprint for action (e.g., how to increase enrollments of minority youths in high school science and mathematics). However, fewer than one-fifth of the SEA respondents indicated that the needs assessments were "of little or no use" to them. It may be that one of the main uses of the needs assessments was to help build consensus by establishing a common core of information that was shared throughout the state. Whether the assessments typically uncovered any problem areas that were not well known (e.g., to the state supervisors of science and mathematics) is questionable.

The first application for Eisenhower funds (in 1989) also required various needs assessment data (such as a projection of the supply and demand for mathematics and science teachers). The time available for preparing this needs assessment was shorter than for the first one and, partly for that reason, fewer states conducted surveys of districts or institutions of higher education. (Many SEAs require state data collection forms to go through a clearance procedure, and some states found they did not have time to clear a new survey.) Still, more than half of the SEAs conducted a survey or study of districts for the three-year Eisenhower application.

On the basis of the law, the needs assessments, preexisting perceptions of needs, administrative and political constraints, and other considerations, SEAs formulate strategies for managing the LEA flow-through funds and the D&E monies. These strategies, and the activities supported by the SEAs, are discussed in the next section.

SEA Strategies for Using Program Funds

SEA Strategies for Directing the LEA Flow-Through Funds

There is some ambiguity about the role of the states in directing the LEA flow-through funds. On the one hand, SEAs have the right to impose additional provisions--beyond what is in the law--restricting what districts may do with the money. For example, the state of Arkansas decided that districts should use flow-through monies to concentrate especially on the

upper elementary grades. But this type of restriction was the exception, not the rule.

In general, states took a less directive approach to districts' use of flow-through funds (within the limits of what was allowable under the law). One state wrote, "LEAs were allowed to address all eligible areas based upon their assessment of greatest need," and this approach appears to be the norm in most SEAs. Such an approach is especially attractive to the many states that have large numbers of applications to review. (Twenty-five states have 200 or more districts.)

Moreover, the state needs assessments are typically general in nature and cannot elaborate on every district's individual needs. For example, the state may include in its report estimated shortages of qualified science and mathematics teachers, and judge that there are special needs for better elementary science curricula. Nonetheless, there may be districts in the state in which teacher shortages are not a problem and others that believe they have far more serious problems in elementary mathematics than in elementary science. States typically defer to local assessments of need; in fact, the data for the state needs assessments are usually based on locally collected data.

Notwithstanding that the overall approach to flow-through funds involved few outright restrictions (beyond those in the law), there are a variety of means by which SEAs influence the local use of program dollars. Most prominent are the following five ways that SEAs shape the districts' uses of funds:

- By encouraging small LEAs to use intermediate units. Several states with large numbers of districts strongly encouraged LEAs, and especially the smaller LEAs, to sign over their program funds to an intermediate service unit serving many districts. The state of Arkansas provides an excellent example; 90% of districts there sign forms allowing an Education Service Center to administer their portion of the program funds. Vermont, with a network of "supervisory unions" throughout the state, provides another good example. At the other extreme, some states--large, medium, and small ones--took few, if any, steps to encourage the use of intermediate units.

- By providing or not providing waivers. As suggested above, states took very different approaches as to whether they required a waiver for certain activities, and, if so, how often they provided them. The law required waivers for districts wishing to use large proportions of the program funds for equipment (such as computers). The total number of waivers in Year 4, for the nation, was somewhat over 1,600 (with just five states accounting for more than 1,200 of these). However, because so many of the waivers were for small districts, few program funds overall were used for equipment (see Part Two for details).

- By interpreting the law and regulations. When LEAs have a question about what is legal and what is not, they typically go to the SEA. In our experience, many SEAs are perceived as very helpful to LEAs having questions or problems. However, lack of clarity about federal regulations was an issue for many SEAs, with 25 indicating "greater regulatory clarity at the federal level" as a high priority for change. One important issue was whether it was legal to purchase equipment and materials as part of training; most states allowed this purchase, but some discouraged it.

- By directing D&E funds in certain ways. In many states, D&E funds have supported leadership activities (e.g., state conferences) that help districts make informed decisions about using Title II funds. A common example would be state conferences about the use of mathematics manipulatives or calculators; we encountered many teachers and other district personnel who were influenced by such experiences. In addition, as is shown in the next section, oftentimes D&E funds are used directly in conjunction with LEA funds, stretching each source of funds farther than it would go alone.

- By persuasion. Without necessarily expending program funds, states often use their persuasive powers to move LEAs in particular directions. In some states, the SEA attaches to the blank LEA application a lengthy list of features that make for a good local Title II program. In other states, the state science and mathematics supervisors typically see and talk to very large numbers of local Title II coordinators, and urge them to take certain approaches--e.g., emphasizing particular grade levels or subjects. Not all states have strong science and mathematics supervisors to take on such roles, but a great many states do have them, and they are well informed about state and national reform efforts. (However, states with very large numbers of districts--and without strong networks of intermediate units--find it more difficult to use a direct person-to-person or "jawboning" approach to leadership concerning flow-through funds.)

Some SEAs play a strong role in shaping what is done with flow-through funds. But SEAs are aware that if they were to set very precise, restrictive requirements for the use of funds, fewer districts (especially small ones) might participate in the Title II/Eisenhower program; and some states--

typically geographically large ones, with many small LEAs--already find that large numbers of LEAs choose not to accept funds. (Additional data about LEA participation and nonparticipation are presented in Chapter IV.)

The use of intermediate units to administer flow-through funds on behalf of an LEA was common in some states, but not most. **In more than three-fifths of the states, few LEAs (from 0 up to 10% of districts, at most) received flow-through funds through an intermediate unit. By contrast, in nine states more than half the districts in the state were served through intermediate units (see Table 7).**

Table 7

USE OF INTERMEDIATE UNITS TO SERVE LEAs (1988-89), BY STATE[a]

	Number of States
States serving fewer than 10% of LEAs through intermediate units	30
States serving from 10% to 50% of LEAs through intermediate units	10
States serving more than 50% of LEAs through intermediate units	9

[a]"Service" indicates that the LEA flow-through funds are assigned to an intermediate unit or consortium on behalf of the LEA.

SEA Support for the Demonstration and Exemplary Projects

The funds set aside for SEA-initiated Demonstration and Exemplary Projects are the most flexible of any component of the program. There is no requirement that the funds be competitive, nor that any particular entity (such as school districts) carry out the projects. In Year 4, a total of $14.8 million was allocated for D&E projects; in Year 5 (under the reauthorized program), that amount was reduced to $4.6 million.

Typical D&E projects were small, with less than $17,000 of program funds invested in each (see Table 8). As a result, the number of projects was very large--more than 700 in Year 4 alone. There were a very few SEAs that decided to mount large D&E projects (California, most notably, which did so in conjunction with SAHE "cooperative" funds), but most SEAs adopted a mixed strategy, spreading the funds across a wide variety of activity types: conferences, leadership training, regional demonstrations, small curriculum projects, targeted teacher training efforts (e.g., for biotechnology in the classroom), projects aimed at underrepresented groups, state telecommunications network projects, and so forth. The box on the following page provides examples.

Table 8

MEAN SIZE OF D&E PROJECTS (1988-89)

Mean Size of D&E Project	Number of States
Under $10,000	16
Between $10,000 and $20,000	9
Above $20,000	20

Nearly half of the D&E projects (45%) were carried out by school districts (see Table 9). The remainder were carried out by a diverse set of performers, including: institutions of higher education (15%); the SEAs themselves (13%), for example, for conferences; professional associations (such as the state affiliate of NCTM or NSTA); and other nonprofits (e.g., museums).

DEMONSTRATION AND EXEMPLARY (D&E) PROJECTS: SOME EXAMPLES

An LEA Acting as an "Intermediate Unit". A rural district in a very rural state received more D&E funding than flow-through funding during Years 1 through 4. The state provides the D&E funds so that the district, which has a very strong science and mathematics program, can serve five or six nearby districts whose programs are much weaker.

A State Conference. The legislature in this state is requiring that earth science be offered in grades 10-12, whereas it used to be a middle school course. This has placed stress on LEAs to find teachers, materials, and other resources. The SEA took this opportunity to provide districts with comprehensive information.

A Model Curriculum. This state is concerned that there are few units of study in elementary mathematics that adequately meet the standards set by the NCTM. It has commissioned a model unit to be developed for fifth-graders, focusing on fractions, to be used by 20 teachers who will then train an additional 1,000 teachers.

Dissemination of the EQUALS Program. The EQUALS program is designed to reduce the gap in mathematics achievement between majority and minority students and males and females. This D&E project is designed to disseminate EQUALS to 26 additional districts within the state.

Statewide Teleconferences on Advanced Technologies. Three teleconferences were supported in this rural state, focusing on computers, videodiscs, and other instructional technologies. The follow-up for teachers included curriculum development as well as opportunities to try using the technologies.

School of the Future. A large city school system developed a citywide, K-8 magnet program called School of the Future, which integrates technology into all subjects. There is a waiting list to enter the program, which other LEAs may wish to adopt.

Project Science Literacy. A high school serving large numbers of underrepresented (minority) students is providing a special program to give them "a realistic chance" to meet a two-year science requirement. The project combines new, high-interest secondary science courses with a staff development program.

Under the original and the reauthorized laws, D&E projects have four purposes. According to SEA survey data, the purpose of most D&E projects (65%) in Year 4 was teacher training or retraining. Another 18% were special projects for underserved populations; 11% were aimed at instructional equipment and materials (including curriculum development and necessary technical assistance); and the remaining 7% were for the purpose of disseminating information about exemplary programs.

These categories, established by law, overlap to a large extent, so the resulting estimates are very rough. For example, a great many curriculum projects simultaneously involve teacher training. Another example is that D&E projects operating in particular regions of a state (as many did) may be serving predominantly underserved populations but are not conceived solely in those terms. In other words, many projects could as easily be put into two or more categories as into one.

Table 9

LOCATION OF D&E PROJECTS, 1988-89

	Total Projects in U.S.	Percent
School district (LEA)	332	45
Two-year college	2	<1
Four-year college	18	2
University	86	12
Not-for-profit institution (e.g., museum, public TV station)	26	3
No single primary location (e.g., collaborative projects)	64	9
State agency	97	13
Other	118	16
Total	743	100

SEA respondents indicated that inservice teacher education was the highest-priority use of D&E funds (see Figure 6). Other priorities were as follows:

- Conferences and other dissemination activities were high priorities (and some of these doubled as teacher training experiences).
- Curriculum development was an important priority (and, again, some of these projects served as teacher training experiences).
- Teacher retraining (i.e., in a new discipline or at a new level) was a fairly frequent focus of D&E projects.

Missing from this list is preservice education of teachers. This was not a high-priority use of D&E funds. In fact, subsequent chapters will show that it was not a priority use of program funds for any of the components.

The D&E projects focused overwhelmingly on science (45%) and mathematics (40%) education. Foreign languages were the focus of 10% of the funds, and computer education was the focus of 5%. These are national averages; in some states, a very different distribution was apparent. For example, five states allocated 25% or more to foreign language education, including one small-population state in which the figure was above 40%. Additional details about disciplines and levels emphasized in D&E projects are provided in Tables 10 through 12.

As indicated, a mixed strategy of different types of activities was the most common way that states managed the D&E funds. But the emphasis varied considerably from state to state. The D&E funds were conceived to allow states wide latitude to select their own priorities, and there is little question that states took advantage of that fact. The following examples give an idea of the range of state strategies: New York used its D&E funds largely to disseminate "validated programs," including projects validated by the National Diffusion Network (NDN) and by the state; North Carolina consistently used a portion of D&E funds for a series of annual state conferences focusing on new legislative provisions in science education, the use of mathematics manipulatives, and the like; California supported projects costing hundreds of thousands of dollars apiece (in part by pooling D&E funds

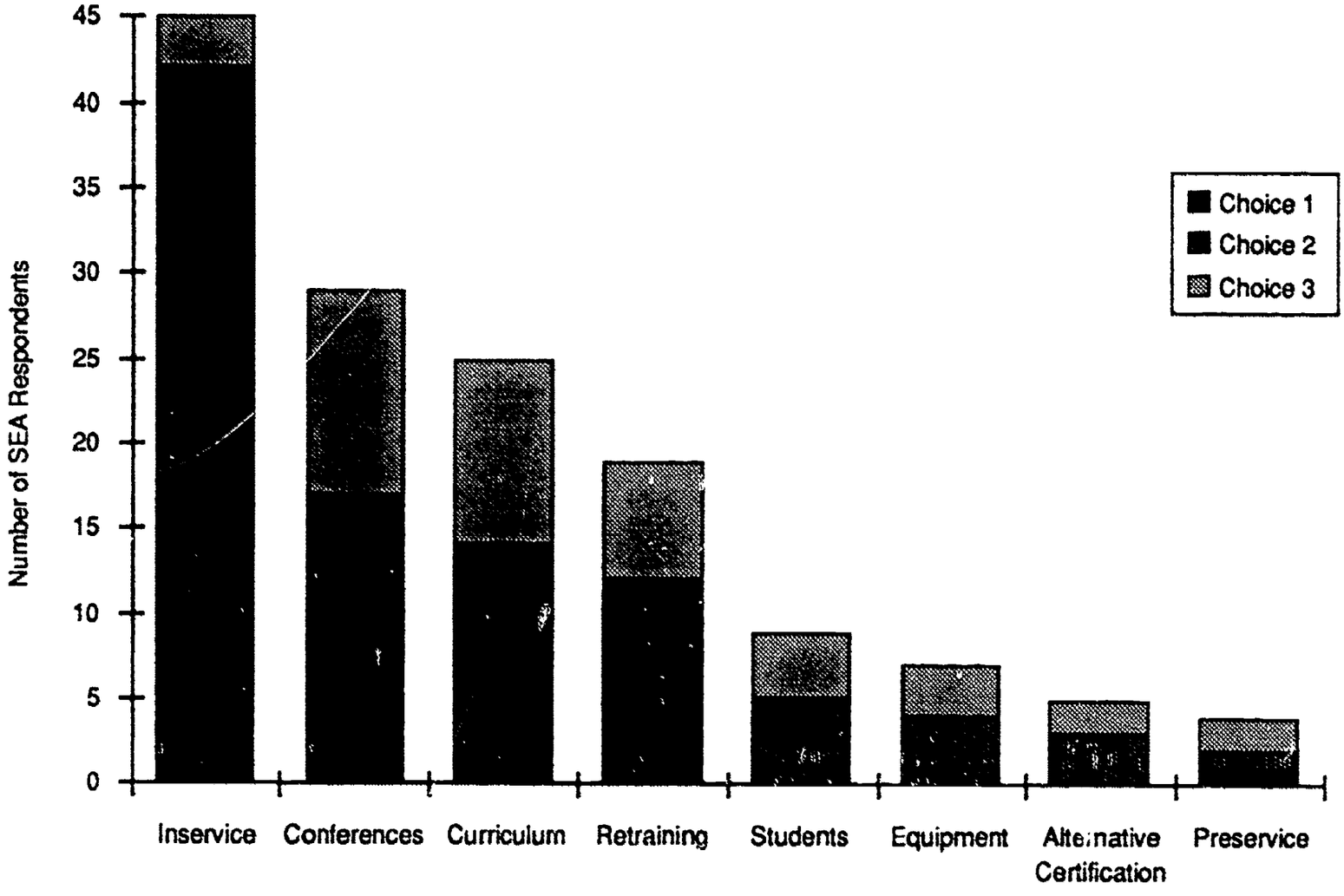


FIGURE 6 PRIORITIES FOR D&E PROJECTS, 1988-89

with SAHE "cooperative" funds), such as a preservice training program to ameliorate the shortage of qualified secondary school physical science teachers, and training a "leadership cadre" of teachers to implement the new state science and mathematics frameworks.

Technical Assistance and Evaluation by the SEAs

Under the original legislation, SEAs were permitted to use up to a total of 10% of the SEA grant (including flow-through funds) for a combination of technical assistance activities (5%) and administration (including needs assessment and evaluation activities). The reauthorization reduced this total to 5%. (In dollar terms, the median amount per SEA in Year 4 was about $105,000, and in Year 5 it was about $70,000.)

Table 10

SCIENCE DISCIPLINES EMPHASIZED IN D&E PROJECTS (1988-89)

Science Discipline	Number of States
Biology/life sciences	30
Physical sciences	34
Earth science/astronomy	30
"General" science	32
Other	9

Table 11

MATHEMATICS AREAS EMPHASIZED IN D&E PROJECTS (1988-89)

Area of Mathematics	Number of States
Arithmetic problem solving	45
Arithmetic computation skills	22
Geometry	23
Probability, statistics, data analysis	28
Algebra	15
Advanced mathematics	15
Other	16

Table 12

PRIORITY FIELDS FOR D&E PROJECTS (1988-89)[a]

Field of Education	Number of States
Elementary school science	25
Elementary school mathematics	27
Middle/junior high school science	27
Middle/junior high school mathematics	24
High school science	12
High school mathematics	12
Foreign languages (all grade levels)	6
Computer education (all grade levels)	5

[a]"Priority" indicates SEA respondent marked it as number 1, 2, or 3 choice.

Under Title II, some states targeted the technical assistance monies very narrowly and, by doing so, were able to put a lot into one or two activities. A notable example is New York, which invested about $1 million in its Elementary Science Mentors program. Of course, few states have had the same resources to draw on under the program as New York. More often, technical assistance involved small-scale activities, similar to the types of dissemination activities supported with D&E funds (e.g., conferences).

Eleven states complained that there was not enough money to cover administrative expenses, but many more claimed they had no fiscal problems in managing the program (see Table 13). In Year 4, 14 states that received the statutory minimum amount under the program had less than $20,000 to cover administration and evaluation--and it is easy to see that this might not stretch very far, particularly for states with few dollars but a large number of districts.

Table 13

SEA PROBLEMS WITH FISCAL MANAGEMENT OF THE PROGRAM

	Number of States
Not adequately reimbursed for administrative costs	11
Funding level set too late to permit adequate planning	7
Funds not received in a timely manner	3
Other fiscal problems	6
No particular fiscal problems	29

Final reports were required under the program, but the Title II statute required no evaluations of the various program components, except evaluation of the entire state program "to the extent feasible." (The Eisenhower Act similarly does not require evaluations, beyond reporting the numbers of teachers and students affected.) Many states gathered data from districts concerning their activities under the program (see Table 14), such as numbers of teachers served. But, not surprisingly, the study did not find very much in the way of formal evaluation activity by the SEAs. A few states (Michigan, for one) funded, at least once, a third-party evaluation of their Title II program. At the other end of the spectrum, about three-fourths of the states gathered informal feedback from districts, and--since almost every state has several pertinent annual conferences (e.g., meetings of mathematics and science supervisors in the state)--there are many opportunities for state personnel to gather informed opinions.

Thirty-six states require districts to evaluate the effectiveness of the activities supported by program funds, but there was little evidence of rigorous evaluation on the part of the districts. It was easier for SEAs to evaluate D&E projects (there were only about 15 per state in Year 4), and final reports to the U.S. Department of Education sometimes included detailed assessments of these projects (such as compilations of survey responses from teachers who attended conferences).

Table 14

SEA APPROACHES TO STATE EVALUATION UNDER TITLE II

	Number of States Using Each Evaluation Approach
Collected statistics describing local activities supported by Title II	41
Conducted site visits to LEAs	40
Gathered informal feedback	37
Required districts to evaluate the effectiveness of their Title II activities	36
Conducted formal evaluations of D&E projects	18
Gathered no information	1

Rigorous evaluation of this program would be extremely difficult if by that were meant an evaluation that can demonstrate increased student test scores due solely to the program (and not to changing graduation requirements, better curricula, or a host of other factors). Given the small dollar size of the program, it is understandable that SEAs typically invest very modest resources in evaluation. Evidence about program impacts gathered as part of the National Study is presented in the next section.

Impacts of the Elementary/Secondary Components at the State Level

Program impacts are discussed in three parts. First, we discuss effects on the SEA's capacity for leadership and technical assistance, next influences on various institutional networks and relationships at the state level, and finally the impacts of the D&E projects at the local level.

Impacts on SEA Leadership and Capacity

Survey data show that in 1988-89, program dollars allocated to the SEA accounted for about half of the average SEA's budget for improving mathematics, science, and computer education (see Table 15). That is a large percentage--and in many states, of course, the fraction was even higher. A number of states reported simply that "there is no discretionary money," or "no staff development money" at the state level without the Eisenhower program.

Table 15

SOURCES OF SEA DISCRETIONARY BUDGETS FOR IMPROVEMENT OF SCIENCE, MATHEMATICS, OR COMPUTER EDUCATION (1988-89)

Source	Mean Percent[a]
Title II program funds set aside for SEA	48
In-kind contributions (e.g., staff salaries)	18
Other state funds	22
ECIA Chapter 2 (state set-aside only)	6
Corporate or foundation gifts	2
National Science Foundation funds	1
Other	3
Total	100

[a] Mean percent per SEA, based on responses from 44 states. The median budget from Title II funds was 50%, almost identical to the mean of 48%.

Since state leadership is important to improving science and mathematics education, these data are extremely interesting. They tend to confirm earlier reports that states have pursued primarily inexpensive reforms (Firestone, Fuhrman, & Kirst, 1989), and suggest that states typically have few resources available with which to educate, persuade, or build networks of science and mathematics teachers. In the absence of such resources, the policy levers available to SEAs are likely to be legislation, regulation, tests, and other pieces of paper (e.g., new curriculum frameworks). These are potentially powerful, of course--but far less so, one would think, without an outreach and education component, whether for a leadership cadre within the state or for the grass-roots teacher.

Thus, it is very interesting to find that the states are commonly using Eisenhower program D&E dollars to reinforce and support their state reform agendas. Examples abound:

- State Math Manipulatives Kit. One state had developed a mathematics manipulatives kit before the Title II program was created, but had trained few teachers to use it. When Title II funds became available, thousands of teachers received training to use the kits.

- Implementing New "Frameworks." Distinctly new mathematics and science frameworks were published in another state, and D&E funds have been used to educate a leadership group of teachers about what these mean and how best to use them.

- NCTM Standards. The associations of mathematics teachers in several states have developed sets of recommendations to supplement the NCTM Standards, and Title II funds have been used to disseminate and implement these recommendations statewide.

- A Guide to Curriculum Development. To assist districts in revising science and mathematics curricula to meet the specifications of new standards in one state, a guide was developed by the SEA, college and university staff, and local educators. Copies were distributed to every school in the state.

This kind of evidence supports the proposition that D&E funds have been an important resource for state leadership and technical assistance activities. Comments by the SEA program coordinators (see box on the next page) and responses to the survey (see Table 16) also reinforce this view. There is little question that Title II/Eisenhower funds have also raised the

WHAT SOME STATE AGENCY RESPONDENTS ESPECIALLY LIKED ABOUT THE D&E FUNDS*

[The state D&E funds] help immeasurably with state leadership.... They really are the only discretionary money that is available for math or science, and therefore are invaluable.

Our SEA was able to use D&E monies ... for statewide conferences. These conferences were especially useful to smaller districts lacking the sources to fund such opportunities themselves.

Without Title II funds, [Demonstration and Exemplary Projects] of this magnitude would not have been possible....

D&E funds were instrumental in focusing on critical thinking skills, problem-solving, etc., in high-risk areas such as rural districts and districts with high percentages of disadvantaged youth.

The statute's flexibility in this area is advantageous. However, the recent reduction in the proportion of funding allowed for this purpose [under Eisenhower] makes it increasingly difficult to meet the state's needs.

Foreign language projects have had the most impact.

The projects have generated over 10 times the dollars [from other sources], because several projects were expanded [using NSF and other sources of funds].

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*Note: Most of these comments come from the mail surveys.

visibility of science and mathematics compared with other subjects, both within SEAs and within the larger education community they serve (LEAs).

An interesting question is why states are not investing more of their own resources in science and mathematics education improvement (for example, in those SEAs reporting "no discretionary monies" other than from the Eisenhower program). Answering the question goes far beyond the scope of this study, but it is possible that: (1) in recent years, most states have not felt it necessary to change science and mathematics education, so there is little recent history of institutionalized reform efforts (or budgets); (2) large numbers of states have experienced budget problems and feel pressures to keep discretionary activities (such as these) at low levels; and (3) the average state now contributes more to support K-12 education than do local districts, and therefore may believe that discretionary state resources are not necessary. Another observation, offered by Susan Fuhrman, director of the Center for Policy Research in Education at Rutgers University, is that state education agencies have largely been overlooked as major players in school reform and are regarded by most state legislators as bureaucratic obstacles to school improvement, rather than as potential leaders of it (Schmidt, 1990). Whatever the reason, future state reform efforts seem likely to encounter significant barriers if there is not some implementation money available to help teachers, principals, parents, and others in the community understand the reforms and put them in place.

Table 16

IMPACT OF TITLE II ON SEA LEADERSHIP AND TECHNICAL ASSISTANCE CAPACITY IN MATHEMATICS AND SCIENCE EDUCATION

	Number of SEA Respondents Indicating:		
	Has Decreased	No Change	Has Increased
State leadership in math/science education	1	2	42
State capacity for technical assistance in math/science education	0	3	44

Impacts on Institutional Networks and Relationships

Evidence suggests that the program has had a very significant effect in many states--probably most states--on the strength of professional associations in science and mathematics education. This effect is due both to specific D&E projects and to the flow-through funds that are used by many districts to send teachers to conferences. There are many examples, including:

- In a rural state, a number of the D&E projects were grants to state affiliates of NCTM or NSTA, or to other professional associations. One was to develop a five-year action plan; others were specifically for professional association meetings that have been "entirely rejuvenated" since Title II was initiated.
- In another state, there has been a very large growth in attendance at state conferences for math and science teachers, which many knowledgeable people attribute to Title II. Teachers may have to share hotel rooms, but they show up at state association meetings by the thousands--many more than before Title II was created.

Typically, it would be LEA flow-through monies that send teachers to the national meetings rather than state D&E funds, but the various components of Title II/Eisenhower have each worked to strengthen professional associations for teachers. The program is obviously not responsible for all of the growth in professional association memberships at the state or national level (see Figure 7), but it does seem at least partly responsible for their dramatic upturn.

Another state-level impact is that in states that have a network of intermediate units serving districts, the program seems to strengthen significantly the capacity of these units to provide training and technical assistance in science and mathematics. In some states, it is the D&E funds that are responsible for this effect. For example, in North Carolina, which has a network of eight regional education centers, a large proportion of the state D&E funds has been channeled to the regional centers, and the effect has been to strengthen greatly their capacity for teacher training and technical assistance. Many of the demonstration projects supported by D&E funds and initiated through the regional centers, at least in this state, are subsequently continued with flow-through (LEA) funds, because demand for

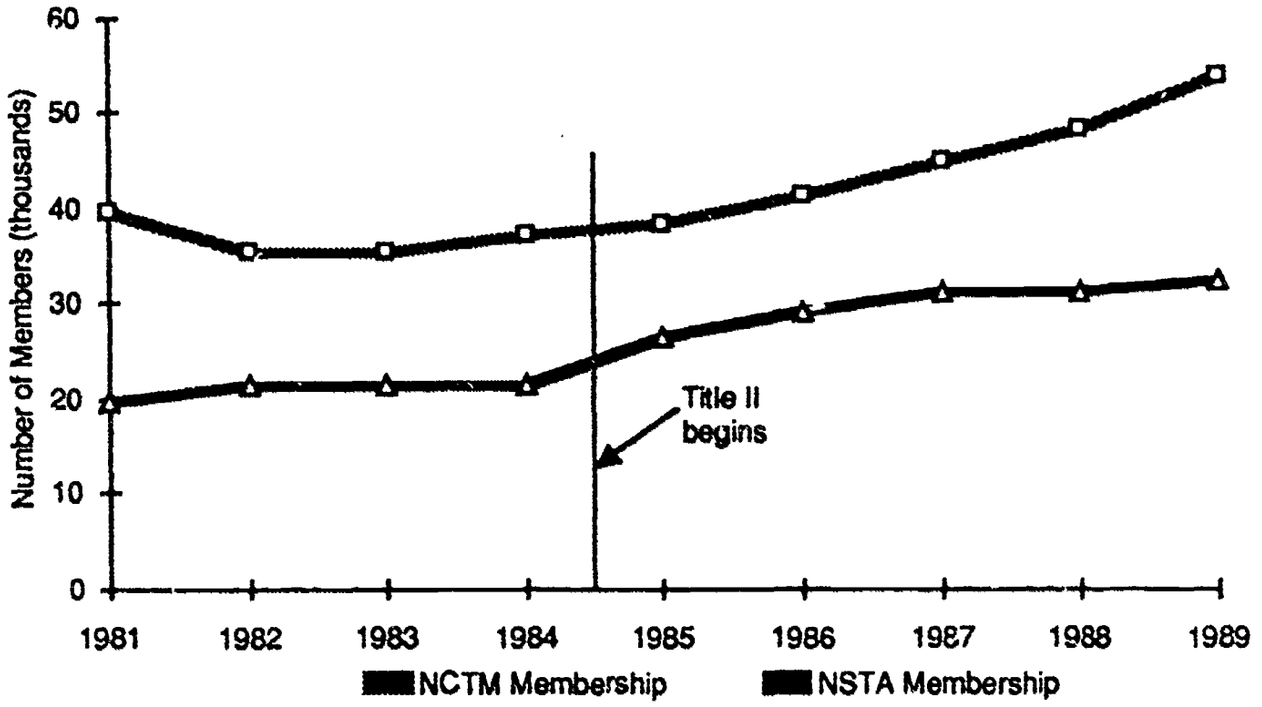

FIGURE 7 PROFESSIONAL ASSOCIATION MEMBERSHIPS (INDIVIDUAL MEMBERS)

training offered by the regional centers is typically greater than can be supported by D&E funds alone. In other states, the increase in capacity of the intermediate units is more a result of flow-through funds (which are pooled in the intermediate units). For example, in New York state about one-third of the Boards of Cooperative Educational Services (BOCES) now have science and mathematics expertise available in-house, whereas before 1985 almost none did. A similar situation applies in some other states with intermediate units. Naturally, in the many states that do not have intermediate units--or that do not use them extensively for this program--this type of effect is absent.

Finally, the program helped to foster a number of other networks and linkages (see Table 17). We have already discussed the collaboration between the SEAs and the SAHEs (which typically does not extend beyond collaborating on the program itself). In addition, many states used D&E funds to support "planning groups," "leadership networks," or other forums consisting of large numbers of local or regional representatives. These groups were concerned with such issues as state curriculum frameworks, new state requirements in

Table 17

IMPACT OF TITLE II ON COLLABORATION
BETWEEN SEAs AND OTHER GROUPS

Other Groups	Number of SEAs Indicating Stronger Ties or Increased Interaction as a Result of Title II
State-level groups	
The corresponding SAHE	39
Professional associations of math/science educators	35
Scientists, mathematicians	37
Governor's office	10
State legislature	4
Private-sector firms	23
Local educational institutions	
Public-school districts	40
Private schools	31
Colleges/universities	39
Nonprofit educational institutions (e.g., museums)	25

science and mathematics education, and establishing state goals (e.g., for serving underrepresented groups in science and mathematics education).

One of the functions of D&E projects in quite a few states was to serve rural districts. State-level staff, including science and mathematics supervisors, were often concerned that small, rural districts received such small allocations under the program; many districts in the nation are entitled to less than $100 annually. To serve such districts, D&E grants were sometimes made to one school district that could serve, in effect, as a regional center for outreach. In other situations, intermediate units, institutions of higher education, or some other entity served the same

purpose. At least a half dozen states commented on the mail survey that D&E funds were of special assistance to rural districts (even though the survey did not specifically ask about this).

Impacts of SEA Projects at the Local Level

The survey sent to school districts included two items that requested information about local interaction with state D&E projects. The intent was to document the frequency and the nature of interaction of LEAs with state projects, but this method proved inadequate. More than one-third of LEA respondents indicated awareness of specific D&E projects in their state, and fully 13% suggested that their district had benefited from such projects. However, although these results indicate that the D&E projects have made their mark in many districts, interviews in a great many sites indicate that these responses significantly underestimate the local impact of D&E projects. Individuals at the local level who were aware of D&E projects by name (e.g., "the state conference on math manipulatives")--who might even have participated in them--very often had no knowledge of the funding source(s) involved, and could not identify these activities as "D&E projects" funded by "Title II" or "Eisenhower." Thus, the survey responses should be interpreted only as lower bounds. Short of asking in the survey about hundreds of individual D&E projects (whose names were not available), there was virtually no way to use a district survey to find out about the impacts of the D&E projects.

Instead, evidence about local impacts must come from other sources: (1) perceptions of the state coordinators; (2) evidence provided by project directors; and (3) interviews with teachers, district supervisors, and other beneficiaries and potential beneficiaries of D&E projects. There is evidence from each of these sources. Many teachers, district supervisors, and others who had participated in D&E projects had positive things to say about their experiences. State coordinators provided what seemed to be realistic assessments of these projects; for example, one state coordinator who was enthusiastic about the D&E money was also candid in describing how the state's first strategy for using these funds failed and was replaced by another strategy that worked well. The responses of higher education project directors (whose

projects were supported by a combination of SEA and SAHE funds in a number of states) are described in Chapter III. Unfortunately, evidence is missing about the effects of (those relatively few) D&E projects aimed directly at students. The study did not include student interviews, and the teachers who were interviewed had no specific knowledge of such projects. (Only 14 SEA respondents indicated that their state's D&E projects directly served students.)

The evidence collected about the impact of D&E projects is more limited than evidence about most other program components--relying on fewer teacher interviews, for example. Nonetheless, information was collected about a wide range of D&E projects, from those that were poorly conceived or poorly implemented to notable successes. **The rationale for a strong state role in improving science and mathematics education seems clear, and the evidence suggests that D&E projects have served to support this function well** by providing training, networking, regional support, and other means to implement state and national reforms.

III THE HIGHER EDUCATION COMPONENT AT THE STATE LEVEL

In this section we describe the SAHE's role in administering the higher education grants (the so-called "competitive" and "cooperative" projects), as well as technical assistance, evaluation, and planning activities of the SAHE. Because Part Three describes the higher education grants themselves at length (and their impacts), this chapter is limited to a description of how the SAHE administers the "competitive" and "cooperative" grants, and the impacts of the higher education component of the program on the SAHE itself (as well as other state-level impacts of the higher education projects).

Program Administration in the SAHE

Who Administers the Funds?

In most states an agency other than the SEA administers the higher education component. The name varies--in California it is the Post-secondary Education Commission; in Iowa it is the Board of Regents--but typically it is the agency that administers student assistance programs and handles some or all postsecondary education planning in the state.

In at least seven states (e.g., Wyoming, New York, and Vermont) the same agency takes responsibility for both the elementary/secondary and the higher education components of the program. (The surveys did not specifically request this information.) This overlap may occur for a variety of reasons, notably (especially in small states) a perception that the SEA has more expertise to administer a grants program aimed at improving elementary/secondary education, as well as a desire to closely coordinate the two parts of the program.

An interesting arrangement in at least three states is giving a major university a key role in administering the higher education grants program.

In Georgia, the University of Georgia (Athens) is designated by the state as the SAHE for purposes of administering the federal funds. In North Carolina, the Mathematics and Science Education Network--a network of 10 higher education centers managed by the University of North Carolina's central office in Chapel Hill--administers the program for the state. In Vermont, the University of Vermont manages a higher education cooperative that receives most of the higher education funds (however, the Vermont SEA--not the university--acts as the SAHE). A key reason for using a university as the "home base" is to ensure that the program is managed by individuals with substantial expertise concerning the improvement of science and mathematics education.

In each case where an institution of higher education has administered all or a major portion of the higher education program, special care was taken to avoid conflict of interest between the university as administrator and the university as applicant for grants (e.g., through use of a peer review panel to rank applications). As a result, there appear to have been no complaints about this approach, which seems to have worked well.

It is even more unusual for SAHEs than for SEAs to designate an individual to work full time on the program (see Table 18). The median in Year 4 was zero full-time and two part-time staff working on the program. Their responsibilities included applying to the federal government for funds, writing the grants announcement(s) (RFPs), managing the review and awards processes, monitoring the grants, evaluation, and reporting. In cases where "cooperative" projects were awarded using a different process (because it was possible to make these awards noncompetitively during the first four years), this process involved additional responsibilities. The mean allocation of Title II funds to each SAHE in Year 4 was $622,000.

The individuals in the SAHEs designated as the program coordinators were often involved in other types of grants administration activities (in 29 SAHEs). But most of these seemed not to involve K-12 education, since in the majority of SAHEs (27) there are simply no other grant programs aimed at elementary/secondary education improvement. Besides grants administration,

Table 18

PROGRAM ADMINISTRATION IN THE SAHE

Staff Characteristics	Number of Respondents[a]
Number of states having an administrator with full-time responsibility for Title II	6
SAHE coordinators who have been with the program for all five years	24
SAHE Title II coordinators currently having the following responsibilities:	
Managing other programs	32
Grants administration	30
Program review	29
Teacher education	14
Title II elementary/secondary component	7
Other	28
No other responsibilities	1
Prior grants administration experience of coordinators:	
A federally funded grants program	28
A state-funded grants program	21
Other types of grants programs	15
No prior grants administration experience	12
States in which the following groups are actively involved in making decisions about program funds:	
University faculty or other inservice providers	29
Other SAHE administrators	29
IHEs or their associations	17
Professional associations	11
Teacher certification boards	4
Other (e.g., the SEA)	24

[a]Unless noted otherwise, all SAHE data in this report are based on responses from 48 SAHEs.

the program coordinators are involved in such a wide variety of other activities that it is difficult to paint a picture of a "typical" Eisenhower (or Title II) coordinator in an SAHE. It is interesting, however, that only 14 respondents to the SAHE survey indicated that they have any responsibility for teacher education. (As will be discussed in Part Three, few higher education grants are focused on preservice teacher education.) Also, unlike in the SEAs, very few program coordinators have responsibility for K-12 curriculum or curriculum development.

Advisory boards are frequently used to supplement in-house expertise. There are no survey data to establish the frequency, but within the intensive study states this was so common (California, Arkansas, Iowa, Vermont, and Wyoming) that the same can be assumed to be true nationally. The advisory groups have varied responsibilities, from helping to draft the grant announcements to reviewing proposals. In addition, states that do not have formal advisory groups nonetheless may have sophisticated peer review processes in place (e.g., with attention to regional distribution of reviewers, or use of a two-stage proposal review, preliminary and final). Aside from the SAHE staff, those most often involved in making decisions about program funds are higher education faculty; at times, SEA personnel, K-12 teachers, and a variety of others are also involved.

Determining Needs

In a few states (Iowa, for one), the SAHEs conduct sophisticated needs assessments on their own, independent of the SEAs. However, this appears to be the exception rather than the rule. (Typically, the SEAs have far more expertise and information about K-12 education improvement needs.) As suggested earlier, the joint submission of needs assessments (to the federal government) helps both agencies to share a common view of needs, and may be particularly useful to the SAHEs.

Nonetheless, the SAHEs played an active role in the needs assessment process (see Table 19). For example, more than three dozen SAHEs were involved in surveying institutions of higher education in their state for

Table 19

SAHE NEEDS ASSESSMENTS UNDER TITLE II AND EISENHOWER[a]

	Number of Respondents
Role of the SAHE in collecting needs assessment data	
Surveyed IHEs	37
Helped to analyze/synthesize survey responses	31
Assisted the SEA to develop an LEA survey	10
Other (e.g., managed a special contract)	6
Usefulness of needs assessment data	
Helped formulate state policies for the use of program funds	37
Helped specifically with guidelines for RFPs	37
Of little or no use	6

[a]Questions asked about the needs assessments in 1985-86 (Title II) and 1988-89 (Eisenhower) considered together.

either the 1985-86 or 1988-89 needs assessments. As in the case of the SEAs, almost all the SAHEs found the needs assessment process to be useful. In more than three dozen states, the needs assessments helped the SAHEs to write announcements for the grant competitions. For example, the needs assessment may have allowed the SAHE to describe a variety of illustrative problems in science and mathematics education as part of its grants announcement. However, because many of these competitions had few restrictions, it is not at all clear that the needs assessments substantially shaped SAHEs' uses of funds.

SAHE Strategies for Using Program Funds

This section follows the organization of the program under the original legislation, examining separately the "competitive" and the "cooperative" higher education projects, followed by a description of technical assistance and evaluation activities of the SAHE. The discussion begins with an overview.

There are many similarities between "competitive" and "cooperative" projects (see Table 20). In quite a few states there was little or no distinction between the two types of grants. For example, 31 SAHEs reported that "cooperative" grants were made through a competitive process, just as the "competitive" grants were (even though the law permitted noncompetitive funding by the SAHE for "cooperative" projects). In most respects, the profiles of "cooperative" and "competitive" projects gleaned from the surveys show that they are quite similar: projects of approximately the same size (about $30,000), duration (12 months, median), and nature (primarily inservice training).

Table 20

A COMPARISON OF "COMPETITIVE" AND "COOPERATIVE" PROJECTS[a]

	"Competitive"	"Cooperative"
Total number of projects funded in Year 4 (48 SAHEs)	678	190
Average (mean) number of projects per state funded in Year 4	14.4	4.2
Total applications received	917	354
Ratio of applications to awards	1.4 to 1	1.9 to 1
Average (mean) Year 4 grant award	$32,722	$28,118

[a]Based on 48 responses to the SAHE survey, except that the last item is based on data from the IHE survey.

On the other hand, the law established certain differences between the two types of projects. Only "cooperative" projects could be awarded directly to nonprofit institutions other than IHEs. Only "cooperative" projects could serve students directly (but competitive projects could provide services to students if those services were incidental to training or retraining teachers). Only "cooperative" projects could be directly funded by the SAHE without an open competition (and some SAHEs welcomed the flexibility to award funds without competition). Also, whereas cooperative projects were intended to involve a variety of agencies and institutions in the improvement of teaching and learning, competitive projects were essentially limited to IHEs and IHE-LEA partnerships.

Most SAHEs assumed a leadership role in one respect or another concerning the way that the higher education funds could be spent. For example, some states precluded requests for indirect costs (overhead) on the project costs, which contributed to the result (discussed in Part Three) that few of the higher education grant funds, on average, were used for this purpose. Some SAHEs specifically precluded support for preservice education projects, based on the premise that the limited funds available would not adequately cover all needs for inservice (let alone preservice) training; the Title II program office in the U.S. Department of Education endorsed such an approach. In some states, the SAHE targeted the funds to particular grade levels or to particular groups, most notably to those groups underrepresented in mathematics and science (especially minorities and women). The states of Minnesota, North Carolina, Ohio, and Texas, for example, focused their "cooperative" funds on underrepresented groups.

As shown in Figure 8, one strategy that the SAHEs used to accommodate fluctuations in the size of the federal appropriation was to increase or decrease the average grant size accordingly. That is, larger grants were provided in years with larger appropriations, and smaller grants in years with smaller appropriations. However, the increase in the appropriation in Year 4 of the program (1988-89) was not accompanied by a proportionate increase in grant size. Because the average grant size (about $31,000) remains small by the standards of many grant programs, the SAHEs should in

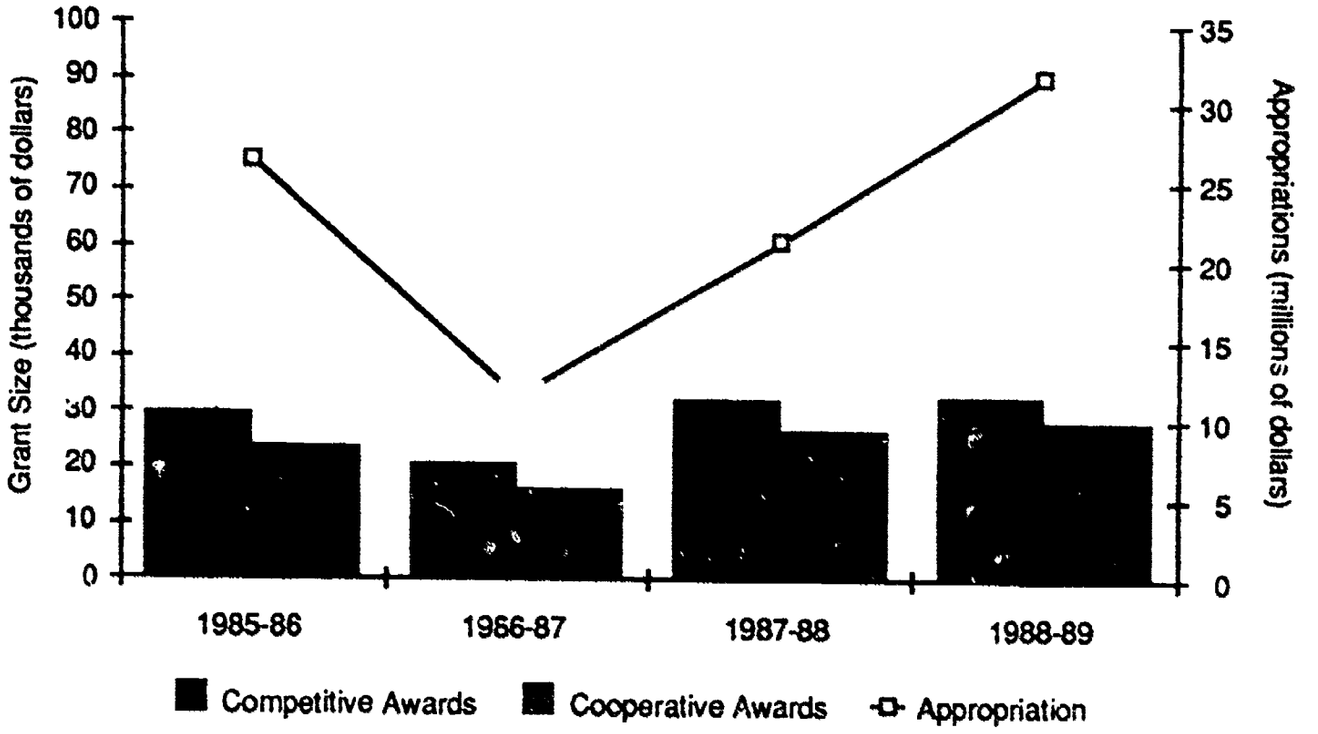

FIGURE 8 CHANGES IN AWARD SIZE OVER TIME

the future consider whether to increase the average size of the grants. This would enable more individual projects to provide higher levels of service, pay stipends to teachers, or cover the IHE's indirect costs.

SAHE Strategies for "Competitive" Grants

In many states, the grants announcement (RFP) for the "competitive" grants was wide open. Applicants could propose projects focusing on subjects and education levels (from K-12) substantially of their own choosing (within the limits of the authorizing legislation). Furthermore, an implicit philosophy was to "spread the wealth" by encouraging small to medium-sized projects. For example, one state simply stated in the RFP that "grant awards will not exceed $20,000"; others put a high priority on geographic and institutional "coverage" of the state.

Funding of projects for more than one year at a time was very unusual. However, in most (if not all) states, applicants were permitted to reapply in subsequent years. On this basis, **de facto**, many projects were multiyear ones (see Part Three). California was exceptional in aiming from the outset for large projects, funded for several years at a time.

Variations from these overall strategies were common. For example, in some states foreign-language awards were simply precluded by the way that the RFP was framed. On the other hand, in a few states one-third of the funds, or more, were used for foreign-language grants. Some states restricted the grants to particular subjects or levels (for example, one state initially restricted grants to grade levels four through six, and later enlarged this to include grades seven through nine). Another state initially issued RFPs discouraging applicants from running summer projects (because it was believed that the state already had enough of those from other sources); however, this philosophy changed in light of the finding that teachers preferred summer inservice projects.

To generalize, the program permits states to set priorities--and some did so. However, because a more "open" philosophy for awarding all or most of the funds was very common, avenues exist for states to exercise greater leadership by designing RFPs in ways that promote specific and desired goals.

The "competitive" program did not involve nearly such fierce competition as typical discretionary grants programs at the federal level. Based on responses from more than 40 SAHEs, it appears that there were fewer than two applications for every grant awarded (see Table 20). As a result, the SAHE could be selective, but only within certain limits. In a few cases where the SAHE encouraged or required very specific types of projects (such as approaches to integrating elementary mathematics and science), there was disappointment that few applications were submitted matching the specifications. Looking at the same situation from the other side, the favorable grants-to-applicants ratio contributed to applicants' beliefs that it was far simpler, quicker, and more promising to apply for Title II/Eisenhower program

money than to apply directly for federal funds (see Part Three for additional details).

According to the SAHEs, nearly 15 different IHEs per state, on average, received awards under the "competitive" program during the first four years. **In all, then, more than 650 different institutions received "competitive" Title II funds, or about 20% of the roughly 3,000 degree-granting higher education institutions in the nation.** A profile of institutions receiving Title II grants is provided in Part Three.

Most states focused the funds for "competitive" grants on inservice teacher training (see Table 21). Teacher retraining was also a high priority in many states, whereas a focus on preservice education of teachers, or alternative certification, was a major focus in only a few states.

Nationally, the "competitive" projects focused overwhelmingly on science (49%) and mathematics (35%) education in Year 4. About 14% of the "competitive" funds were used for foreign languages and 5% went for computer education. (These figures add to 103% because some respondents did not divide the whole into entirely distinct pieces.) In at least 26 states, no funds were spent on foreign languages (however, three states spent fully half, or more, of their 1988-89 funds for foreign languages). For computer education, at least 32 states spent no funds in 1988-89--but several states spent 25% or more on computer education. As was the case for the SEAs, the SAHEs took advantage of their ability to establish the subject areas of projects funded.

SAHE Strategies for "Cooperative" Grants

As noted above, "cooperative" grants frequently resembled "competitive" grants, with the two pots of money often pooled into a single grants competition. The IHE survey uncovered few dramatic differences between the two types of projects. However, "cooperative" projects were three times as likely to focus on foreign languages (24% versus 8% of "competitive" projects), and almost four times as likely to provide services to students

Table 21

MAIN TYPES OF "COMPETITIVE" GRANTS SUPPORTED (1988-89)

Types of Activities "Mainly Supported"	Number of SAHEs
Inservice teacher training	48
Retraining of teachers certified in other disciplines	23
Preservice teacher training	9
Alternative certification	7

(36% versus 10%). Also, as one would expect from the very term "cooperative," fewer than 10% of the institutions administering these projects indicated they had no other partners, compared with about 30% of the competitive projects.

In some states visited by the study team, "cooperative" projects were used especially to focus on the needs of groups underrepresented in science and mathematics education. Sometimes this was done through a separate and distinct RFP; in other cases, a single RFP was used with a portion of funds clearly set aside for projects focusing especially on underrepresented groups. Still other states took advantage of the fact that "cooperative" projects could be funded directly, without a competitive process, and made awards in this way to serve underrepresented groups.

Only under the "cooperative" component were awards permitted to be made directly to museums or other nonprofit entities (besides institutions of higher education). This option, however, was not widely used by SAHEs. Only 100 of the more than 1,500 projects funded in Years 3 and 4 went to institutions that were not IHEs. Currently, under the Eisenhower program, museums and other nonprofits are precluded from applying directly to the SAHE for funding (but they may join with an IHE that can act as the leader of a consortium of institutions). Although no state respondents made comments about this change in the law, it is unclear what advantage there is in excluding

certain nonprofits from competition, and some museum personnel did express this concern.

Nationally, the "cooperative" projects focused overwhelmingly on science (43%) and mathematics (33%) education in Year 4. About 24% of the "cooperative" funds were used for foreign languages, and 4% went for computer education. (These figures add to 104% because some respondents did not divide the whole into entirely distinct pieces.) In at least 28 states, no funds were spent on foreign languages; however, 3 states spent 100% of their 1988-89 "cooperative" funds for foreign languages. For computer education, at least 39 states spent no funds in 1988-89--but 3 states spent 30% or more of the "cooperative" funds for this purpose (and 1 used 100% for computer education). Once again, many states took advantage of their ability to establish the subject areas of projects funded under the program.

The main types of activities supported under "cooperative" projects are described in Table 22, as well as which institutions have principally conducted the activities. Inservice teacher education was the type of activity supported by the most states. Conferences and other dissemination activities were also a a major focus in many states. The projects typically involved IHEs, as one would expect; but in many states, school districts, museums and other nonprofits, and professional societies or associations were also involved. (There was no requirement that "cooperative" projects involve school districts.)

SAHE Technical Assistance and Evaluation Activities

In Year 4, each SAHE had an average of about $31,000 to administer the program, including the provision of technical assistance. A larger number of SAHEs than SEAs indicated that the administrative allowance did not cover their costs (Table 23). Nonetheless, SAHEs were actively involved in various facets of program administration.

The most common means by which SAHEs evaluated the program was by requiring grantees to evaluate themselves (see Table 24). This is the same

Table 22

NATURE OF "COOPERATIVE" GRANTS SUPPORTED (1988-89)

	Number of SAHEs
Types of activities "mainly supported"	
Inservice teacher training	42
Retraining of teachers certified in other disciplines	17
Preservice teacher training	10
Alternative certification	3
Curriculum development	24
Direct services to elementary/secondary students	17
Conferences and other dissemination activities	19
Types of organizations involved	
Local school districts	41
Institutions of higher education	46
Private business and industry	27
Museums and other private nonprofits	28
Professional societies or associations	24

Table 23

SAHE PROBLEMS WITH FISCAL MANAGEMENT OF THE PROGRAM

	Number of States
Not adequately reimbursed for administrative costs	17
Funding level set too late to permit adequate planning	8
Funds not received in a timely manner	4
Other fiscal problems	2
No particular fiscal problems	25

Table 24

SAHE APPROACHES TO STATE EVALUATION UNDER TITLE II

	Number of States
Required projects to evaluate themselves	44
Gathered informal feedback	31
Conducted formal evaluations of all projects	11
Conducted formal evaluations of some projects	10
Gathered no information	0

strategy that the National Science Foundation (NSF) has used with its grantees for many years. Gathering informal feedback about projects was another common strategy. In general, evaluations of the individual projects or the SAHE awards as a whole cannot be described as rigorous or extensive. On the other hand, given that these are typically small, short-duration projects, which together focus on an enormously diverse array of subjects and grade levels, and which are managed by a very small staff in most SAHEs, it would be unrealistic to expect a sophisticated evaluation strategy to be in place in most states; however, a few SAHEs did conduct third-party evaluations of the program.

At the same time, a significant and successful effort to document basic information about the higher education component of the Title II program was carried out by an evaluation subcommittee of the Eisenhower (then Title II) National Steering Committee (Jones, Franklin, & Rudin, 1988). The National Steering Committee was (and is) a group of state program coordinators initially organized by the director of the federal Title II program. Its purpose is to improve administration of the program (e.g., by sharing information, both among the states and between the federal government and the states).

The report, published in November 1988, includes extensive information about the nature of the grants made during the first two years of the

program. Numerous features of the higher education portion of the Title II program that were documented in the report (for Years 1 and 2) are confirmed by the data collected for the current study (for Years 3 and 4): the number of grants (about 1,500 per two-year period), their small size (about $20,000 to $30,000), the preponderant focus on inservice teacher training activities, the high proportion of project directors affiliated with schools of liberal arts and sciences (rather than with education, per se), and the fact that only a small minority of grants focused on foreign languages or computer education. However, the extent of information collected for the current study, with its survey of IHEs as well as fieldwork, is much greater.

Virtually every SAHE provided technical assistance in the form of information (and advice) about how to apply for a grant and how to interpret various regulations and requirements of the law and the grants announcement, and most SAHEs disseminated information about projects supported in earlier years (often through lists of project abstracts) (see Table 25). Respondents in 15 SAHEs indicated that staff actually helped with implementing one or more projects, and in 20 SAHEs project directors were given assistance with project evaluations. For example, in some states uniform data collection instruments were prepared by the SAHE and distributed to project directors.

Table 25

TECHNICAL ASSISTANCE PROVIDED BY SAHEs

Forms of Assistance	Number of States
Information about how to apply for a grant	45
Advice to applicants	44
Information about previous awards	37
Information about regulations and requirements	46
Help to implement some projects	15
Assistance with project evaluations	20

In general, most SAHEs provided less in the way of technical assistance than most SEAs. Considering that the mission of the SEAs--quite apart from the Eisenhower program--almost always includes technical assistance to LEAs relating to science and mathematics education (whereas SAHEs typically do not have a corresponding mission for IHEs), this finding is unsurprising. There were occasional exceptions, such as the New England state that made a higher education grant specifically for providing technical assistance. (In that case, however, it was assistance to LEAs, not IHEs, that was provided through the grant.)

Impacts of the Higher Education Component at the State Level

Most of the impacts of the higher education grants are discussed in Chapter III. In this section, we examine only state-level impacts.

Impacts on SAHE Leadership and Capacity

Before this program was created, very few of the SAHEs were directly involved with efforts to improve K-12 education. The change from nothing to a well-established grants program that has made thousands of awards to hundreds of separate IHEs has certainly meant that **the SAHEs have become far more important as leaders--or at least as supporters of leaders--in K-12 education improvement. The distinction is important, since few additional staff have been added in SAHEs, and most still have limited expertise in-house concerning K-12 science and mathematics education.**

According to the SAHE survey, 28 SAHEs did not administer other funds (besides Title II/Eisenhower) aimed at improving K-12 elementary and secondary mathematics or science education in 1988-89. Nineteen SAHEs provided information about the various other funds that are available to them for this purpose, but even for those states Title II/Eisenhower provided a median of 60% of the total. Funds from other sources (e.g., regular SAHE budget, corporate or foundation funds) came to about $8.5 million in Year 4--much of this concentrated in only a few states--compared with $31.8 million

nationally in Title II higher education funds. Thus, nationwide in **1988-89, about 80% of the SAHE funds for improving K-12 science and mathematics education came from Title II.**

The SAHE respondents to the mail survey do believe that the program has increased their capacity for state leadership (40 respondents) and, to a lesser degree, their capacity for technical assistance (26 respondents) (see Table 26). Even in states that were investing substantial funds in K-12 science and mathematics education through their SAHEs before 1985, the program is perceived as having substantially increased their leadership capacity. As one state higher education policymaker said, "this program is one wonderful arrow in our quiver--but not the only one." However, in most states (28 of 48 respondents), the program is, indeed, the only arrow in the higher education quiver; there are no other K-12 grants programs.

In about seven states, the higher education component of the program is administered by the SEA. The information collected for the study does not suggest that this makes the program more or less effective than in states where the SAHE is involved, but one obvious consequence is that in those states the capacity of the SAHE, per se, is not affected by the program.

Table 26

IMPACT OF TITLE II ON SAHE LEADERSHIP AND TECHNICAL ASSISTANCE CAPACITY IN MATHEMATICS AND SCIENCE EDUCATION

	Number of SAHEs Indicating Interaction Has:		
	Decreased	Not Changed	Increased
State leadership in math/science education	1	7	40
State capacity for technical assistance in math/science education	4	17	26

Impacts on Institutional Networks and Relationships

In most states, administering the program (including sharing information about needs) unquestionably strengthened ties between the SAHE and the SEA (at least in cases where the SEA did not administer both components of the program). These links were described at some length in the first section of this chapter, and there is no need to elaborate on them further.

The SAHE respondents believe that the program has strengthened a variety of other linkages, as well (see Table 27). Ties between the SAHE and colleges and universities were increased in more than 40 states, according to

Table 27

IMPACT OF TITLE II ON TIES BETWEEN SAHEs AND OTHER GROUPS

Other Groups	Number of SAHEs Indicating Stronger Ties or Increased Interaction as a Result of Title II
State-level groups	
The corresponding SEA	39
Scientists, mathematicians	32
Professional associations of math/science educators	30
Private sector firms	20
Governor's office	7
State legislature	2
Local educational institutions	
Colleges/universities	42
Public school districts	30
Nonprofit educational institutions (e.g., museums)	26
Private schools	20

survey data. Stronger links were also reported with school districts (30 respondents); nonprofit educational institutions, such as museums and professional associations (25 to 30 respondents); and private schools (20 respondents). New or stronger ties were also established with scientists and mathematicians (e.g., professors in these fields) and with private-sector firms. (Note that--as in the case of the SAHE-SEA ties--if the program were to disappear, so, too, would many of these linkages.)

The program was too small to foster stronger links between the SAHE and the governor's office or the state legislature. Only a few respondents reported otherwise.

The SAHE survey did not specifically ask about ties to the network of institutions in each state that provide preservice education of teachers. A few cases were encountered in which the state reached out to involve these institutions in large numbers, such as one southern state that planned to hold a meeting in the summer of 1990 with the mathematics and education department chairs of all four-year IHEs in the state with a teacher education program, to discuss state mathematics certification requirements. However, this kind of linkage appears to be quite unusual. In general, few higher education grants or other program-related activities have focused on preservice education.

PART TWO: THE ELEMENTARY/SECONDARY COMPONENT AT THE LOCAL LEVEL

The Title II/Eisenhower program provides an unusual kind of resource to local education agencies. Under the current version of the law, more than half of all the funding under the program "flows through" state agencies directly to LEAs in annual allocations that can be used for a wide variety of professional development activities in the target subject areas and, in some instances, for equipment or material purchases. Because the program stresses state and local initiative, this allocation of funds resembles that from another federal program, Chapter 2,* except that the Title II/Eisenhower resources are targeted to particular subject areas (mathematics and science primarily) and a particular kind of activity (professional development). The funding is highly discretionary and provides LEAs with a kind of resource that they may not have otherwise. However, unlike Chapter 2, the funds must be spent on the basis of the LEA's assessment of needs in the specified target areas, and in a manner consistent with the state's own needs assessment.

This part of the report describes the operations of the LEA component (in Chapter IV) and reviews what has been learned about the impact of the component in LEAs (Chapter V). Following that (in Chapter VI), several issues are discussed that apply uniquely to the LEA component--namely, the way small districts, which receive relatively little money under the program, are served; services to students in nonpublic schools; and the problem of focusing the funds. To preview the major findings regarding the LEA component, the highlights of study results are summarized below, by research question.

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* Originally Chapter 2 of the Education Consolidation and Improvement Act of 1981, revised as part of the Hawkins-Stafford Amendments of 1988.

Highlights of Findings About the Elementary/Secondary Component at the Local Level

The highlights are organized by chapter. Each major research question corresponds to a section within the chapter. The first chapter describes how the program works in local education agencies.

Summary: The Operation of the Program in Local Education Agencies and the Intermediate Units (IUs) That Serve Them (Chapter IV)

(1) How is the program perceived by LEA and IU staff associated with it?

LEA and IU staff tend to see the Title II/Eisenhower program as small and relatively invisible. They also take note of the program's targeted nature and its flexibility. Beyond these general characteristics, the program's identity is typically subsumed within the broader range of activities undertaken by the individuals or office that takes charge of the funds.

(2) What districts participate in the program, either directly or indirectly through an IU or consortial arrangement?

The great majority of LEAs across the nation participate in the program: although all districts are eligible, currently 93% receive annual flow-through funding, up from approximately 80% at the program's inception. Virtually all of the nation's largest LEAs (those with enrollments of 25,000 or more, which collectively account for a fifth of the nation's teachers) receive grants directly. Nearly two-fifths of the nation's smallest LEAs (those with enrollments less than 600, which together account for only 5% of the nation's teachers) receive funds through an IU or consortium. Another 10% of the smallest LEAs do not participate in the program, while the rest receive direct grants.

(3) (a) How much money does the program make available to LEAs? (b) How do participating LEAs (especially the smallest districts) respond to the generally small amounts of money available through the program?

(a) Because flow-through allocations are enrollment driven, the amount of money made available to districts varies enormously by the size of the district. In Year 4 of the program, the largest districts (which account for 29% of all flow-through funds) received a median allocation of $60,000 per year, while the median for the smallest districts (which receive approximately 7% of flow-through funding) was approximately $600 per year. Regardless of

LEA size, however, the amount of funding per teacher of mathematics and science was constant at between $26 and $37 per year during 1988-89. Over the five years of the program, the funding received by LEAs has fluctuated considerably, from less than half the Year 4 figure in the program's second year to 30% more than Year 4 in following year.

(b) Large numbers of LEAs take steps to augment the small amount of resources received under the program: the great majority combine Title II/Eisenhower money with other funds; approximately half carry over funds unspent from one year to the next to achieve a critical mass for spending; and (as noted above) many smaller LEAs pool their funds through IUs or consortial arrangements.

(4) What do LEA and IU staff see as the greatest needs and priorities among the target subject areas (mathematics, science, foreign languages, and computer education)?*

Mathematics and science are seen as top priorities across most districts, especially at the elementary level, less so at the middle school/junior high level, and even less at the senior high school level. A majority of LEAs also regard computer education at all levels as extremely important. Foreign language education, however, is generally not seen as a top priority (in fewer than a fifth of LEAs nationwide). The relative priority among these needs has not changed much over the five years of the program.

(5) (a) How do LEAs address their improvement needs? What role do Title II/Eisenhower funds play in LEA improvement strategies? (b) What activities are supported and what precisely are the program funds spent on?

(a) Some LEAs approach the task of improving mathematics and science education more strategically than others. The role of Title II/Eisenhower funds directly reflects the LEA's strategy and the degree of local planning. In LEAs with clearly defined improvement agendas, program resources typically act as an implementation resource or as a stimulus to innovation and experimentation. The funds can play two other roles in these LEAs and also in other LEAs, in which strategies for improvement are less well defined: they act as an "opportunity fund" (that is, flexible money to fill gaps that can't be covered by other budgets) or as a networking resource (that is, funds that help individual teachers take advantage of opportunities outside the district).

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* Because most of the data collection referred to the first four years of the program, when all four target areas were included in the program's purview, the study asked about all four. Under the Eisenhower program, only the first two are eligible.

(b) The great majority of flow-through money is used for professional development in mathematics and science, with roughly equal amounts going to each subject area; two-thirds of the expenditure for professional development goes for within-district inservice training and the other third for out-of-district activities. The remainder of the funds support curriculum development, educational technology, and a variety of other uses (e.g., administration, test development, assessment). Across all these activities, comparable amounts of funds are spent on salaries, consultant fees and expenses, materials and supplies, travel costs, and participant stipends. The remainder is spent on other items, such as equipment.

(6) What is the extent and nature of professional development supported by the program in LEAs and IUs? (a) How many teachers are served? (b) What forms of inservice training are offered and for what kinds of teachers? (c) What forms of out-of-district professional development are supported?

(a) The program serves large numbers of mathematics and science teachers: during Year 4, slightly more than a quarter of all such teachers nationwide took part in inservice training supported by LEA flow-through funds, and 10% (including some of the inservice participants) were helped to attend out-of-district events.

(b) Inservice training takes many different forms, ranging from intensive activities such as summer institutes of a week or more and school-year workshop series with repeated sessions to less intensive forms of training (typically, one-time inservice events). The amounts of training received average one school day (six hours) per participant; approximately a quarter of all LEAs offer training with three or more days per year, while in an equivalent percentage of LEAs, teachers receive less than half a day's training. Most districts target their training to particular types of teacher, as often to "lead" or master teachers as to underprepared teachers.

(c) Out-of-district training consists primarily of conference attendance, especially at state or regionally based events, often sponsored by professional associations. In a small number of instances, teachers attend courses at nearby institutions of higher education.

(7) What do LEAs do to direct the flow of funding? Who or what groups inside and outside the LEA are involved, and what kind of decisionmaking process takes place?

Leadership of the program at the LEA level is highly varied across districts, though fairly stable across time, and often devolves to one or two persons who act as "champion" for local mathematics and

science education improvement (in a third of all districts, curriculum supervisors are in charge of the funds). Generally speaking, the program is too small to encourage an extensive consultation process. Outside groups may be involved, especially nearby institutions of higher education and, less often, other LEAs, professional associations, or other groups.

Summary: The Impact of Flow-Through Funds in Local Education Agencies (Chapter V)

The questions addressed in this chapter are more evaluative and concern the impact of the program on institutions and individuals.

(8) **How have Title II resources and requirements affected the institutions (LEAs and IUs) that receive the funds--in particular, (a) institutional leadership, (b) capacity (resources and staff expertise), or (c) collaborative relationships?**

(a) Title II/Eisenhower funds are a key leadership resource and are used as such in districts in which individuals controlling the funds have a well-planned improvement agenda. However, the program does not create such leaders, nor does it typically stimulate the development of an improvement agenda.

(b) The program has affected LEA capacity primarily by substantially augmenting the pool of resources directed at professional development in the target subject areas. Except in the largest districts, the program does little to change the collective expertise of staff, though there is some increase in specialists at the school level, who can act as lead teachers.

(c) Participation in the program is more likely to sustain existing relationships between LEAs and other groups or institutions than to forge new ones. Institutions of higher education, other LEAs, and intermediate units are the most common partners in LEA-based activities, though fewer than half of all LEAs have teamed up with any of these groups.

(9) **What effects have professional development activities that were supported by LEA flow-through funds had on individual teachers--that is, on their attitudes, content knowledge, pedagogical skills, or commitments to the profession?**

The clearest impact of LEA-sponsored professional development is on teachers' attitudes toward science and mathematics, and their teaching in these areas. Workshop and conference participation has clearly had a widespread rejuvenating effect on the teachers who participate. In particular areas of the curriculum, notably

elementary science and mathematics, there is also clear evidence that large numbers of teachers are picking up certain teaching ideas, such as the appropriate place and use of manipulatives in elementary mathematics teaching. However, there is little evidence that most LEA-sponsored professional development activities are improving teachers' grasp of scientific or mathematical content. In the more intensive forms of training experience, teachers are affected in other ways, similar to those described in the discussion of IHE project impacts (see Chapter VIII).

(10) Have school programs or curricula in mathematics and science been influenced in ways that can be attributed to the Title II/ Eisenhower program? In what ways?

Developing new curricula is not a common target of program funding; consequently, there is little impact on this activity. However, modest forms of curriculum improvement are often a part of program-supported professional development in one of three ways. First, some workshops are devoted to introducing a new curriculum (developed elsewhere) that the school or district has decided to adopt (this occurs in a quarter or more of all LEAs, depending on the subject area). Second, materials development is frequently incorporated into training to help teachers adapt teaching ideas to their own situations (this is a feature of training in the majority of LEAs). Third, existing district or school curricula are sometimes revised by teams of teachers, supported by program funds (this happens in a small number of LEAs). Other than these effects, Title II/Eisenhower resources, as currently implemented, are unlikely to affect school mathematics and science programs as a whole.

(11) What have been the consequences for classroom practice and student learning?

The impact of LEA-sponsored professional development (inservice training, courses) on classroom practice is mixed and depends heavily on the design of professional development in place. In cases where the majority of the following factors are in place, there is clear evidence that what is learned during training transfers to classroom practice: relatively intensive training (that is, three or more days in the year devoted to a particular training experience); accompanying mandate for implementation (e.g., a district decision to adopt a new curriculum); teachers' participation in planning for inservice; the chance (as part of the training itself) to adapt what is learned to the teacher's own classroom situation; follow-up support; school-level support for implementation; and adequate incentives for the teachers' participation. Judging from data on intensity of training, teacher's participation in planning, the use of funds for participation incentives, and the emphasis on adapting material for the teacher's

own classroom, a substantial proportion (perhaps a quarter) but less than the majority of LEAs are providing training events that are likely to transfer to classroom practice.

The impact of short-term experiences and events such as conference attendance on classroom practice are exceedingly difficult to trace, and the value of such events is not necessarily related to immediate transfer to practice. Teachers frequently claim that such experiences give them new ideas for teaching.

Summary: Special Issues Related to the Elementary/Secondary Component of the Program (Chapter VI)

A third set of questions address special issues that pertain to this component of the program:

(12) **(a) How does the program work within, and for, smaller districts, which tend to receive only a small amount of funding? (b) Of what assistance are intermediate units or consortia in meeting the needs of these districts?**

(a) Smaller districts that retain their annual allocation of Title II/Eisenhower funds do many of the same things that larger LEAs do with these resources. However, they tend to support less intensive inservice activities within the district and to use a larger proportion of their funds for out-of-district professional development of various kinds.

(b) Smaller districts that participate through an IU or other pooling arrangement (approximately two-fifths of LEAs with enrollments less than 600) find available to them a range of activities that resemble those offered in the largest LEAs. There thus appears to be a net gain to these districts by participating in such arrangements, given the generally limited options available to them otherwise.

(13) **How do LEAs serve nonpublic school students under the Title II/Eisenhower program? (a) How extensively do nonpublic schools participate? (b) How do LEAs carry out their responsibility for this aspect of the program?**

(a) Only a small proportion (7%) of the overall flow-through dollars for LEAs are allocated to services that benefit nonpublic school students and teachers. This amount is somewhat less than--but still close to--the overall percentage of nonpublic school students in the nation's student population (e.g., 9% of all students in LEAs not served by IUs). Nonparticipation generally

reflects very small numbers of these students in some districts (hence little money to serve them); lack of interest or active disinterest by some nonpublic schools in federal programs; in some instances, skimpy planning or notification by LEA staff to involve nonpublic school staff.

(b) LEAs typically fulfill their responsibility for involving nonpublic schools by inviting teachers from these schools to attend LEA events, providing separate services for them, or making the money or its equivalent in materials or equipment available.

(14) How does professional development supported by LEA flow-through funds address the needs of groups traditionally underrepresented in science and mathematics education?

Few LEAs make the needs of female students, minorities, and other underrepresented groups an explicit focus of the professional development supported by Title II flow-through funds, but many more LEAs indicate that the funds have helped them serve these groups. Program-supported training involves disproportionately large numbers of teachers who are themselves female or of minority background.

(15) What do localities do to target and assess the use of funds under this program? How do LEAs (a) know what their needs are, (b) target their use of funds, and (c) determine whether they are making progress (through Title II or any other means) toward meeting those needs?

(a) The assessment of needs in LEAs is best thought of as a consensus-building process. Formally collected data has a relatively small role in determining or identifying needs, which come more from local planners' "sense of the situation" and from external events (such as state mandates) that "create" needs or elevate certain ones to top priority. The program and its requirements (e.g., recent needs assessment requirements) do little to direct the use of funds in any formal sense, though a majority of LEAs indicate that the program has helped in clarifying priorities.

(b) Activities sponsored by program funds are typically targeted on high-priority needs (as identified locally), and there is sustained attention to these needs over time.

(c) LEAs have few formal means to ascertain progress toward their goals. Formal measures such as testing (to which some LEAs pay attention) are as likely to be misleading as helpful, and in some instances counterproductive to improvement goals.

IV THE OPERATION OF THE PROGRAM IN LOCAL EDUCATION AGENCIES AND THE INTERMEDIATE UNITS THAT SERVE THEM

This section reviews what the study found out about the operation of the program in local education agencies (LEAs) and the intermediate units (IUs) or consortial arrangements through which some LEAs receive services. The findings can be clustered around seven topics that correspond to the major questions noted in the introduction to Part Two:

(1) The way LEA and IU staff perceive the program.

(2) LEA participation in the program, both as direct recipients of flow-through grants and as part of IU- or consortium-based services.

(3) The amounts of money made available to LEAs through the program and their response to it.

(4) Top-priority needs among the four target subject areas, from the perspective of LEA and IU planners.

(5) The strategies and activities LEAs undertake to address improvement needs, and the role of program resources in these strategies.

(6) The extent and nature of program-supported professional development in LEAs and IUs.

(7) What LEAs do to administer and direct the flow of funds.

The LEA Component of the Title II/Eisenhower Program from the Perspective of LEA and IU Staff

From the perspective of local education agencies, Title II/Eisenhower is a simple program. In brief, it involves a short annual application to the state education agency, from which the LEA receives an annual allocation of discretionary funding; the program takes little administrative time to keep track of funds expenditures. Like other programs of its sort that stress local initiative and discretion (e.g., the federal Chapter 2 program), the program imposes few requirements on LEA staff.

The LEA component represents a substantial portion of the program as a whole. Under the original Title II formula, 49% of all the funds appropriated at the federal level were passed on to the LEAs through annual "flow-through" grants by state agencies; since reauthorization as the Eisenhower program, that percentage has increased to 67.5%. All LEAs in the nation are eligible to receive the funds, and (as discussed later in this chapter) the vast majority do.

Certain attributes of the program, in particular, are salient to LEA staff who deal with it:

- Small scale relative to other special programs (but not necessarily to resources for staff development). Relative to various benchmarks, the program offers only modest funding to an LEA. At the same time, by comparison with the resources available for staff development, the program may offer a substantial amount of money.

- Invisibility. The Title II/Eisenhower program lacks a clear identity in the minds of most LEA and school staff. In part, this is a function of size. The program does not pay for enough activities--mu less the usual trappings of a "program" (staff, facilities, equipment, etc.)--to have acquired the kind of visibility that other improvement initiatives may have at the local level. In part, the function it supports--staff development--is not particularly visible in some larger districts. Staff development is often part of a program or one of many things that an assistant superintendent for curriculum and instruction does.

- Targeting to particular subject areas. The program's governing requirements clearly direct the funding at particular areas of the curriculum (now mathematics and science), and that fact ensures that some activities and expenditures take place in relationship to these areas. In some cases, respondents told the study team that little would be done to address mathematics and science problems if Title II funding were not there and restricted to this purpose.

- Flexibility. The flexibility of Title II resources is very noticeable to LEA staff, and it is a welcome feature, given the highly constrained nature of most local and state funding for education.

These attributes apply to the program in nearly all LEAs to some degree, but the identity of Title II/Eisenhower varies across settings, depending on many things in the district, among them the availability of other resources for addressing mathematics and science improvement needs and the absolute amounts of Title II/Eisenhower funds, which relate to the LEA's size.

LEA Participation in the Program

To understand LEA participation, one must first visualize how districts, students, and teachers are distributed across the nation. LEAs vary enormously by enrollment size and other important features of their student population, organization, and setting. In the simplest terms, these characteristics affect the amount of Title II/Eisenhower funding an LEA receives, because the enrollment of the district is the primary criterion determining the size of the annual allocation; the proportion of low-income students also affects the allocation, with poorer districts receiving a somewhat larger share of the dollars. As will be apparent in the analyses that follow, the program thus takes on a different character depending on these student population factors.

The survey and site visit data have been analyzed with five size categories of LEA in mind, defined by enrollment cutpoints set at 25,000, 10,000, 2,500, and 600 students. As Table 28 and Figure 9 indicate, the distribution of LEAs across these categories is highly skewed, with the largest--a tiny fraction of all LEAs--accounting for nearly a quarter of all teachers nationwide, and hence, for a corresponding proportion of Title II flow-through dollars. At the same time, the smallest category (LEAs with enrollments less than 600) represents nearly two-fifths of all of the nation's school districts, yet houses only 5% of the nation's teaching force.

Size differences are strongly associated with whether LEAs participate directly or indirectly in the Title II/Eisenhower program. As will be discussed at greater length later in this part of the report (see section on program funding later in this chapter and also Chapter VI), smaller districts are especially likely to receive services funded by the program through an intermediate unit or as part of a consortial arrangement. Therefore, wherever there are clear differences between the two categories of LEA, findings are reported separately. Table 29 summarizes the basic pattern in the types of support arrangements by district size categories.

Table 28

DISTRIBUTION OF LEAs, TEACHERS, AND FLOW-THROUGH DOLLARS ACROSS DISTRICTS OF DIFFERING SIZE

LEA Size Category (Enrollment Range)	Number (and Percent) of Nation's LEAs		Approximate Percentage of Nation's Teachers	Approximate Percentage of Title II/Eisenhower Flow-Through Funds
Very large (25,000 or more)	177	(1%)	22	29
Large (10,000-24,999)	476	(3%)	17	20
Medium (2,500-9,999)	2,882	(20%)	35	28
Small (600-2,499)	5,369	(37%)	21	16
Very small (less than 600)	5,769	(39%)	5	7
Total	14,673[a]	(100%)	100	100

[a] This figure excludes supervisory unions and other specialized entities (e.g., regional vocational-technical schools) that are sometimes counted as "LEAs."

Table 29

DISTRICTS RECEIVING TITLE II/EISENHOWER FUNDING DIRECTLY AND THROUGH AN INTERMEDIATE UNIT OR CONSORTIAL ARRANGEMENT

LEA Size Category (Enrollment Range)	Percentage of LEAs in Each Size Category That Did or Did Not Receive Program Funding During Year 4			
	Directly	Through an IU or Consortium	Did Not Participate	Total
Very large (25,000 or more)	97	3	0	100
Large (10,000-24,999)	95	3	2	100
Medium (2,500-9,999)	82	14	4	100
Small (600-2,499)	70	23	7	100
Very small (less than 600)	52	38	10	100

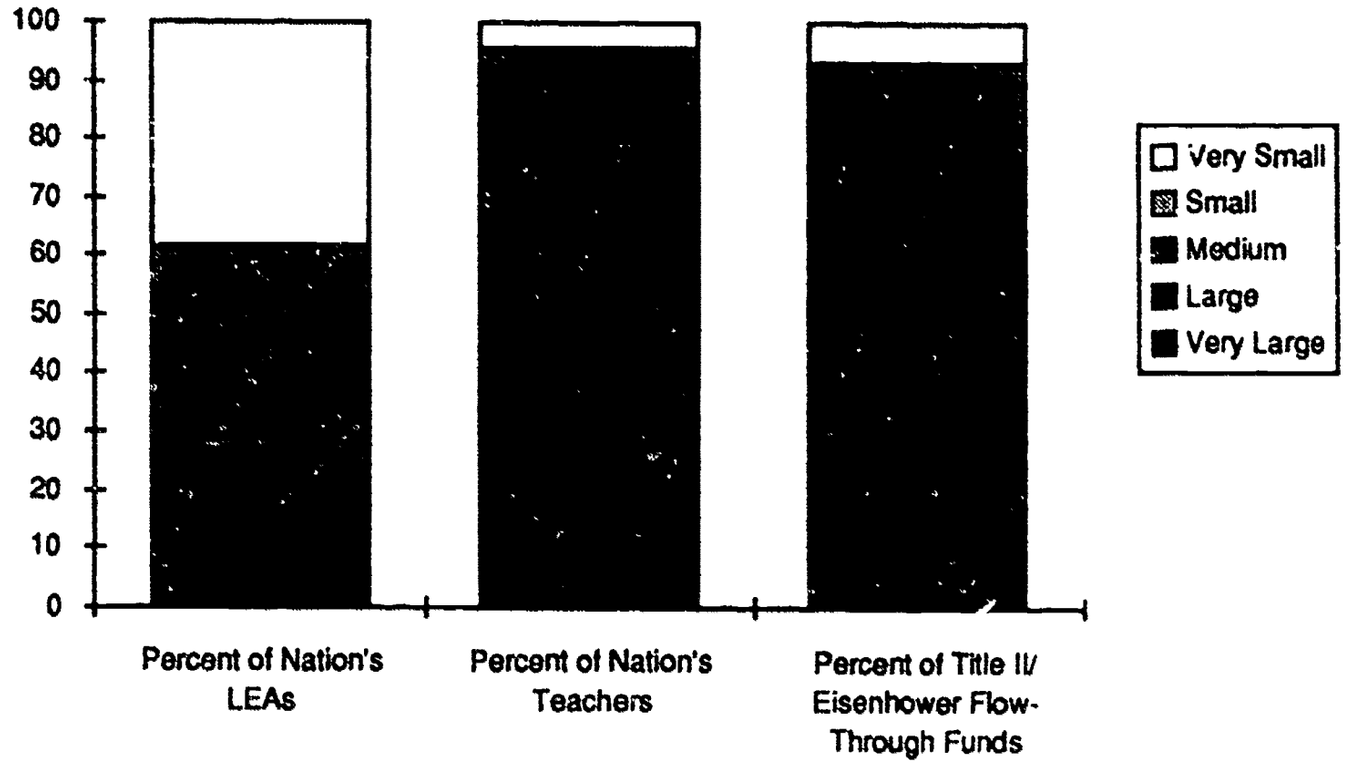

FIGURE 9 ESTIMATED DISTRIBUTION OF LEAs, TEACHERS, AND FLOW-THROUGH FUNDS, 1988-89

The relevance of these differences will become apparent in the ensuing discussion, but an overall caution should be kept in mind when interpreting survey-based findings: the percentage of districts, by itself, gives an incomplete--and potentially misleading--picture of operations under this program. Consequently, where appropriate, findings have been broken out by size category, or the proportion of program funding to which a given result pertains has been indicated.

The great majority of LEAs nationwide participate in the program, and the number has grown across the five years of the program. As shown in Table 30, all but 7% of the nation's LEAs participated in the program in Year 4.

Nonparticipation is clearly related to the amount of funds districts receive and the relative gain to the LEA for the trouble involved in administering the program. Among the two smallest categories of LEAs, which account for the vast majority of nonparticipating districts, approximately half (49%) of LEAs indicate that the funds are "too low to bother with" and that the

"cost of administration outweighs the benefit." The fact that participation has increased over time (see Table 30) suggests that familiarity with the program contributes to the level of participation. Furthermore, there is some evidence, shown in Table 30, that growing participation levels roughly reflect the growth in overall federal funding levels.

Flow-Through Funds: What the Program Makes Available to LEAs

Before examining the needs that LEAs address with program funds and the specific activities that are supported, it is necessary to understand exactly what the program makes available to LEAs, and also the numbers of LEAs that take advantage of these resources.

The Amount of Funding Available to LEAs

As implied by the discussion above, the amount of funds available varies enormously across LEAs of differing size. As shown in Table 31, the average grant size is not large in absolute terms--the average (median) smallest district (i.e., with enrollment less than 600 students) received close to $600 in Year 4 of the program (1988-89 school year), while the largest (with

Table 30

LEVELS OF NONPARTICIPATION ACROSS THE FIRST FOUR YEARS OF THE PROGRAM

Program Year	Overall Federal Appropriation ($ millions)	Rate of Nonparticipation
1	$99.0	20
2	42.6	17
3	79.2	12
4	118.5	7

enrollment of 25,000 or more) were allocated an average (median) of $60,000.* However, because the annual allocation is formula driven, the level of funding per teacher is more or less constant for LEAs regardless of size.**

The amounts of flow-through money for LEAs have fluctuated considerably over the five years of the program in direct response to changes in congressional funding levels, as shown in Table 32. At the lowest point in the five years (the 1986-87 school year), LEAs were allocated a median amount of money that was less than half of the Year 4 figure (approximately $25,000 for the largest districts and $250 for the smallest). In the fifth year of the program (1989-90 school year), the appropriation for flow-through funds to school districts increased by more than 60% over the Year 4 figure (because both the distribution formula and the appropriation changed).

There are several ways to interpret the meaning to a district of these amounts of funding. In absolute terms, the funding is small, between $26 and $37 a year per teacher engaged in mathematics or science teaching.*** By itself that amount of funds can buy relatively little if the funds are not used in conjunction with any other resources and if the funds are dispersed evenly across all eligible teachers.

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* Throughout the report, median figures are used to represent the average wherever the distribution of cases is very skewed, hence making the mean misrepresent the typical case.

** Note that in a few small states receiving the statutory minimum amount from the federal government, the actual allocation per teacher is greater--in a few cases more than twice that of other states.

*** This estimate (based on National Education Association and National Center for Education Statistics data) assumes that all elementary teachers are potentially science teachers (virtually all are math teachers), and that approximately 23% of all secondary school teachers are engaged in one or the other subject.

Table 31

WHAT LEAs[a] HAVE TO SPEND ANNUALLY
FROM TITLE II/EISENHOWER FLOW-THROUGH GRANTS

LEA Size Category (Enrollment Range)	Median Amount of Year 4 Dollars	Median Dollars/Teacher of Mathematics or Science in Year 4
Very large (25,000 or more)	$59,999	$37/teacher
Large (10,000-24,999)	16,241	32
Medium (2,500-9,999)	4,703	29
Small (600-2,499)	1,655	26
Very small (less than 600)	582	34

[a] LEAs not served by IUs or consortia.

Table 32

TOTAL FLOW-THROUGH DOLLARS RECEIVED
BY LEAs IN THE FIRST FOUR YEARS OF THE PROGRAM

	Annual Allocation Reported by LEAs	
Program Year	LEAs Not Served by IUs/Consortia	LEAs Served by IUs/Consortia[a]
1985-86 (Year 1)	$29,364,083	$2,227,400
1986-87 (Year 2)	22,926,634	1,873,000
1987-88 (Year 3)	34,442,741	2,981,400
1988-89 (Year 4)	50,517,550	5,356,800

[a] Not directly reported by these LEAs, but estimated from the residual of total LEA flow-through money not allocated directly to LEAs.

Other reference points can be used to judge the amount of funding. Relative to other federal programs such as Chapter 2, which provides flexible discretionary funding, the program is small (yielding an eighth as much as Chapter 2). Targeted categorical programs such as Chapter 1, which provides compensatory education assistance to LEAs, are an order of magnitude larger than Title II/Eisenhower funds and focused on only a segment of the students served by the district.

However, in relation to local discretionary resources aimed at mathematics and science improvement needs, the Title II/Eisenhower program may provide a substantial proportion of the funding. LEAs often do not have much funding for efforts to improve staff capabilities in these areas of the curriculum (some districts that have the resources opt to support staff development related to other subject areas). Relative to that benchmark, the funds may appear substantial, though still small in relation to the magnitude of the needs.

Augmenting and Concentrating the Small Amounts of Funding Received Under Title II/Eisenhower

A number of LEAs augmented the amount of money they received from the program in one of three ways: (1) combining Title II/Eisenhower funds with other resources, (2) carrying over funds until a subsequent year, and (3) pooling funds through IUs or consortial arrangements. **By augmenting the funds, local program administrators indicate that what they receive annually per year--approximately $33/teacher, on average--is not enough to cover the full cost of professional development.** Consequently, they seek whatever ways they can to make the money go as far as possible.

Combining Program Funds with Other Resources--The most obvious way of augmenting the amount of resources available for mathematics and science education improvement activities is to combine Title II/Eisenhower funds with other funding sources. Because of the program's flexibility, this can readily be done, and a majority of LEAs do so. For example, as shown in Table 33, LEAs are especially likely to use program funds in conjunction with resources from district budgets.

Table 33

RESOURCES USED IN CONJUNCTION WITH TITLE II/EISENHOWER FUNDS

Funding Source	Percentage Using Each Type of Resource in Conjunction with Title II/Eisenhower Funds: LEAs not Served by IUs or Consortia	LEAs Served by IUs or Consortia
Regular LEA budget(s)	92	87
Chapter 2 funds	32	24
Specially earmarked state funds	21	29
Corporate/foundation contributions	7	19
National Science Foundation funds		
All LEAs	3	20
Very large LEAs	20	--

As the table indicates, other federal sources such as the Chapter 2 program and special state funding were commonly used alongside Title II/ Eisenhower funds. (National Science Foundation funding was not commonly available in LEAs except in very large districts and in some IUs or consortial arrangements; in one-fifth of the LEAs, NSF funds were linked with Title II/Eisenhower money.)

Combining program funds with other resources took various forms, but the following were common patterns in inservice training supported by the program: Title II/Eisenhower funds picked up the cost of substitute teachers (to release teachers for a professional development activity) while other funds paid for a consultant to provide training, transportation, materials used during training, or other kinds of training expense; or the program money brought in a trainer, while other funds covered the release time of

teachers and other incidental expenses. The net effect was that Title II/ Eisenhower covere' a part of the cost of an activity, often a substantial part.

Carrying Over Funds Until a Subsequent Year--The amount of funds available to an LEA in a given year is not necessarily a good reflection of the amount it actually spends. As survey data and field visits showed, a number of districts carry over from one year to the next substantial amounts of funding. At the end of Year 4, in approximately half of all LEAs (not served through IUs or consortia) some Title II/Eisenhower funds remained unspent; a quarter of all districts were carrying over 20% or more of the funding they had received in that year. Sometimes the carryover was due to delays in funding at state or local level, but also this process allowed many LEAs to accumulate enough resources in a particular year to support a more substantial activity than they otherwise would have done.

Pooling Funds Through IUs and Consortial Arrangements--As noted earlier in this section, not all LEAs chose to receive the funds directly. Especially among the smaller LEAs, which otherwise might opt not to participate because the program offered so little, it was common to forward the annual allocation to a neighboring IU, or in some instances to join a consortium with other districts. The net effect of this was to create a larger pool of resources, thus enabling a more extensive professional development program to be offered to teachers from all LEAs that participated in the pooling arrangement.

As a result of pooling, IUs or consortia received an amount of program funds approximately equivalent to those available to a large district (e.g., with an enrollment of 20,000), as Table 34 indicates. By contrast with what an individual member district might receive by itself, this concentration of funding makes possible a different scale of program support, even though the amount per participating teacher is not different.

Table 34

AVERAGE TITLE II/EISENHOWER DOLLARS ALLOCATED BY LEAs TO INTERMEDIATE UNITS OR CONSORTIA

Program Year	Median Title II/Eisenhower Dollars Received by: An IU or Consortium on Behalf of the LEAs It Serves	A Single Very Small LEA (Not Served by IU)
In Year 4	$33,500	$582
In the lowest-funded year (Year 2)	14,050	255
In the highest-funded year (Year 5)	44,605	759

Needs and Priorities from the LEAs' Perspective

The subject areas that are the target of the Title II/Eisenhower program are a focus of considerable concern at the local level. In particular, a majority of districts across the nation believe that, in mathematics and science, attention must be paid to the elementary level--as shown in Table 35, between a half and two-thirds of all districts have targeted this as a top priority need in mathematics and even more did so for science. A smaller percentage of districts noted the middle school level as a top-priority need in both areas (a little more than a third of all districts for each subject area), and a smaller percentage still for both mathematics and science at the high school level. Finally, perhaps prompted by apparent emphases within the legislation itself, foreign languages were not considered to be a high priority by a large percentage of districts nationwide.

Districts that were served by IUs and those that were not show similar patterns of need, as indicated in Table 35, except that in pooled arrangements, there was even more attention to the elementary-level needs and less to those at the high school level.

Table 35

EDUCATIONAL IMPROVEMENT NEEDS IN TARGET SUBJECT AREAS, AS PERCEIVED BY LEA AND IU STAFF

Subject Areas/Levels	Percent Indicating the Following As "Top Priority" Needs in Year 4[a]: LEAs not Served by IUs or Consortia	LEAs Served by IUs or Consortia
Elementary mathematics	53%	77
Elementary science	61	86
Middle/junior high mathematics	37	32
Middle/junior high science	34	52
High school mathematics	28	20
High school science	24	35
Foreign languages	25	12
Computer education	52	36

[a] "Top priority" = Ranked 1, 2, or 3 out of the above list.

There are various explanations for these patterns. Most important, in response to the push for reform in these subject areas, there appears to have developed a clear professional consensus about the need for certain kinds of changes in math and science teaching. For example, the National Council of Teachers of Mathematics (NCTM) Standards for Curriculum and Evaluation have been widely circulated and have become a reference point for activities aimed at improving mathematics. In site visits the study team found these standards being used as a basis for planning mathematics inservice training in disparate settings, both urban and rural, and in various regions of the country.

In districts across the nation, officials have become aware that particular aspects of mathematics and science teaching need attention, a state of affairs that has been intensified by state actions that draw attention to these needs. Elementary science is a case in point:

- One large state targeted elementary science as a reform priority and revised its state syllabus in the mid-1980s, coupled with a new elementary-level science test implemented for the first time in 1988. It is no wonder, in such circumstances, that elementary science should show up as a high priority among districts in this state.

- In another, smaller state, a state supervisor declared elementary science to be the highest priority for discretionary funding, including Title II. Once again, large numbers of districts and IUs in this state indicated that elementary science was a top-priority need.

As perceived by LEA and IU staff, the lineup of needs and priorities has not changed much over the five years of the Title II/Eisenhower program. The relative ranking of needs for the 1985-86 school year (the first year of the program) versus the same ranking four years later shows little change, either in the absolute number of districts indicating each need or in the relationship among the ranked items.*

However, a more subtle evolution of needs has taken place in some districts, as early foci of attention give way to others. For example, several of the LEAs that were visited had concentrated their attention during the first few years of the program on updating curriculum, and then shifted attention to the training of teachers to prepare them to use the curriculum, often in response to state framework or syllabus revision. In such cases the overall need for improving elementary science did not change all that much over the years, whereas the particular programmatic focus did. (This example also illustrates the fact that, given limited resources, LEA staff often define their programmatic needs fairly narrowly at any one time, even though they realize that many aspects of the situation need to change.)

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* Rankings for the 1985-86 school year were done retrospectively by survey respondents, who were asked to respond for both the first year of the program and the fourth.

Strategies and Activities Supported by the Program

Some LEAs approach the task of improving mathematics and science education more strategically than others. Although the dichotomy oversimplifies the nature of LEA efforts, it is helpful to characterize LEAs as those with focused agendas for improvement and those with unfocused (or nonexistent) agendas. In "focused-agenda" LEAs, improvement efforts reflect a coherent, long-term plan that acknowledges the complexities of making instructional programs change. Different activities aim at the various facets of the instructional program that need change--curriculum, teacher know-how, facilities and equipment, and so on--and over time these efforts work together to bring about the kind of change that is needed. In such LEAs, there is usually evidence of widespread effects on both classroom practice and, in due course, student performance. Not surprisingly, such districts typically have one or more people who act as reform leaders, often individuals with strong backgrounds in science or mathematics education.

The LEAs with unfocused improvement agendas, on the other hand, exhibit little planning or forethought about the improvement of mathematics or science education. Instead, activities are undertaken on an ad hoc basis, in response to personal preferences or idiosyncratic events. In these LEAs, less may be done to improve mathematics or science at all, or there may be a lot of activities, but with little clear relationship to one another and little evidence of cumulative impact over time. Such LEAs typically do not have strong leaders in these subject areas.

The uses--and usefulness--of Title II/Eisenhower funds directly reflect the character of the LEA's improvement strategy. In focused-agenda LEAs, these resources are typically used in a carefully orchestrated sequence that maximizes their potential impact on certain aspects of the local instructional program. The following LEA we visited exemplifies this pattern:

- A focused-agenda LEA. In this large urban district, Title II/Eisenhower funds (approximately $20,000 in 1988-89) were used to create a follow-up support group system for district elementary school teachers who had been trained in a manipulative-based elementary mathematics curriculum. The introduction of this program had

been funded by the LEA across a period of three years, as part of a major push to revitalize elementary mathematics. As of the time of the site visit, nearly all teachers in grades one through three had taken workshops in the new curriculum and were participating in the follow-up support group system. There is evidence from this district of impact on collegial interactions among teachers, of the introduction of the new curriculum into classrooms, and of increasing student achievement in mathematics.

By contrast, Title II funds appear to be used in a more scattered way in LEAs with unfocused improvement agendas, where the funds are used to support various activities that typically do not bear a clear relationship to one another, either within a given year or over time. For example:

- An unfocused-agenda LEA. In this medium-sized urban district, there is no clear philosophy or direction for approaching mathematics or science education improvement goals, beyond the general principle that a small number of teachers from each school should be trained (who might then spread the word to others). Across the first four years of the program, Title II/Eisenhower funds (approximately $12,000 in 1988-89) were used for many unrelated activities, among them: a couple of graduate-credit courses for elementary science teachers, a computer/VCR workshop, a review of high school science offerings, a set of meetings for high school teachers to tell elementary teachers what they should be doing in mathematics and science, the validation of a criterion-referenced science test, and creation of a new middle school foreign languages curriculum. Although this appears to be a great deal, there is little evidence that these activities had any discernible cumulative impact on classroom practice or student achievement, except perhaps in isolated classrooms.

To some extent, the strength of the LEA's improvement agenda determines the role these funds can play in altering the situation. As part of the district strategy, Title II/Eisenhower funds can play different roles, and sometimes more than one role in the same district. From the site visits, four basic roles can be discerned. The first and second are most likely in focused-agenda sites:

- Implementation resource. In this role, LEA flow-through funds are a means by which a preexisting initiative or reform program (initiated at the state or local level) is carried out. The role of Title II/Eisenhower money, of course, is limited: it is never enough to implement a full and ambitious program, and it is generally restricted to the immediate professional development aspects of a reform program; nonetheless, it can be central to the operation and success of the improvement venture. The strong-agenda site described above is a case

in point. In other examples from the site visits, program funds have been instrumental in disseminating a revised curriculum produced by others, furthering a big-city district restructuring effort, and introducing a state-developed science test to school people who will subsequently administer it, to mention a few instances.

- Innovation stimulus. This role is less common, probably because innovative programs typically require more resources than the program offers, except in the largest districts, in which concentration of funds is possible. One very large urban district makes use of its Title II/Eisenhower funds in this way at the high school level. There, a majority of the funds (totaling approximately $450,000 in 1988-89) were used to support the development of curricula and technology tools across a three-year period that could ultimately be used in large numbers of the city's secondary schools. In at least one of these projects, program funds have helped to get an initial pilot development effort off the ground, which subsequently led to a larger grant of money from the National Science Foundation.

Two more roles are more likely in districts with less-focused improvement agendas, although they also occur elsewhere in combination with the roles just described:

- Opportunity fund. In this mode, the program's funds are seen and used as a flexible resource to cover miscellaneous expenses for various activities. The unfocused-agenda case described above is a good example of such an LEA. In another instance, a small rural LEA used its first-year funds to purchase a lab table, send an administrator to a conference, and help a second-grade teacher get "lead teacher" training at a neighboring university. In each instance, the funds were a way of meeting a one-time expense that, for the moment, could not be covered in any other way.

- Networking resource. Title II/Eisenhower resources are often the means by which individuals within the district avail themselves of professional development opportunities, often (but not always) external to the district, such as professional conferences or other locally available staff development events. In one such LEA, a medium-sized district in an agricultural area, Title II/Eisenhower funds (approximately $6,000 in 1988-89) were placed at the disposal of middle and high school principals, to enable their teachers to take advantage of such opportunities. In the past few years, individuals have used the funds to attend summer mathematics and science conferences, to participate in computer practicums, and also to take part in a Title II-sponsored institute in a nearby state college.

These roles can often be found in combination. LEAs are not monolithic institutions, and there is often more than one agenda at work in determining the use of the funds. Nonetheless, there is a tendency for the funds to be

used in a more focused and strategic way in LEAs that, apart from Title II/ Eisenhower, have forged a plan for improving their mathematics and science education programs.

The Range of Activities Supported By the Program

The examples described above give a taste of the different kinds of activities supported by LEA flow-through funds. The range is fairly wide, but there are some clear patterns. For the most part, as shown in Table 36, the funds are used to support within-district inservice training activities of various kinds, taught by local staff or trainers who reside nearby (e.g., in local institutions of higher education). Fewer dollars overall are used to support out-of-district professional development--either conferences or courses at nearby institutions. Less still goes for curriculum development, educational technology, administration, or other purposes.

The activities supported by Title II/Eisenhower funds spread resources fairly evenly between mathematics and science, as can be seen in Table 37; most LEAs split their funds in a given year between the two disciplines. With regard to the two subject areas no longer in the Eisenhower program, few LEAs put program funds into foreign languages during the last year when these subjects were eligible, although a fifth of all districts supported some kind of computer education activities (other than activities that integrated computers with mathematics or science).

The categories of activity referred to above are actually fairly broad. A few examples of each illustrate what Title II/Eisenhower funds have actually paid for:

- Within-district inservice training. This includes a range of workshops from one-time events to workshop series spaced across a semester or year; support group and follow-up activities; summer-institute-like training (see further description below).
- Out-of-district professional development. Typically, this means either professional conferences at the regional, state, or national level; or participation in some course offered by a university or other training institution nearby.

Table 36

TYPES OF ACTIVITIES SUPPORTED BY PROGRAM FUNDS[a]

Activity	Total Year 4 Flow-Through Dollars Nationwide Allocated to Each Type of Activity	Percent of Districts Putting Funds into Each Area
Within-district inservice	$26,723,783	48
Out-of-district professional development	11,315,931	48
Curriculum development	2,778,465	13
Educational technology	4,647,615	17
Administration	909,316	4
Other	4,142,439	14
Total	$50,517,549	

[a] Figures refer to LEAs not served by IUs or consortia. The activities supported under these arrangements resemble those occurring in the largest LEAs; see discussion in Chapter VI.

Table 37

ALLOCATION OF TITLE II DOLLARS TO TARGET DISCIPLINES[a]

Discipline	Total Year 4 Flow-Through Dollars Nationwide Allocated to Target Disciplines	Percent of Districts Putting Funds into Each Area
Science	$22,208,818	79
Mathematics	$22,673,160	79
Foreign languages	$879,459	8
Computer education	$4,584,886	20
Total	$50,346,323	

[a] Figures refer to LEAs not served by IUs or consortia. The activities supported under these arrangements resemble those occurring in the largest LEAs; see discussion in Chapter VII.

- Curriculum development. When so labeled, LEA-supported "curriculum development" most often takes the form of a small committee of teachers working during the year or for an intensive week or two in the summer to generate or revise curriculum materials. Note, however, that many inservice training activities also include work on curricular materials. Thus, it is difficult to estimate precisely the extent of Title II's support for this activity.

- Educational technology. Either in conjunction with training events or not, computers and other forms of educational technology are sometimes the focus of purchases under the Title II/Eisenhower program (LEAs typically need special permission from the state to make such expenditures).

- Administration. Small amounts of money are used by a minority of districts to support the administration of the program; more often than not, administrative time and support are donated.

- Other. A variety of other activities are supported in small numbers of cases, such as test development and validation, evaluation, or the purchase of instructional materials or equipment (where this is not part of a training activity).

How Program Funds Are Actually Spent

Program funds are spent on various things, but generally, the money divides fairly equally among five categories of expenditure; the overall amounts put to each purpose are summarized in Table 38.

- Materials and supplies. Because much of the training supported by the program has been about hands-on science and mathematics, it is natural that materials--both for training purposes and for teachers to take back to their classrooms--would be a major expense. In one large urban district, offering materials was a major incentive for getting teachers to training sessions.

- Salaries. A less frequent use of the money, for salary costs, is more likely in larger districts where sufficient funds are concentrated to support part or all of a staff person. In some cases, the money buys part of a specialist's time to carry out training or conduct follow-up activities; in other cases, the funds pay for a portion of the district curriculum supervisor's time (in cases where there would be only a part-time supervisor or none at all without the program). The costs of substitute teachers, to provide release time for teachers to attend training events, was also part of this category of expenditures.

- Travel. A majority of LEAs put some (or in a few cases all) of their money into travel to enable teachers to attend out-of-district events. Usually, teachers travel to state and regional events, and the costs per teacher therefore are not too substantial.

Table 38

HOW LEAs SPEND TITLE II FUNDS

Expenditure Category	Total Amount (and Percentage) of Year 4 Flow-Through Funds Spent By LEAs Not Served by IUs or Consortia[a]	Percentage of Districts Using Funds for This Purpose
Materials and supplies	$10,659,202 (21.1%)	59
Travel costs (e.g., for conferences)	8,234,360 (16.3%)	57
Participant stipends	8,032,290 (15.9%)	28
Salaries (including benefits)	8,689,018 (17.2%)	26
Consultant fees and expenses	8,032,290 (15.9%)	36
Equipment	4,142,439 (8.2%)	17
Other	2,727,948 (5.4%)	11
Total	$50,517,549 (100%)	

[a] The expenditure profile for LEAs served by IUs or consortia is similar.

- Participant stipends. Stipends for workshop participants accounted for nearly as much flow-through money as travel and were especially important in the case of intensive training in the summer, when teachers had to forgo other income-producing opportunities to attend training.
- Consultant fees and expenses. Program funding gives LEAs a way to bring in outside experts to do workshops, most of whom have to be paid. In some instances, high-caliber trainers are brought long distances to lead training sessions.

Other expenditures are less frequent. Equipment purchases, for example, account for less than 10% of total flow-through funding, even though under Title II all of an LEA's allotment could be put to this use (with a waiver granted by the relevant state agency), including up to 30% for computers and computer-related instructional equipment. (The Eisenhower program now greatly restricts purchase of equipment.) Site visits revealed few examples

of actual equipment purchased with Title II/Eisenhower funds, although the use of technology was frequently part of the workshop's focus.

The Extent and Nature of Professional Development Supported by the Program in LEAs and IUs

Large numbers of the nation's mathematics and science teachers are served through activities funded by the Title II/Eisenhower program. As Table 39 indicates, approximately a fifth of all elementary and secondary

Table 39

TEACHER PARTICIPATION IN DIFFERENT TYPES OF PROGRAM-SPONSORED PROFESSIONAL DEVELOPMENT ACTIVITY

Type of Activity	Total Number (and Percent) of All Science and Mathematics Teachers Nationwide[a]	
	... In Districts Not Served by IUs/Consortia	... In Districts Served by IUs/Consortia
Within-district inservice	326,496[b] (22%)	58,843[b] (5%)
Out-of-district professional development (e.g., conferences)	105,925[b] (7%)	5,930[b] (<1%)
College or university courses	19,714[b] (1%)	3,044[b] (<1%)
Other professional development	25,753[b] (2%)	363[b] (<1%)

[a] Based on NCES and NEA data, this presumes 1.24 million elementary teachers (who may teach mathematics or science) and 240,000 secondary teachers of mathematics or science.

[b] Please note: These numbers should not be summed, since they may include duplicate counting across types of activities.

teachers of mathematics or science (including all elementary teachers, who typically teach math and may teach science) participated in program-sponsored inservice activities conducted by LEAs during Year 4 of the program, and an additional 5% were part of inservice training hosted by IUs or consortia.A third as many (including some of the same teachers who were part of within-district inservice training) traveled to out-of-district events--for the most part, professional conferences.

As the data in the table imply, **the program is most often used as a way for LEAs to mount inservice training for their own staffs.** For obvious reasons, however, the smaller the district, the more likely they are to use program funds to support participation in out-of-district events (41% did so, as opposed to 25% that supported some kind of in-house activity); the largest districts, on the other hand, are much more likely to support training in-house (65% did so, as contrasted with 19% that used funds for out-of-district events). IUs provide services to their districts which are comparable to the services provided by very large districts.

Within-District Inservice Training

It is difficult to generalize about LEA-supported inservice training because the range of activities is so great. Site visits revealed a surprising variety of approaches to training. As one might expect, "focused-agenda" LEAs were more likely to have supported powerful forms of training--that is, those with follow-up mechanisms built in, greater-than-average intensities, highly qualified training staffs, and training aimed at teams of teachers from the same school rather than single individuals. Examples include the following:

- Extended academic year (or semester) training. One small suburban LEA used Title II/Eisenhower funds ($2,320 in 1988-89) to support an eight-session seminar in the use of manipulatives in elementary mathematics spread across the school year. Teachers from the district's four elementary schools met once a month for two-hour sessions to be introduced to new materials that they could then work into the next month's teaching. Subsequent sessions were a review and follow-up opportunity, as well as the time for introducing the next set of materials. Teachers were enthusiastic about the training and have incorporated much of what they learned into their practice.

- Training combined with materials. A number of districts found ways to combine training with the purchase and distribution of new science or mathematics materials, so that teachers had the wherewithal to put what they had learned into practice immediately, thus helping to overcome the chronic shortage of materials (required for hands-on science, for example) and thereby increasing the chances that what they were taught would become part of their classroom repertoires.

- School-site training and support. Part of one very large urban district's funds (totaling $159,000 in 1988-89) were used to support the activities of district-based resource teachers who are "on call" to any school in the district desiring their help. These individuals--themselves veteran mathematics and science teachers with long experience in the district--make numerous "house calls" on schools and help them to fashion school-based training or other forms of support as the school struggles to implement the district's new core curriculum.

- Follow-up support team systems. In one "focused-agenda" example, program funds ($20,000 in 1988-89) have supported the formation and operation of follow-up support teams that bring teachers together who have completed a district-funded training program introducing a new elementary mathematics curriculum. The support teams reinforce the messages of training and give teachers help while they are trying to introduce the new curriculum to their classrooms.

- Intensive training in the summer. A small rural district used its program funds for the last two years ($1,200 in 1988-89) to support a week-long introduction, to successive grades of lower elementary teachers, of a nationally validated health science curriculum for the elementary grades that features active hands-on instruction. Teachers who participated in this program are now using it in their classrooms throughout the year.

These are only a few of the forms that within-district training takes. Other forms of LEA-based inservice training are typically variations on the "one-shot workshop"--sometimes a day, more often an afternoon or a couple of hours once a year, at which teachers are exposed to some new ideas or instructional approaches. For various reasons, these types of training events were less likely to effect large-scale changes in classroom practice. Not surprisingly, these types of events were especially apparent in "unfocused-agenda" LEAs. For example:

- Weekday inservice (replacing part or all of the teacher's day). A large urban district brought in all its third- and fourth-grade teachers for an afternoon inservice session to discuss results of the state's mathematics proficiency test and to promote a problem-solving approach to math teaching. Although teachers were excited by the ideas, some that were interviewed felt they didn't get enough information to know what to do in the classroom.

- Weekend inservice events. A medium-sized urban school district used program funds one year to mount a series of Saturday sessions, to which science teachers came for help with hands-on science teaching.

Intensity of Training--As the preceding examples suggest, LEA-based inservice training sponsored by Title II/Eisenhower funds ranges in intensity from those that expose teachers to three hours or less of training or instruction per year (approximately a quarter of LEAs do so) to those that offer more intensive training experiences. Although the median LEA offers training that averages six hours per participant, 18% of the nation's LEAs offer training with three school days or more (18 hours or more) of exposure; 10% sponsor training events that total nearly a week or more of exposure.

The intensity of training bears some relationship to the size of the district, as shown in Table 40. The largest districts are twice as likely as the smallest to support intensive training. Nonetheless, a large percentage of districts in each size category (between 40% and 55%) use Title II funds to support activities in which participants receive six hours or less of training.

Targeting to Particular Types of Teachers--Approximately three-fifths of all districts target some or all of their Title II/Eisenhower resources on inservice training for particular types of teachers, as shown in Table 41. In addition, most districts aim at particular grade levels or ranges, as Table 42 reveals. Several observations about this targeting come to mind:

- LEAs are as likely to aim their staff development resources at teachers who can provide leadership to others as to support training for the least able teachers.
- Overall, more training is aimed at adequately or excellently prepared teachers than at poorly prepared teachers.
- LEAs are somewhat more likely to support training for elementary teachers than for those at other grade levels, mirroring the pattern of perceived needs reported earlier. This is especially true for LEAs served by IUs or consortia, a greater proportion of which serve grades K-8 only.
- LEAs target mathematics and science teachers in almost identical ways--that is, with the same degree of emphasis on particular grade levels.

Table 40

INTENSITY OF WITHIN-DISTRICT INSERVICE TRAINING
SUPPORTED BY TITLE II FUNDS

District Size Category (Enrollment Range)	Percentage of Districts in Each Size Category with the Following Average Hours per Participant in 1988-89		
	Six Hours or Less	Seven to Eighteen Hours	More than Eighteen Hours
Very large (25,000 or more)	40	34	26
Large (10,000-24,999)	48	30	22
Medium (2,500-9,999)	52	30	18
Small (600-2,499)	55	28	17
Very small (less than 600)	49	38	13

Table 41

TARGETING OF PROFESSIONAL DEVELOPMENT ON TEACHERS AT PARTICULAR LEVELS OF PROFICIENCY OR EXPERTISE

Targeting	Percentage Nationwide That Used Some or All of Their Program Funding in Year 4 as Shown: LEAs Not Served by IUs or Consortia	LEAs Served by IUs or Consortia
Targeting on particular types of teachers		
Yes	57	67
No	43	33
Training targeted to:		
"Lead" or master teachers, who will train others	40[a]	72[a]
Teachers adequately prepared in one area of math or science, who need retraining in another area	53[a]	94[a]
Underprepared teachers currently assigned to math or science	42[a]	68[a]
Out-of-field or uncertified teachers	5[a]	14[a]
Preservice teachers	7[a]	12[a]

[a] Percentage based on all districts nationwide, not just those that targeted activities to particular levels of teachers.

Table 42

TARGETING OF PROFESSIONAL DEVELOPMENT ON PARTICULAR GRADE LEVELS

Targeting to Subject and Grade Levels	Percentage of All Districts Targeting Professional Development to: Districts Not Served by IUs/Consortia	Districts Served by IUs/Consortia
Mathematics		
Elementary school	67	97
Middle/junior high school	57	89
High school	51	61
All levels	36	60
Science		
Elementary school	58	99
Middle/junior high school	55	89
High school	51	67
All levels	33	65

The degree of targeting is not surprising, given the small amount of resources at hand. As site visiting showed, local planners are reluctant to spread the already small resources to too many activities, and it is most natural to single out one or a few grade levels in a given year and emphasize other grade levels in subsequent years.

Targeting to Needs of Underrepresented Groups--Generally speaking, LEAs do not design inservice training specifically for teachers who deal primarily with children from one or another group that is underrepresented in mathematics or science learning or professions. Only 15% of all LEAs do so explicitly--half of these for teachers of minority children, two-fifths for teachers of handicapped children, and approximately a third for teachers of limited-English-proficient children.

Nonetheless, large numbers of participants are women and/or of minority background. The majority (71%) of participants in inservice training are women--a fact that is not surprising, given the heavy emphasis on the elementary school level and the general demographics of the teaching force. The proportion of participants from minority backgrounds is considerably smaller (14%), but this percentage exceeds the typical distribution of such individuals in the teaching force (8%)--the program is thus reaching these kinds of teachers in disproportionately large numbers.

As will be discussed in greater length in Part Four, the general lack of targeting to the needs of underrepresented groups does not necessarily mean that the needs of these groups are unattended to, or that these groups have been deliberately ignored in local planning for the use of Title II funds. Changing the modes of instruction to feature a more active, engaging kind of science and mathematics experience will do much to keep children from these groups participating in these subject areas.

Out-of-District Professional Development

Out-of-district events fall into three basic categories. The most prevalent are conferences, often associated with professional associations. For example, in many districts, a few teachers were helped by program funds to attend a meeting of the state affiliate of the National Science Teachers Association or the National Council of Teachers of Mathematics. Program funds were also used to facilitate participation in other kinds of local or regional conferences, and occasionally those at greater distance.

Courses on scientific or mathematical topics, or science and mathematics teaching, comprise a second category of outside activity supported by program funds. Typically, courses require more intensive involvement over time and are an option only in situations where an institution providing the course is located near enough to an LEA for teachers to attend classes on a regular basis. Not surprisingly, program funds are used for this purpose less frequently than for conferences. In the right situation, however, committed teachers could make excellent use of this opportunity, as did 12 teachers from one rural LEA who got master's degrees in science education with the aid of Title II funds.

Finally, there are a host of off-site workshops and other professional development opportunities located away from the district, which teachers took advantage of with support from the Title II/Eisenhower program. Examples from site visits include:

- Four teachers from one rural LEA went for a one-week workshop on the NCTM standards at a university on the other side of the state.
- A biology teacher from another rural LEA went to a biology workshop in a nearby city that is a prime paleontological excavation site. A geological/anthropological research group from England came to the site and gave a workshop related to their work for interested teachers in the area.
- A few teachers from an LEA in an agricultural area were sent with program funding to take part in computer practicums offered at a local IU (the LEA did not forward its program money to the IU; it simply paid on its own for travel and registration fees).

Directing the Flow of Funds in LEAs and IUs

As the discussion of LEA improvement strategies has implied, local leadership for mathematics and science improvement has much to do with how--and how well--Title II/Eisenhower funds are used. As might be expected from a program that is small and relatively invisible, local program leadership is extremely varied. Title II/Eisenhower coordinators in LEAs range from individuals who supervise mathematics and science education to federal program coordinators to those in charge of all staff development activities in the district.

The pattern of local program leadership varies somewhat by size of district, as the following examples from our site visits indicate:

- Title II/Eisenhower coordinators in very large districts. In one district, which split its funding in two (one for the high schools and the other for K-8 schools), the high school portion was coordinated by the Director of Staff Development and the elementary portion was decentralized with science, mathematics, or special program coordinators in each of the LEA's K-8 subdistricts sharing control over the funds. As a result of internal maneuvering, the directors of science or mathematics education for the LEA had no direct responsibility over the funds. By contrast, in another very large district, the individual who ran the science and mathematics curriculum unit in the LEA central office took sole charge of the Title II/Eisenhower funds.

- Title II/Eisenhower coordinators in medium-sized districts. District staff with responsibility for coordinating mathematics and science education are often in charge of Title II/Eisenhower funds, as in the case of an LEA in a sparsely populated rural county. There, a district mathematics coordinator, assisted by a full-time science teacher (who acts as the LEA's science supervisor as well), oversaw the use of the Title II/Eisenhower funds. By contrast, in other LEAs, responsibility for the program is lodged with people who have a broader, less specialized role, as in one suburban/rural LEA, in which the Director of Instructional Support took charge of the funds. This individual's role included the oversight of new programs and curriculum and, along with that, the provision of support to teachers who were undertaking these new programs or curricula.

- Title II/Eisenhower coordinators in small districts. In one rural school district, coordination of the program fell to the principal of the two elementary schools (the same person had responsibility for both); in fact, he had a fairly strong background in mathematics and science education, and had successfully obtained for grants to do improvement projects in the past. In another case, the assistant

superintendent for curriculum and instruction took responsibility for managing the funds. He had no particular background in mathematics or science education, but staff development and grants development were a major part of his job description, so the program gravitated to his desk.

The typical pattern of control over the program funds seems to be the following: one individual, or sometimes several, take control over the money fairly early in the lifetime of the program and use it to advance their particular agenda for improving mathematics or science education. The individual acts as a "champion" for the funds, and personally determines the use of them, with varying degrees of input from relevant parties. A number of districts split the control over the funds somewhat mechanically between mathematics and science, or between elementary and secondary levels; in such instances, the pattern repeats itself in each individual's bailiwick.

Generally speaking, the program is too small to encourage an extensive consultation process, although the larger the annual grant, the more likely it was for some formal consultation mechanism to be established. In site visits among LEAs of all sizes, there were few instances of formal advisory groups or other features of multistep decisionmaking, such as are common in other federal programs. Rather, the Title II/Eisenhower coordinator consulted individuals informally--for example, a few principals and teachers, often those who would be part of the training event, or district staff most likely to be involved in carrying out professional development activities (in larger districts). The highest levels of LEA staff were typically uninvolved in decisions about the program (one big-city superintendent in the study sample had never heard of Title II). The relative invisibility of the program, in addition to its small size, contributed to this decisionmaking pattern--and in some instances the "champion" for the funds tried to keep the consultation pattern small and informal to maintain control over a useful source of funding.

Because of this pattern of control over the funds, the characteristics of the Title II/Eisenhower coordinators have a great deal to do with the direction and impact of these funds. Nationwide, the following can be said of such individuals:

- Stability. Coordination of the program is fairly stable: in nearly half of all LEAs (41%), the same individual has been in charge of the program for the full five years of Title II/Eisenhower.

- Part-time responsibility. For nearly all (98%), the program is only part of what they do, and typically a very small part.

- Subject-area expertise. Approximately a third of all Title II/Eisenhower coordinators have the coordination of mathematics and science education as a major responsibility. This is typical of the larger LEAs, which are most likely to employ such individuals as district staff: in approximately three-quarters of very large LEAs, for example, Title II/Eisenhower coordinators have this role, compared with one-quarter of the very small LEAs.

- Overall responsibility for curriculum and instruction. Two-thirds of Title II/Eisenhower coordinators have overall administrative responsibility for curriculum and instruction across all subject areas, especially in the smallest districts (three-quarters of which have individuals with this responsibility overseeing the program).

- Responsibility for staff development. Approximately half of all Title II/Eisenhower coordinators are in charge of staff development for the LEA, regardless of district size.

- Classroom teaching assignments. Individuals with classroom teaching roles are not often in charge of the program (14% of all LEAs).

Administering the program is understandably a simple affair for most of these staff. Only in the largest districts does the program reach the proportions that require a substantial amount of anyone's time to manage the decisionmaking, consultation, applications to the state, planning and oversight for the funded activities, bookkeeping, and evaluation (when it is done). Typically, these matters require only a small number of meetings, correspondence with the state agency several times a year, and brief focused activities by the administrator(s) in charge at certain times of the year. In instances where Title II/Eisenhower is folded in with other programs, its administration is indistinguishable from the management of the larger set of activities of which it is a part.

Groups and agencies outside the LEA may become involved in the activities supported by the program. This is most likely in the largest districts, which have more funds to work with, and hence are more likely to seek partners to join in their efforts to improve mathematics and science

education. The largest districts are especially likely to join forces with nearby institutions of higher education (89% do so). The one exception is that the smallest districts are much more likely to collaborate with regional or intermediate units of some kind; alternatively, as discussed at length in Chapter VI, they simply forward their money to a nearby IU or consortial arrangement and receive Title II/Eisenhower services that way.

V IMPACTS OF FLOW-THROUGH FUNDS IN LOCAL EDUCATION AGENCIES

As discussed in the introduction to this report, the Title II/Eisenhower program can have various kinds of impacts in--and on--local education agencies, in particular, the following four:

- Institutional impacts: how the presence, funding, and requirements of the program have changed the LEA's leadership, capacity for undertaking improvement efforts, or institutional relationships inside and outside the LEA.
- Impacts on individual teachers as professionals: how participation in program-sponsored activities has affected individual teachers' attitudes, knowledge, ideas about teaching, access to colleagues, or commitments to the profession.
- Impacts on curricula and school programs: how professional development sponsored by the program has influenced the design of mathematics and science programs currently used in schools.
- Impacts on classroom practice and student learning: the extent to which professional development sponsored by the program translates into changed practices in the classroom, and ultimately alters the students' experience.

Although in many respects the last type of impact represents the program's "bottom line," the direct effects of the program in local education agencies include all of the above. Ultimately, student learning will be affected only in proportion to the institutional, professional, and programmatic changes in the system of schooling of which students are a part.

Institutional Impacts

A program like Title II/Eisenhower can influence the LEA as an institution in three important ways: (1) the program can stimulate or enhance leadership assumed by LEA staff for the ongoing improvement of the target

subject areas; (2) the program can change LEA or school capacity for improving mathematics and science education judged in terms of staff expertise and resources available for professional development or related activities; and (3) planning and implementing funded activities can alter the network of relationships among key groups inside and outside the LEA who are concerned about the improvement of these subject areas. Data from site visits, along with some information from the study's surveys, shed light on these matters.

LEA Leadership

The most significant impact in this regard follows from our discussion in the preceding chapter of LEAs with focused and unfocused improvement agendas: **Title II/Eisenhower funds enable preexisting leaders to extend their programs or otherwise push their agendas. The program does not create such leaders; it merely enhances their activities by providing them more wherewithal and also a certain legitimation due to the targeted nature of the funding.** In this sense, flow-through funds are a key leadership resource, but mainly where the LEA is already geared up--or is in the process of gearing up--to improve mathematics and science education.

Site visits provided numerous examples of such leaders making productive use of Title II/Eisenhower funds. For example:

- In one big city school district, the program's funds have become one more resource in a portfolio of funding controlled by the district director of science and mathematics curriculum. This individual is pursuing an ambitious reform program in these two subject areas that is associated with LEA-wide restructuring efforts. He finds the program's resources especially flexible and without the restrictions of specially funded projects (of which he has several).

- Title II/Eisenhower funds in a rural district have enabled the Title II coordinator to act in an informal support capacity for other neighboring districts in the isolated agricultural area in which his district is located. He uses the program funds to bring adjunct professors from a nearby university to do workshops on various topics. In this capacity, he has been instrumental in assisting others to understand and act on NCTM standards, among other issues of concern in mathematics teaching.

But there is no guarantee that the strong agenda of a local leader will be well conceived or on target. One site visit revealed that an IU staff person responsible for Title II/Eisenhower funds had poured tens of thousands of dollars (from several sources) into a wide variety of computer and video hardware and software--yet there turned out to be relatively low use of the technology by many teachers served by the IU. Despite state-level review, the program is still not foolproof--it empowers wrong-headed leaders as well as those with reasonable approaches to the task at hand.

LEA Capacity: Professional Development Resources and Staff Expertise

The principal effect of the program on LEA capacity is that it has substantially augmented the pool of resources LEAs direct at professional development in the target subject areas. In addition, it has helped to develop school-level staff expertise, principally by training and supporting lead teachers, mentors, and other specialists who can--and sometimes do--help their colleagues. The magnitude of these impacts is hard to estimate, but is probably small.

LEA Resources for Professional Development--An increase in the pool of resources for professional development in the target subject areas has occurred simply because, in most cases, relatively little was being invested in staff development overall before the coming of the program, and under such circumstances, staff development in mathematics or science had to compete with other subject areas for the scarce resources. When Title II/Eisenhower funding arrived, it was earmarked for mathematics and science (and in its first four years two other subject areas), which guaranteed that it would be spent in these areas. Small as it may have been, it was often the only set of resources, or at least the primary resource, available for this purpose. As the survey data suggest, in approximately two-thirds of all LEAs not served by IUs, Title II/Eisenhower funds are considered the "primary funding for mathematics and science improvement."

There are exceptions to this pattern, such as a very large urban district in which a special levy had been passed by the City Council to address the training needs of mathematics and science teachers, a small suburban district with a virtually "unlimited budget for staff development," or a medium-sized district that had received windfall state lottery money sufficient to cover all conceivable professional development needs. In such instances, Title II/Eisenhower funds were a useful but nonessential addition to an already adequate pool of resources.

But such instances were not typical. More often, the funds simply increased the number of teachers who could be served, made more time available for professional development, and made it easier for teachers to participate (by providing for release time, teacher incentives, or support for travel expenses), as indicated in Table 43.

Table 43

IMPACTS ON THE QUANTITY OF PROFESSIONAL DEVELOPMENT OFFERED BY LOCAL EDUCATION AGENCIES (NOT SERVED BY IUs OR CONSORTIA)[a]

	Percentage of Districts Indicating "A Fair Amount" or "A Great Deal,"[b] by District Size				
"Title II Funding Has..."	Very Large	Large	Medium	Small	Very Small
Increased number of teachers served	89	83	64	43	43
Increased time for professional development	88	81	66	45	24
Provided more release time	56	62	48	37	34
Provided teacher incentives	77	67	47	33	42
Paid for travel expenses	55	60	45	52	29

[a] The pattern for LEAs served by IUs or consortia is similar.

[b] Based on a 4-point scale: 1 = not at all; 2 = somewhat; 3 = a fair amount; 4 = a great deal.

The pattern in the table points to a basic fact about the program's impact on resources: the perception of impact depends to a great extent on the size of the district--the larger the district, the more likely respondents reported that the program had influenced more than one aspect of the resource pool for professional development. This is not surprising, given the direct relationship between district size and the amount of funds a district has to work with.

The program appears to have some effect on leveraging of funds--that is, instances in which Title II/Eisenhower resources are used to attract other funds to the purposes of mathematics and science improvement. The magnitude of this effect is hard to gauge, however, and judging from site visit data, is small at best. The site visits uncovered several obvious examples of this kind of effect:

- Title II/Eisenhower money as matching funds. There are situations in which Title II funds, with or without district funding, were used as part of the in-kind matching funds required by other grant funding.
- Title II funds as seed money. Pilot activities funded with Title II/Eisenhower money were sometimes used as a feasibility test for ideas that enabled LEAs to secure more substantial grant funding--as in the case of a very large urban district that secured a National Science Foundation grant for developing technology-based curriculum, in part, on the basis of pilot work done under sponsorship of Title II/Eisenhower funds.

There is no direct evidence regarding the incidence of leveraging nationwide, other than the fact that approximately two-fifths (39%) of all districts (not served by IUs) indicate that the program's resources are helpful in leveraging other kinds of funding. Little clear evidence of substantial leveraging, however, could be detected during site visits.

Staff Capacity at the District and School Level--For reasons that are fairly straightforward, the program contributes little to the permanent district-level staff capacity for improvement of mathematics and science education, except in the largest districts--and in many IUs--where the program pays for additional staff (or parts of staff) who have subject area or staff development expertise. Otherwise, LEA staffing has been

unaffected by the coming of the program. Those LEAs who had individuals well grounded in the subject areas before the program were more likely to behave as "focused-agenda" districts after the program began (see discussion in Chapter IV). The more typical contribution of the program to district-level staff expertise is temporary, and occurs in those instances (more than half of all LEAs not served by IUs or consortia) where program funds bring in consultants to act as trainers at particular professional development events.

However, there is evidence that a more subtle, long-term capacity building is occurring under program sponsorship at the school level (in some cases at the district level as well), through training for lead teachers, mentors, and other forms of specialist teachers who are expected to provide further support to their colleagues after training. As in the case of leveraging effects, there is no easy way to estimate the magnitude of this impact, beyond noting the proportion of districts in which this form of training is supported by the program, as shown in Table 44.

There is both more and less than meets the eye in LEA-based lead teacher or specialist training sponsored by Title II/Eisenhower funds. Activities aimed at this goal were commonly encountered in site visits; clearly, some were more carefully conceived than others and thus had a better chance of achieving the second-stage impact on colleagues who were not part of program-sponsored training. In poorly conceived cases, the rationale for supporting lead teacher training usually boils down to a wish or hope that, by training the best and exhorting them to help their colleagues, a small amount of staff development money could be made to go farther. In such instances, there was little evidence that lead teachers were performing their leadership role, except in isolated individual cases.

On the other hand, more carefully conceived lead teacher training--and the study team uncovered examples of that--is providing participants with the leadership tools, motivation, and support necessary to carry out their lead teacher role. The most successful examples were at the elementary level:

- Training of elementary science specialists. In one K-8 subdistrict in a big-city LEA, a great deal of emphasis was placed on school-site planning for the use of Title II/Eisenhower staff development funds. In one school, a teacher heading the school improvement committee received training in the use of plants in teaching botany to early elementary grade students, then organized large-scale training for her colleagues on the same topic.

- Training of elementary mathematics and science mentors. In this large county district, Title II/Eisenhower funds were used for several years running to support a mini-conference aimed initially at training lead teachers in elementary mathematics and science. These teachers subsequently surveyed available materials, designed activities, and sponsored mini-conferences for all other elementary teachers in the district.

Table 44

THE PROGRAM'S ROLE IN BUILDING SCHOOL-LEVEL CAPACITY FOR PROFESSIONAL DEVELOPMENT

LEA Size Category (Enrollment Range)	Percentage of Districts (Not Served by IUs) That Used Year 4 funds to Support Training for Lead Teachers or Specialists		
	In Mathematics	In Science	In Any Subject Area
Very large (25,000 or more)	53	44	76
Large (10,000-24,999)	29	31	71
Medium (2,500-9,999)	25	26	55
Small (600-2,499)	17	21	39
Very small (less than 600)	13	12	14
All districts	20	21	40

The results of these training activities will only be apparent over time, as the individuals so trained carry on an informal support function within the school buildings in which they teach. There are already indications that this is happening in some cases. Generally speaking, lead teacher training sponsored by LEAs is weaker than when done by--or in conjunction with--IHEs (see Chapter VIII discussion).

The Network of Relationships Among Key Groups

Although in principle the program can encourage various forms of collaborative activity--in which the LEA joins forces with neighboring institutions to attack science or mathematics needs--there is less evidence of such activity that is attributable to the Title II/Eisenhower program directly or indirectly. The majority of LEAs have not formed institutional partnerships with other groups to carry out activities funded by the program, as Table 45 indicates.

Where interinstitutional relationships exist, they were typically formed before Title II/Eisenhower and are maintained independently of the activities funded by the program. The types of collaborating partners typically represent those most readily available and most likely to have mathematics or science education expertise. Very large LEAs, which usually are located in large metropolitan areas, often turn to local institutions of higher education, which are numerous in such settings. Very small LEAs, by contrast, more often turn to IUs or equivalent regional entities, which are typically the only organization within reach that can help out with professional development needs. In some instances, these relationships are enhanced or maintained by activities funded by Title II/Eisenhower, but the effect is generally negligible.

Table 45

LOCAL INTERAGENCY COLLABORATION UNDER THE TITLE II/EISENHOWER PROGRAM

Type of Organization	Among Districts[a] That Collaborated with Other Organizations, the Percentage That Joined Forces with Each Type of Organization		
	Very Large LEAs	Very Small LEAs	All LEAs
Other LEAs	31	39	39
Institutions of higher education (IHEs)	89	23	44
Private business and industry	21	0	8
Private, nonprofit institutions	36	6	10
Professional societies/associations	38	12	18
Regional/intermediate education units	22	51	43
(Percentage of all LEAs that did not collaborate with outside organizations)	(29)	(52)	(54)

[a] LEAs not served by IUs or consortia.

Impacts on Individual Teachers As Professionals

Perhaps the clearest local-level effect of LEA flow-through funding is that large numbers of teachers are rejuvenated by their experiences in Title II/Eisenhower-supported professional development, whether within-district training or out-of-district events such as conferences. Although one must be careful not to exaggerate the effect on teachers of the typical workshop experience--one or a few days' interaction with other teachers and trainers--it must be remembered that for most teachers, their participation in such events is their first in many years; many respondents reported that before Title II, there had been a long dry spell in support for staff

development in mathematics and science. In such circumstances, it doesn't take much to get people excited about what they are doing. A veteran high school mathematics teacher from a large city who had participated in a week-long summer institute, organized by the LEA and funded by Title II/ Eisenhower money, commented on her experience as follows:

> *Before [taking a childcare leave], I taught a lot of advanced mathematics; my major love was geometry.... I took the institute because I loved that aspect of mathematics and was so out of touch. I wanted to find out what was new.... I came out of the training [and realized] that I had been teaching basic math so much that I had lost touch with my love for mathematics. I said to myself, "Gee, I should be doing this, and I'm not." I enjoyed the institute. It opened my eyes. Teachers were really doing it [hands-on, conceptually oriented teaching of geometry].*

An upper-elementary teacher in a large urban district, who had done relatively little science teaching over the last five years, came away from a one-day workshop with the following comments:

> *The workshop got me excited. I guess maybe it was time for a change. I felt like a student. They put us through each of the experiments, and it made me realize what children will learn or see....*

Across the variety of training experiences that were examined during site visits, there were various ingredients to the excitement that many teachers felt, among them:

- Exposure to content and teaching ideas after long absence from such experiences.
- Opportunity to interact with teachers one did not know or with little-known colleagues.
- Contagion: absorbing some of the excitement that trainers expressed in presenting material to workshop participants.
- Connection to national reform movements: opportunity to learn more about ideas that many teachers have begun to hear about.
- Being treated as a full professional--especially true of training aimed at lead teachers or specialists, and where teachers were provided stipends or other incentives that communicated that a high value was placed on training.
- Participating in training that had career-enhancing potential, as in the case of teachers attending credit-bearing courses at local institutions of higher education.

Not all training experiences are equally inspiring. Rejuvenating teachers is far from automatic, and there is nothing built into the funding mechanism or the resources the Title II/Eisenhower program provides that can ensure this result. Teachers were most enthusiastic about professional development experiences where they were exposed to top-notch trainers who could present practical material that applied to their teaching situation. Furthermore, the fact that many of the training experiences were about hands-on teaching in mathematics or science enabled them to be done in a fun way, a fact that no doubt increased teachers' level of excitement. One first-grade teacher contrasted the mathematics methods course she had taken three years earlier as part of her teaching credential program at a state college with the Title II/Eisenhower-funded workshop series in the use of mathematics manipulatives put on by her LEA:

> *The math methods courses I took at state college were very weak.... I got more out of the inservice by far. The methods course instructor was in his late 60s; he had been out of the classroom a long time, so what he taught us was abstract and broad. We didn't get hands-on experience.... I took a lot of math in college, but I was not realizing how kids learn. The inservice course brought it all down to a kid's level.*

Where the right combinations of trainers, topics, materials, and settings are arranged by the LEA, this kind of effect is easily achieved. Elsewhere, the impact of the program on individual teachers was small.

Rejuvenation and inspiration often appear to go hand in hand with getting new, usable ideas for teaching. This is a second substantial effect on individual teachers. Many of the workshop or conference experiences funded by the program seem to have changed teachers' thinking about particular aspects of their teaching, in particular:

- Ideas for demonstrations, ways to make concepts understandable and vivid to children.
- Ways to engage or motivate learners in mathematics and science lessons.
- New curricula or units to be introduced to classes.

These kinds of ideas are most likely to take root as a result of training in which teachers experience--both as learner and teacher--the idea in practice. The examples cited above of teachers reflecting on hands-on mathematics and science workshops illustrate the point. Whether these ideas transfer into practice and become part of the teacher's repertoire of pedagogical skills is another matter (see discussion below). There is no basis for asserting that teachers' pedagogical skills have changed dramatically or quickly as a result of training experiences supported by Title II/Eisenhower funds, especially in the short term. Such changes typically evolve more slowly, as a result of trial, error, and persistence.

LEA-sponsored professional development under this program seems to have its least powerful effects on individual teachers' scientific or mathematical content knowledge. There were few instances across nearly 40 LEA site visits in which content was a prime focus of training (graduate coursework sponsored by the program is an exception). More typically, courses dealt with issues of how to teach, rather than what to teach. There are various explanations for this state of affairs. For one thing, the short duration of LEA-sponsored training typically precluded extensive attention to issues of content. For another, many teachers interviewed did not see a lack of content knowledge as their primary problem.

Effects on individual teachers tended to be more pronounced and varied as a result of the more intensive training experiences. In such instances, teachers appear to have been influenced in ways that resemble the effects of IHE projects funded by Title II/Eisenhower. These effects are described at length in Chapter VIII.

Impacts on Curricula and School Programs

The mathematics or science curriculum per se was less often the target of flow-through funding from the Title II/Eisenhower program. As described in Chapter IV, only a small percentage of districts nationwide put their money into some form of "curriculum development" (approximately 13% did so

and allocated to this function a total of $2,778,465 in Year 4, a tiny sum by comparison with the typical cost of high-quality curriculum work, which often requires hundreds of thousands of dollars to produce a single curriculum).

A somewhat extreme example of such investments in a big-city school district illustrates the potential problems with this use of the funds. In this instance, Title II/Eisenhower funds paid for software and some other aspects of a pilot project developing videodisc science curriculum for the high school level. Prototypes of several videodisc units were created, and because the results appeared promising, the LEA managed to secure funding from other sources. The ultimate payoff has yet to be realized; few schools in this district have videodisc players to begin with, and teachers are generally unfamiliar with the technology. Thus, a substantial investment in equipment and training will be necessary to carry the results of this project from the small number of pilot schools to widespread use. In this case, the cost-benefit ratio is relatively high; in other cases of curriculum development from scratch, though less costly, the same basic pattern holds. Title II/Eisenhower funds are simply insufficient to account for much of the development effort.

However, there are three other ways that the program can influence the curricula in use among a large number of districts, with more immediate and far reaching payoff:

(1) Introducing new curricula. As shown in Table 46, activities funded by the Title II/Eisenhower program are often one key step in implementing a new curriculum developed elsewhere (e.g., a published series or nationally validated program).

(2) Incorporating the development of materials into training. Also as shown in the table, professional development often embeds within it the development of materials or activities for use in the classroom--in other words, teachers act as adapters of curriculum to suit the needs and conditions of their own individual teaching situations.

(3) Revising or upgrading district curricula. Small groups of teachers are often assembled to revise or upgrade the district's curriculum, thereby creating materials that large numbers of teachers in the district can use. A common pattern here is to support a group of teachers for an intensive week during the summer.

Table 46

FOCUS OF TITLE II-SUPPORTED PROFESSIONAL DEVELOPMENT ON MATHEMATICS AND SCIENCE CURRICULUM

Focus of Professional Development	Among Districts Whose Teachers Participated in Mathematics or Science Professional Development, the Percentage Focused on Curricular Activities	
	In LEAs Not Served by IUs or Consortia	In LEAs Served by IUs or Consortia
In mathematics-oriented activities		
Developing activities/units	61	60
Introducing new curriculum	30	29
In science-oriented activities		
Developing activities/units	70	78
Introducing new curriculum	26	24

The study team found examples of all three kinds of curriculum work in site visits:

- Introduction of a new curriculum developed elsewhere. Two LEAs mentioned in Chapter IV provide clear examples of this type of use. In one case, a small rural LEA used Title II/Eisenhower funds to pay teachers stipends to come to a one-week summer institute to introduce them to Growing Healthy, a nationally validated health science program for elementary grades. In the other, a large urban district that was introducing a manipulatives-based program for lower elementary grades created follow-up support groups with Title II/Eisenhower support, to reinforce the training teachers had received previously. In both cases, there was clear evidence that the curriculum was successfully introduced.

- Professional development that involves the creation of materials for use in the classroom. In one large-city LEA, training in the Family Math program, which included teachers, placed heavy emphasis on the creation of physical models for representing mathematical ideas.

- Revision or upgrading of district curricula by teams of teachers. In one state in particular, which had revised its state elementary science syllabus in the mid-1980s and followed that with the introduction of an elementary science test several years later, Title II/Eisenhower funds were used widely to support small groups of teachers working together in the summer to produce a new and expanded version of district curriculum guidelines for elementary science. The actual spread and use of these materials varied; in one case, they seem to be currently in common use, in another LEA only in some classrooms.

As the examples suggest, the creation of new curricular materials does not ensure that this curriculum will be used in schools across the district. To accomplish that, the various factors discussed later in this chapter (in relation to effects on classroom practice) must be in place.

Title II/Eisenhower funds are unlikely to affect the school program as a whole, for a number of reasons (not limited to the size of the allocation). Except in unusual circumstances, teams of teachers from the same school are not trained as a group, thereby reducing the chance that the collective thinking and practice of a school faculty could be affected by the same staff development effort. For another thing, many aspects of a school's mathematics and science program lie outside the purview of professional development, and, with some exceptions, Title II/Eisenhower funding cannot be used to influence them. Course sequences and the articulation of courses across grades, equipment and facilities, teacher salaries and working conditions, and the restructuring of the school day are among the facets of local academic programs that Title II/Eisenhower has little to do with. The fact that the program is not designed to address these elements represents a distinct limitation on its capacity to bring about change (see further discussion of the limitations on the program's contribution to changing mathematics and science education in Chapter XI). However, the larger reform efforts of which Title II/Eisenhower-sponsored activities are a part often do seek the broader changes that are required.

Impacts on Classroom Practice and Student Learning

The impacts of the program on classroom practice- and hence on student learning--are mixed. In many districts that were studied, classroom

practice has clearly been influenced by the professional development opportunities made available to teachers with Title II/Eisenhower funding. In others, teachers have picked up some of the ingredients of more successful and challenging science or mathematics teaching, but lacked others. Finally, there are many instances where no clear link can be traced between program-sponsored professional development and what takes place in the classroom.

Factors That Make Transfer to Classroom Practice Likely

The key to understanding the impacts of Title II/Eisenhower on classroom practice is to pinpoint the factors that make the transfer possible. Site visits reveal various ingredients that encourage the transfer of training from workshop to classroom. These factors are consistent with the current literature on effective staff development (see Chapter X).

- Intensive training. Brief workshop experiences (e.g., one day or less) were less likely to provide teachers with enough ideas, material, or confidence to apply what they had learned to their classrooms. Training events of three days or more had a much better chance; more than a week was better still.

- Follow-up support system. Transfer to the classroom was more likely where districts provided, or arranged for, a knowledgeable person to visit teachers' rooms periodically to reinforce what was introduced during training.

- School-level support for implementation. Principals, department heads, and other administrators can have considerable influence over what teachers do. In cases where these individuals were sympathetic with the goals of professional development and provided teachers with the necessary support, teachers' motivation to implement what they had learned was much greater.

- Accompanying implementation mandate from the district or state. For obvious reasons, teachers tended to take what they learned in workshops seriously when they knew they were supposed to apply what they were being exposed to (assuming they agreed with the mandate to begin with).

- Adequate incentives for teachers' participation. Districts that paid their teachers to attend workshops (especially in the summer) or provided other forms of incentive for participation were more likely to elicit enthusiasm, interest, and willingness to try out what was part of the training.

- Teachers' participation in planning. When teachers were involved in planning the professional development in which they were to participate, their commitment to what they were learning and willingness to apply it to their classrooms were increased.

- Adaptation of curriculum to the teachers' particular assignment. Professional development that allowed or required teachers to adapt content and approaches to the particular circumstances of their classroom assignment was more likely to result in transfer to practice.

- Experiential emphasis. Teachers seemed most confident of themselves when applying instructional ideas that they had experienced, as learners, during training sessions.

Where these factors are found, they provide the basic explanation for the impact of program-sponsored professional development on classroom practice. The focus of the training, of course, differs a great deal across LEAs, a fact that has implications for whether particular factors are more or less relevant. Not all training concerns a discrete program that is to be implemented in classrooms, and hence adapting materials or focusing on experiential training techniques might not be so appropriate. Nonetheless, the more successful training activities that were studied showed the majority of the factors noted above in operation.

When Title II/Eisenhower-sponsored training does little to influence the classroom, many, if not most, of the above factors typically are not present. A case in point occurred in a large urban district visited as part of the study, which chose to use some of its Title II/Eisenhower funds to have all upper-elementary teachers participate in a half-day workshop dealing with the state's mathematics proficiency test scores. The presentation was meant to convey to teachers a detailed sense of where the children were performing well and poorly, and also to give them ideas about orienting teaching toward the conceptual basis of mathematics, building problem-solving strategies into their teaching, and at the same time deemphasizing the teaching of arithmetic. The teachers who attended were interested and excited by what they heard--the presenter was a well-liked and dynamic district mathematics coordinator. But there was little sense of transfer to practice. One fifth-grade teacher, who had taught in the system over 20 years, observed:

He was trying to show us that we were not approaching math in the right way. He was trying to teach us how to teach concepts rather than arithmetic.... When we came out of that inservice, our group asked [the trainer] if he would do additional inservice sometime for us. We didn't get enough specifics to know what to do in the classroom.

A quick analysis of this example reveals the absence of most of the factors associated with transfer to practice: the workshop experience was of extremely low intensity (three hours long, two of which were devoted to issues that bore directly on classroom practice); there was little chance for the participants to experience, practice, or adapt the approach being presented for use in their classrooms; there was no follow-up, nor focused support by building administrators for the messages of the training; the emphasis on conceptually oriented mathematics clearly had the district's blessing but was not part of a local or state implementation mandate. It is not surprising that this experience caused little change in teachers' classrooms.

It is important to understand the role of the Title II/Eisenhower program in bringing about these effects or lack of effects. The program makes it possible to hold intensive summer institutes (for a small number of teachers) and brief, one-time workshops (for a large number of teachers). The decisions made in designing these experiences are mainly the responsibility of local planners. This is both a key strength of Title II/Eisenhower flow-through funding and its ultimate weakness with respect to influencing classroom practice. The program enables but does not determine. It cannot force poorly conceived professional development to be otherwise.

This argument must be qualified in several ways: First, even well-conceived and well-executed professional development does not work--or work equally well--with all teachers. For example, teachers sometimes get part of the message (use demonstrations and hands-on activities) but fail to catch the rest (connect the demonstrations and activities with scientific ideas), as illustrated by the following lesson we observed:

- A health science lesson in Mrs. B's third-grade class. This lesson introduced children to the digestive system. Mrs. B put up a list of 11 terms for the parts of the system (mouth, esophagus, stomach, etc.) and drilled the children for 10 to 15 minutes on pronunciation

and definitions of the terms. Eyes wandered and attention flagged until she shifted to the second part of the lesson, in which she had the children "feed" a school lunch bit by bit into a kitchen blender to simulate digestion. The kids were wild with enthusiasm, but no attempt was made to discuss, explore, or draw parallels between the demonstration and the topic of the lesson. In effect, the demonstration served as a motivator, nothing more. During the last 15 minutes, the teacher returned to the list of terms--children once again practiced them, saying and defining each orally and finally writing sentences that used each term correctly. It was not clear what children had learned about digestion other than vocabulary.

Second, some professional development experiences are not meant to have a direct or immediate impact on the classroom, although they may nonetheless be very valuable to the teachers involved. For example, professional conferences--a popular use of Title II/Eisenhower funds--typically are not focused on a particular aspect of a teacher's curriculum, although the participants often take away a variety of ideas that subsequently might work their way into practice. Similarly, teachers often come away from conferences with a greater awareness of larger trends in the field--for example, many teachers attending mathematics conferences came away with a grasp of the NCTM Standards, many for the first time. The standards, by themselves, are hard to apply directly to teaching, except as a framework to guide teachers' thinking.

Prevalence of Professional Development That Encourages Transfer to Classroom Practice

There is no way of knowing from the study data how frequently professional development experiences supported by the program are designed so that they maximize impact on the classroom--that is, with all or most of the above factors in place. However, the survey data shed light on four of the ingredients: the intensity of training offered by LEAs with funding from Title II/Eisenhower; the use of incentives to encourage teacher participation; the participation of teachers in planning professional development; and the adaptation of curriculum to the teacher's particular classroom circumstances. From these data, it seems reasonable to conclude that Title II-supported professional development encourages transfer to classroom practice in large numbers, though not a majority, of LEAs.

As reported in the preceding chapter, the typical training event lasts a school day (six hours); in 18% of all LEAs (not served by IUs or consortia), participants experienced more than three days of training, and in approximately 10% of all LEAs, training was of a week's intensity or greater. These figures alone (and by itself, intensity of training is insufficient to establish the value of a given training event) suggest that a substantial proportion, but not the majority, of training events were of sufficient intensity to make transfer to the classroom likely.

Regarding incentives for teacher participation, 37% of all LEAs used some or all of their Title II dollars in 1988-89 for participant stipends. A slightly higher percentage (42%) indicated that, in one way or another, the Title II funds had provided incentives (such as stipends and sabbatical leave credits) for teacher participation "a fair amount" or "a great deal." Site visits confirmed that teachers were strongly motivated to attend professional development events by such incentives.

Teachers appear to be participating in planning for district-sponsored professional development in a large fraction of LEAs. Survey responses indicate that in 47% of all LEAs, teachers and principals were considered to be the most influential group in decisions made about the use of 1988-89 Title II funds. Although site visits suggest that in some instances survey respondents may have overstated the role played by teachers in planning, they clearly have an important role in a large fraction of districts, perhaps as many as two-fifths of all LEAs.

Title II-sponsored professional development in LEAs is especially likely to emphasize the adaptation of curriculum by teachers for their particular needs. As noted earlier in this chapter (see Table 46), 61% and 70% of districts, respectively, made the development of activities and units a focus of the mathematics- and science-oriented training activities supported by Title II flow-through funds.

These data do not establish definitively the incidence of factors that encourage professional development to exert a direct and visible effect on

classroom practice. But the data strongly suggest that such conditions pertain in large numbers of districts.

One is left to judge this aspect of the program as a glass half full or half empty, depending on what one expects the program to accomplish. But as currently conceived, the LEA component of the program shifts the burden of expectations to local planners, and their expectations for the use of the funds, which are often quite modest, are typically well met.

VI SPECIAL ISSUES RELATED TO THE LOCAL EDUCATION AGENCY FLOW-THROUGH COMPONENT OF THE PROGRAM

Several important issues related to the Title II/Eisenhower program and the way it serves local education agencies through flow-through funding have not been fully addressed in the preceding two chapters:

(1) The special case of the small district. Given the small amount of funding that is awarded to the smallest districts, how do they use these funds and how useful to them are these resources?

(2) Serving nonpublic school students. What does the program do for nonpublic school students?

(3) Addressing the needs of underrepresented groups. What do LEAs do to meet the needs of female students, minorities, and others who traditionally have been underrepresented in mathematics and science?

(4) The problem of focusing the funds. How do LEAs assess their needs that the program may address, and how do local planners know what progress they are making toward meeting these needs?

This chapter is devoted to a review of survey and site visit evidence related to each of these topics.

The Special Case of the Small District

As noted in Chapter IV, small districts receive relatively little money under the Title II/Eisenhower program--for the 1988-89 school year, a median of $582 per year in the smallest LEAs (those with enrollments less than 600) and a median of $1,655 in the next-smallest size category (with enrollments between 600 and 2,500). The analysis reported in that chapter also made the following points:

- Even though most small districts do accept funds under the Title II/ Eisenhower program, nonparticipation in the program is more likely among the smaller districts.

- The small amount of money was the principal reason for nonparticipation: respondents felt it was "just not enough to bother with," or else that the time required to administer it was not justified by the amount of money received.

- Small districts are especially likely to pool their Title II/ Eisenhower funds through intermediate units (IUs) or consortial arrangements.

These facts make it clear that the program is a marginal event in these settings. Several important questions arise:

- For those LEAs that do retain the funds, what are they able to do with the small amounts they receive? How useful are these funds to these districts?

- What do small LEAs gain by pooling their funds in IUs or consortial arrangements? What kinds of pooling arrangements exist and what kinds of services do they offer participating LEAs? What has the program done to strengthen the role that these institutions can play in meeting professional development needs of LEAs?

What Small LEAs Do with a Small Amount of Funds

In discussing what small LEAs do with the funds they receive from the program, several features of the school district context need to be kept in mind. First, most of these districts are located in rural areas, with less access to institutions or organizations that might provide help or support with regard to professional development needs. Second, though they represent the majority of LEAs in the nation, they account for a much smaller fraction of all teachers (and students), and only a small proportion of Title II/ Eisenhower funds overall. These facts, along with other characteristics of small LEAs and their participation in the Title II/Eisenhower program, are summarized in Table 47.

In general, small LEAs that keep their annual allocation of program money do with it many of the same things that other districts do, only on a smaller scale. As in larger LEAs, within-district inservice training is frequently done in such instances, although it is often of brief duration. More often, such LEAs send their teachers elsewhere for conferences, graduate courses, or other forms of out-of-district inservice, as shown in Table 48.

Table 47

CHARACTERISTICS OF SMALLER LEAs,
CONTRASTED WITH THE LARGEST LEAs

LEA Characteristic	LEA Size Category (Enrollment Range) Very Small (Less than 600)	Small (600-2,500)	Very Large (25,000 or More)
Background characteristics			
Number of LEAs nationwide	5,769	5,369	177
Percentage of all LEAs nationwide	39	37	1
Median[a] enrollment	301	1,254	40,238
Median[a] number of schools in the LEA	2	3	62
Percentage of all public school teachers nationwide	5	21	22
Percentage located in			
Rural areas	84	64	1
Urban areas	0	1	70
Participation in Title II/ Eisenhower Program			
Percentage participating in the Title II/Eisenhower program			
As an individual LEA	63	76	97
Through an IU or consortial arrangement	37	24	3
Median[a] allocation of program dollars received annually (Year 5)	$759	$2,170	$79,052

[a] Medians are based on responding sample and are not weighted to the universe of districts.

Table 48

PROPORTION OF SMALL LEAs' PROGRAM FUNDS SPENT ON WITHIN-DISTRICT AND OUT-OF-DISTRICT PROFESSIONAL DEVELOPMENT, AS CONTRASTED WITH THE LARGEST LEAs

	Mean Percentage of Year 4 Funds Spent on Each Type of Professional Development		
Locus of Professional Development	Very Small LEAs	Small LEAs	Very Large LEAs
Within-district inservice	25	34	65
Out-of-district professional development	41	39	19

It is not unusual for LEAs to combine the two, by using the funds to cover within-district and out-of-district activities depending on whether they can locate the appropriate opportunities elsewhere or could bring the right staff to the LEA for a reasonable amount of money. In this way, small LEAs go to some lengths to make the limited funds stretch as far as they can. Two examples from site visits illustrate these uses of Title II/ Eisenhower funds:

- With its $950 annual allocation in Year 5, this small midwestern LEA held after-school workshops for all 11 of its elementary teachers in mathematics (geometry was emphasized) and in science. The sessions were brief--two hours each, with no follow-up--and were taught by outsiders (a university professor and a person from the state education agency), who e services could be secured for nominal rates. That left enough Eisenhower money to send two high school teachers (the two who didn't get to go last year) to a three-day workshop 100 miles away dealing with current mathematics and science issues.

- In another small LEA, this one located in an agricultural area of the Southwest, program funds (part of an annual allotment of approximately $650) paid for travel and registration fees of two teachers attending a one-day mathematics conference in a neighboring state. The remainder of the year's allotment of funds went to support two of the eight days of district inservice that are mandated for all teachers. These sessions, dealing with mathematics, were held on the afternoon of half-days set aside for staff development, for all elementary teachers in the district.

Title II/Eisenhower funds are also used for equipment and materials, sometimes in connection with inservice training and sometimes not, as in the following case:

- One LEA in a remote area of a western state had made a big pitch to increase computer literacy among all teachers and students. In connection with this effort, they used Title II/Eisenhower funds ($1,106 during Year 4) and some district money to purchase an Apple computer, along with some math software. No inservice was provided on using the new machine or software because, at this stage in the process of improving computer education capabilities, the teachers felt they were fairly computer literate.

What Small LEAs Gain by Pooling Their Funds

As Chapter IV noted, large numbers of small LEAs forward their money to intermediate units (IUs) or join to form consortia, thus pooling their resources. The pooling arrangements (all of which are designated herein as IUs) are of several kinds:

- Regional IUs. These are variously labeled as Boards of Cooperative Education Services (BOCES), Area Education Agencies (AEAs), or Education Service Centers, among other designations. IUs in many states provide services to all the LEAs falling within a particular region. These IUs typically offer special education, vocational education, and other services, such as staff development, that small LEAs are unlikely to be able to afford. IUs of this sort often serve large numbers of LEAs (e.g., 25 or more).

- Supervisory unions (SUs). In a few states, the central office of one small LEA is augmented and serves as the central "district office" for the school districts in a few neighboring communities. The member districts are usually very small and relatively few in number (e.g., three to five). In these states, Title II funds are routinely sent to the SU, which acts like an LEA.

- LEA consortia. LEAs of various sizes sometimes band together for a particular purpose, such as staff development in particular subject areas or to share particular technologies. Typically, one of the large LEAs--or else one that has more expertise than the others--serves as the consortium leader and also provides a venue for training events (occasionally consortia are arranged with a university or other institution as the consortium leader).

The great majority (70%) of LEAs that participate in a pooling arrangement receive their services from a regional IU. Supervisory unions are

restricted to certain states. Consortia require special effort to form. Because there is typically no infrastructure to begin with, new relationships must be established. Perhaps for this reason, relatively few (6%) of the LEAs in our sample chose to pool their Title II/Eisenhower funds in this way.

In most respects, IUs or consortia administer and implement the program similarly to larger LEAs. In other words, because of the concentration of funds, they are able to put together professional development activities that would be difficult for smaller districts. Table 49 summarizes the key similarities between IUs/consortia and the largest LEAs.

Like the largest LEAs, IUs or consortia (1) are typically able to combine resources with specialized forms of outside funding such as those secured from the National Science Foundation or from private-sector firms; (2) collaborate frequently with institutions of higher education and are more able than the smallest districts to join forces with professional associations or private-sector groups; (3) have the capacity to offer professional development activities in-house, and therefore have less need for out-of-district activities; and (4) frequently have an individual with mathematics or science education expertise in charge of the program funds. These attributes stand in sharp contrast to the situation of the smallest LEAs, as the table indicates.

By virtue of their greater resources, staff expertise, and collaborating partners, IUs or consortia are able to make available to the smallest LEAs a richer menu of professional development activities than these districts would otherwise manage on their own. Take, for example, the following consortium being formed at the time of the study:

- Case example: a consortium in the process of formation. In a remote area served by five LEAs in the corner of a sparsely settled mid-western state, the superintendents got together to explore the possibilities of creating their own "distance learning" capability with interactive television. Title II/Eisenhower funds were used to bring an outside expert in to lecture about the possibilities, and then to host an all-day workshop for teachers to acquaint them with this new technology. Three elementary teachers went from the district in our sample (an LEA of 200 children), along with 21

Table 49

PROGRAM OPERATIONS IN INTERMEDIATE UNITS OR CONSORTIA, COMPARED WITH THE LARGEST AND SMALLEST LEAs

Selected Characteristics of Program Operations	IUs or Consortia	Very Large LEAs[a]	Very Small Leas [a]
Available program funds: median Year 4 dollars	$33,500	$59,999	$582
Other resources: percentage of LEAs that combined Title II/ Eisenhower with--			
Specially earmarked state funds	29	26	20
National Science Foundation funds	20	20	0
Corporate/foundation gifts	19	21	7
Activities supported: percentage of annual allocation devoted to--			
Within-district inservice	69	65	25
Out-of-district professional development	13	19	41
Collaboration with other organizations: percentage that joined forces with--			
Institutions of higher education	76	89	23
Private sector firms	22	36	6
Professional associations	20	38	12
Background of program coordinator in IU or LEA: percentage with backgrounds in--			
Mathematics education	46	70	28
Science education	47	74	28

[a] LEAs not served by IUs or consortia.

teachers from the other LEAs. All participants got a chance to use the new equipment--they created and broadcast a short science lesson--and "got all fired up." The five superintendents have since planned to formalize the arrangement next year by submitting a single combined application for program funds. Other neighboring LEAs have heard of the plan and are maneuvering to try to get into the consortium.

The case example just described is not typical of professional development offerings supported by Title II/Eisenhower funds in the various forms of pooled arrangements. More common are:

- IU-based inservice workshops created (with or without input from LEAs that are served) to meet various needs that IU or consortium planners perceive as important.
- Curriculum development activities serving all districts participating in the pooled arrangement.
- "Outreach" inservice, in which IU staff or consultants they hire visit LEAs or subregions within their catchment area to put on events that are more easily reached by teachers.
- General resource support to teachers or schools, in response to requests for help with mathematics and science education issues.

There is reason to believe that the impact of these activities on teachers and school mathematics and science programs is not much different from those described in the previous chapter. After all, the average level of resources--dollars available per teacher, participation hours per teacher--is similar for LEAs that participate in pooling arrangements and those that don't. However, the following differences should be noted:

- <u>It takes less to make an impact in many LEAs served by IUs or consortia</u>. By comparison with many, perhaps most, districts in the land, the teachers served by IUs and consortia tend to be more isolated from trends in the professional world, from other teachers, and from sources of immediate support or advice on the teaching of mathematics and science. Also, these teachers are more often in the situation of having to be "generalists"--that is, teaching a wider range of scientific or mathematical content because there are fewer other teachers with any relevant background. In such instances, the impacts of a relatively small experience--such as a trip to a conference, participation in a one-day event--can be proportionately greater. Some teachers who were interviewed indicated as much.

- Not all LEAs get an equal share of the services available to them through IUs or consortia. Although some pooling arrangements guarantee a certain level of service to all member LEAs, many don't, which leaves the opportunity for the most aggressive LEAs to get more than their share, and others less. The burden of responsibility typically lies with the LEA, though sometimes geographic factors, such as the proximity to the IU or consortium leader makes it more likely for certain LEAs to get the most out of their contacts with IU or consortium staff.

- The impact of the program on institutional relationships is more pronounced than elsewhere. Especially in the case of consortia, but also in many IU arrangements, participation in the program has enhanced the connections between a given LEA and other institutions from which it can derive support for the improvement of mathematics or science education. The strengthened relationship is not always formal, as was the case in the consortium example described above; more often, the relationships developed informally as particular teachers took advantage of the service made available to them by the program.

Serving Nonpublic School Students

As with other federal programs, the Title II/Eisenhower program is designed to serve all students, whether or not they attend public schools. Consequently, LEAs are required to consult with officials in all nonpublic schools attended by students from the area served by the LEA and to make available to them services in proportion to the number of nonpublic school students involved. (Under the Eisenhower Act, the services also must be consistent with the overall LEA assessment of need.) A complication arises from the delicate relationship between public schooling and private educational institutions, most of which are religiously based: LEAs are prohibited from simply sending the money directly to the nonpublic schools; instead, they must spend the money themselves on behalf of the students in question, if the relevant officials in the nonpublic schools request it. But the nature of the relationship--in particular, the degree of discretion exercised by nonpublic school officials and the degree of effort invested by LEA administrators in notifying their counterparts about the program--varies considerably across school districts and is the result of a host of local factors having nothing to do with federal programs.

The requirement to serve nonpublic school students makes different demands on LEAs, depending on the size and nature of the nonpublic school population. As Table 50 indicates, the distribution of this segment of the student population is highly uneven. Many LEAs have no students attending nonpublic schools; some have enormous populations, especially in the largest urban areas. And regardless of the size of the population, the schools they attend have varying degrees of interest in resources that derive from the federal government. As experience with the Chapter 2 program indicates (see Cooperstein, 1986), Catholic schools, which serve the majority of nonpublic school students, are typically quite active in federal programs, as contrasted with schools serving fundamentalist Christian sects or other denominations, which tend to be indifferent or even hostile to the prospect of federal funds. Independent nonreligious schools, a third major segment of the nonpublic school population, are highly varied.

Only a small proportion of the overall flow-through dollars for LEAs not served by IUs or consortia are allocated to services that benefit nonpublic school teachers and students--as shown in Table 51, 7% of the total Year 4 dollars were used for this purpose. The largest districts, in which the great majority of nonpublic school students are concentrated, are most likely to support some kind of service aimed at these teachers and students. The smaller the district, the less likely it is to put Title II/Eisenhower funds into this kind of activity; even so, nearly half of the smallest districts do so.

There are various reasons why certain LEAs do not use any of their program funds for nonpublic school teachers and students:

- There are often remarkably few nonpublic school students in these districts--perhaps a handful, often no more than 10. The number translates into relatively few program dollars (at approximately a dollar a child, there is too little for a nonpublic school administrator to notice).
- Teachers from nonpublic schools are frequently invited to attend professional development events hosted by the LEA, but for various reasons may not attend: scheduling, lack of interest, irrelevance to the nonpublic school program, or lack of awareness (the "invitation" may simply be a flyer sent to the nonpublic school administrative office).

Table 50

DISTRIBUTION OF NONPUBLIC SCHOOLS AND STUDENTS
IN LOCAL EDUCATION AGENCIES NOT SERVED BY IUs OR CONSORTIA

LEA Size Category (Enrollment Range)	Among Districts (Not Served by IUs) Percentage in Which Some Students Attend Nonpublic Schools	Median Number (and Percent[a]) of Nonpublic School Students
Very large (25,000 or more)	98	3,416 (12%)
Large (10,000-24,999)	98	700 (5%)
Medium (2,500-9,999)	91	300 (8%)
Small (600-2,499)	67	60 (5%)
Very small (less than 600)	47	4 (1%)
Total	70	400 (8%)

[a] Percentage of the median public school enrollment in each size category and overall.

Table 51

ALLOCATION OF LEA FLOW-THROUGH FUNDS TO SERVE NONPUBLIC SCHOOL STUDENTS

LEA Size Category (Enrollment Range)	Among LEAs (Not Served by IUs) That Have Nonpublic School Students in the Attendance Area: Percentage Allocating Some Program Funds for Nonpublic School Services	Total Amount (and Percent[a]) of Year 4 Program Funds Used for This Purpose
Very large (25,000 or more)	82	$1,457,960 (10%)
Large (10,000-24,999)	67	577,815 (6%)
Medium (2,500-9,999)	44	781,523 (6%)
Small (600-2,499)	19	178,429 (2%)
Very small (less than 600)	14	354,296 (11%)
Total	28	$3,350,023 (7%)

[a] Percentage of the total allocation to LEAs, in each size category.

- Certain nonpublic schools are decidedly uninterested in taking part in activities sponsored by the federal government. Even though they are aware of events funded by Title II/Eisenhower, they avoid participation to maintain their distance from perceived governmental entanglements.

LEAs arrange for services to benefit nonpublic school teachers and students in a variety of ways that have evolved, typically over the years, in the context of other federal programs, notably Chapter 1 and Chapter 2. The Title II/Eisenhower program differs from these others chiefly by virtue of its focus on particular subject areas and activities (staff development in mathematics and science education) and by its small size. Site visiting revealed three principal ways of managing the nonpublic school component of the program:

- Inviting nonpublic school teachers to the LEA's professional development events. The line of least resistance for most LEAs is to encourage nonpublic school teachers to attend within-district inservice training or other professional development events that are planned by the LEA for its own teachers. The degree of consultation with nonpublic school representatives varies considerably in such instances--according to survey respondents, in only 9% of LEAs with nonpublic school students are such representatives given an "influential role" in decisionmaking about the use of funds. Not surprisingly, participation by nonpublic school teachers in these instances is uneven.

- Providing separate services for the nonpublic school teachers in response to requests from the nonpublic schools. Especially in LEAs that had a sizable contingent of nonpublic school students and schools that actively sought participation in the program, LEA staff often took on the responsibility of arranging events primarily or solely aimed at nonpublic school teachers (administrators from the relevant schools are typically involved in the planning here). In an extreme case, a very large urban district had set up an Office of Nonpublic Education that organized a thick menu of training events at various nonpublic schools that read like a course catalogue.

- Sending the money or its equivalent in materials or equipment. Especially likely in smaller districts, where relatively little money is involved, some LEAs simply make the money available to nonpublic school officials to do with it what they want (within limitations imposed by program guidelines). In such instances, the funds are typically used for a new piece of software, a new science series, some kits or manipulative materials, and the like.

The local pattern of service to the nonpublic school students is thus partially a function of the amounts of money involved, the numbers of students, and the predisposition of the nonpublic schools to be a part of the program. But the patterns also reflect preexisting relationships between the two types of schools that were in place before the program. There is little evidence that Title II/Eisenhower funding has altered those relationships.

In terms of professional development per se, the program has involved a small percentage of the nation's nonpublic school teachers. As Table 52 displays, approximately 8% of the mathematics and science teachers (including elementary grade teachers) in the nation's nonpublic schools took part in some program-sponsored training event in the 1988-89 school year. That figure is lower than the corresponding figure for public school teachers, approximately a quarter of whom were part of program-sponsored staff development in mathematics or science during the same year (see Chapter IV). The difference is explained partly by the widespread pattern, described above, of nonpublic school teachers not taking up the invitation to attend LEA inservice events, and also by the fact that, in smaller districts in particular, the funds are often used for other things than training.

Although it may appear that LEAs have been lax in carrying out their responsibilities vis-a-vis the nonpublic school students within their purview, the evidence suggests otherwise. **On the whole, LEA officials appear to have made good-faith efforts to involve their counterparts in the nonpublic schools, and, accordingly, comparable proportions of the program funds have been used for this purpose, as a quick glance at the overall proportions of dollars and children indicates.** The LEAs not served by IUs or consortia enroll approximately three-quarters of the nation's school children (31,915,671 students), 9% of whom (3,030,646) attend nonpublic schools. Nearly the same percentage of program funds--7% (see Table 51)--are spent to serve these students or their teachers. Considering that not all nonpublic school students are in schools that wish to be part of the program, the difference is probably negligible.

Table 52

PARTICIPATION OF NONPUBLIC SCHOOL TEACHERS IN ACTIVITIES SUPPORTED BY THE TITLE II/EISENHOWER PROGRAM

	Among LEAs (Not Served by IUs) That Have Nonpublic School Students in the Attendance Area:	
LEA Size Category (Enrollment Range)	Percentage in Which Nonpublic School Teachers Participate	Total Number (and Percentage) of Nonpublic School Math and Science Teachers Participating
Very large (25,000 or more)	57	8,133
Large (10,000-24,999)	49	3,220
Medium (2,500-9,999)	24	4,853
Small (600-2,499)	8	1,359
Very small (less than 600)	4	813
Total	13	18,379 (8%)[a]

[a] Percentage of all nonpublic school mathematics and science teachers nationwide, based on estimates from the National Center for Educational Statistics for the 1987-88 school year (approximately 348,000 nonpublic school teachers in all subject areas). The figure was adjusted using the same proportion (65%) who might teach mathematics or science as in public schools (see Chapter V).

Addressing the Needs of Underrepresented Groups

Female students, those of minority background, and other groups traditionally underrepresented in mathematics and science are a major concern to educators in these fields nationwide and are also targeted in the enabling legislation for the Title II/Eisenhower program. Given the generally small amount of resources that the program provides to most districts, the question arises: in what ways (if at all) are the needs of this segment of the student population attended to in the professional development supported with LEA flow-through funds?

At first glance, the answer appears to be that relatively little attention is paid to serving underrepresented groups in the flow-through component of the program. For example, only 20% of LEAs (not served by IUs or consortia) explicitly designed Title II-supported inservice for teachers working with particular groups of children; of those, half of the districts mounted programs aimed at teachers of minority students. In those districts using the funds to support professional development for mathematics teachers, 12% made "methods of teaching minority or disadvantaged populations" a focus of the training; the corresponding percentage for districts supporting professional development of science teachers was 10%. These figures give the impression that the needs of minority students, to take one group that is poorly represented in mathematics and science education, are not a primary focus of professional development attention in large numbers of districts.

Although there is probably some truth to this assertion, several other considerations led the study team to believe that LEAs are doing somewhat more to serve underrepresented groups with Title II funds than may at first appear. First, not all districts in the nation have significant minority student populations; however, among those that do, the proportion of LEAs that target those students' needs is likely to be higher than the figures reported above indicate. (All LEAs have equal numbers of male and female students, however, and so one can still ask why female students have not been a priority more often.)

Second, LEA-initiated professional development serves disproportionately large numbers of teachers who are themselves female or of minority background. Seventy percent of all participants in LEA-based inservice training during the 1988-89 year were women, most likely because of the pervasive focus on the elementary grades. Minority teachers comprised 12% of all participants in that year, one and a half times their proportion in the nation's teaching force as a whole. These facts do not necessarily imply that these teachers then worked more effectively with their minority or female students, but it does suggest that they were given opportunities to improve their grasp of these subject areas and how to teach them. In so doing, they were likely to model for their students interest and involvement in the subject areas. That is one step toward strengthening the representation of the target groups in mathematics and science.

Third, the nature of teaching approaches widely espoused in inservice supported by LEA flow-through funds has special appeal to those who are most likely to become turned off to mathematics and science. As is discussed more fully in Chapter X, hands-on, active teaching of these subjects--a common focus of Title II-supported professional development in LEAs--has special promise for involving children (of all backgrounds) in subject areas that hitherto had seemed alien, uninteresting, or irrelevant to them.

Thus, it should not be surprising that half of the survey respondents agreed that Title II funding had "helped the district to serve particular student groups (minorities, females, gifted and talented, learning disabled)." That response must be interpreted; not all of the "particular student groups" were among those traditionally underrepresented in science and mathematics. In addition, the survey item as written has a tendency to invite positive responses. Nonetheless, it suggests that, despite the lack of explicit targeting to the needs of underrepresented groups, many districts were serving their needs in some degree. At the same time, it is unlikely that districts were doing all they could do to address these needs, as the discussion of IHE projects in Chapter IX will indicate.

The Problem of Focusing the Funds

The LEA component of the Title II/Eisenhower program includes a number of mechanisms designed to focus the funds on the most important needs. For example, under the Eisenhower statute, LEAs are required to submit: data related to the supply of qualified teachers and curriculum needs; a description of how program funds will be used to meet the assessment of need; and assurances that program activities will be assessed and progress toward meeting the needs will be reported. Nonetheless, there is in fact a great deal of room for discretion, and the possibility exists that the funds will be dispersed to a variety of functions in a relatively unfocused way. This is true for many reasons, including the fact that needs assessments are often general in nature, the program funds cannot be used to meet all possible needs (such as for large capital expenditures), and the limited amount of funding precludes addressing certain other needs (such as any extensive LEA support for preservice teacher training)--just to name a few of the reasons.

Study analyses suggest a somewhat mixed pattern in LEAs with regard to questions of focus. As analyses in Chapter IV suggest, districts differ considerably in the degree of forethought and planning invested in the task of improving mathematics and science education. "Focused-agenda" districts do a considerable amount of planning, and they typically have results to show for it. Districts with unfocused improvement agendas proceed in a more scattered and ad hoc way toward improvement goals, if they even specify goals at all. Given this situation, several questions are important to answer:

(1) How are needs ascertained in the first place, and does the program have a role in helping LEAs pinpoint needs?

(2) To what extent are the funds targeted on particular high-priority needs, and does the decisionmaking process help in targeting the use of these resources?

(3) How is the effectiveness of program-sponsored activities assessed, and, more broadly, how do LEAs discover whether they are making progress toward meeting their needs (as a result of any of their efforts, including Title II/Eisenhower-sponsored activities)?

This section reviews what has been learned from survey and site visit data regarding each question.

The Assessment of Needs and the Program's Role

The "assessment" of needs in LEAs is best thought of as a consensus-building process, during which key actors come to agreement regarding the most important deficiencies and targets for improvement in particular academic programs. With regard to the teaching of mathematics and science, the list of deficiencies in most LEAs is long; and under the influence of nearly a decade of reform attention to these subject areas, LEA planners have become well aware of the problems confronting their instructional programs. The degree of consensus across and within districts on the nature of the problem is striking. Local educators agree, for example, on the importance of improving mathematics and science education at the elementary level, on the most appropriate forms of instructional experience for children, and on the nature of the constraints that inhibit improvement (see Chapter XI for a more extended discussion of this consensus).

Local planners arrive at a sense of needs in mathematics and science education by a variety of means ranging from informal to formal, but at the heart of it appears to be interaction between key decisionmakers and a small number of individuals they trust over the issues confronting their district combined with their best sense of what the professional field (of mathematics and science educators) is saying.

Formal data regarding the state of mathematics and science education in the LEA appears not to play a central role in determining what needs to be done. However, there is some variation here depending on the basic decisionmaking and management style of LEA leadership. Some districts are extremely "data driven," and tend to pay more attention to test scores, surveys of teachers' opinion, statistics on teacher qualifications, or other forms of data collected by the LEA. In other LEAs, planners rely exclusively on face-to-face meetings, the professional grapevine, and good intuition. In both instances, they appear to arrive at similar judgments of what needs to be done, and it is difficult to tell which path leads more surely to a clear sense of need.

This state of affairs may exist in part because there are large forces within and around LEAs these days that are, in effect, telling LEA staff what needs improvement, or more directly creating or heightening needs. State policy actions, for example, are as much the source of LEAs' sense of needs as the situations these actions are meant to address. The reform activity described in Chapter IX, for example, orients local educators toward particular aspects of their instructional program, such as the expansion of elementary science (in states that have recently revised the elementary science syllabus or instituted new testing requirements at that level), the creation of better general track science courses at the high school level (in states that have increased their graduation requirements, thereby swelling the ranks of those who might otherwise call it quits with a single science course in grades 9 through 12), or the expansion of staff development offerings (in states that have instituted recertification requirements for veteran mathematics and science teachers).

The role of the Title II/Eisenhower program in clarifying the local sense of needs is hard to assess. Most of the evidence gained on-site suggests that larger forces than the program--emanating from the state, the regional context, the local agendas of key actors, and the ongoing momentum of other reform programs--are largely responsible for shaping key actors' sense of needs. In few instances did the study find evidence that the coming of the Title II/Eisenhower program provided the principal occasion or stimulus for developing strategies aimed at mathematics and science education needs. Nor do the new needs assessment requirements in the reauthorized version of the program (such as specific attention to student achievement in the LEA) appear to stimulate a systematic thinking through of professional or curricular needs. One veteran science coordinator in a large urban district commented as follows about the needs assessment process:

> *I know needs in these schools by face-to-face networking, or they phone me. Also each year there's a school improvement planning process [which results in a plan for each school]; you get a lot of information from these documents, but written documents I, at times, take with a grain of salt. You have to put things down on paper. You put God, motherhood, and the flag on paper.... This year, I said [to the school people], "Don't put 48 items in your plan, put one issue you want to work on."*

Individuals like this filled in the appropriate spaces on the new needs assessment form quickly and without a careful review of evidence. He already had a clear sense of the "big-picture" needs in his head. The more fine-grained needs, toward which he directed particular inservice activities, came from his discussions with teachers, his experiences teaching demonstration lessons, and serendipitous sources.

Nonetheless, the Title II/Eisenhower program is part of the process of taking action to improve mathematics and science education. According to survey responses, program coordinators in the great majority (83%) of districts believe that the program has helped in the process of clarifying priorities. That belief should be qualified by adding that the program's role is probably subsidiary in most cases, except in instances such as the consortium formation case described earlier in this chapter. But even there, what drove the sense of need for a powerful distance learning capability was the strong agenda of several LEA superintendents, a long-term interest among various individuals in distance learning, and the availability of expertise on the use of television as a solution.

Targeting of Activities to Needs

Activities funded by the program are targeted to a degree, if for no other reason than that the small amount of money makes it difficult to spread the funds too widely. Funds are routinely targeted in the following ways:

- Professional development is designed for teachers in a particular grade level or range of grades--e.g., all the first-grade teachers, or the math and science teachers in a middle school program for potential dropouts, and so on.
- In a given year, money is focused on one subject area more than another. Although many LEAs split the funds 50-50 between mathematics and science education, a greater number concentrate the resources on a particular subject in one year (but they often alternate subject areas across years).
- Training is designed with particular types of teacher in mind, such as lead teachers (22% of all LEAs did so) or teachers serving a particular type of student, such as the gifted and talented (12% of all LEAs).

But beyond these kinds of targeting, it is more usual for LEAs to focus the funds on a particular target across more than one year. Examples from our site visits have been described earlier in this report (see Chapter V)--for example, the use of Title II/Eisenhower funds to support:

- An annual mini-conference for elementary grade teachers across several years in a way that initially prepared lead teachers, then gave them the opportunity to run the mini-conference training themselves.
- The process of upgrading science curricula in elementary and middle schools across a three-year period.
- The development across four years of a follow-up system supporting the introduction of a new elementary manipulatives-based mathematics program in the lower elementary grades throughout a district.

In cases such as these, local planners and decisionmakers need to resist the natural pressures to divert funds to a new purpose each year. That is difficult to do in school districts, especially those with few alternative resources--it takes active leadership and a vision of what needs to change and how to build toward those changes over time.

Nonetheless, **it can be argued that the program is being focused on high-priority needs and that, overall, there is sustained attention to these needs over time.** Three pieces of information from the surveys, corroborated by visits on-site, substantiate this view:

- First, the picture of needs, and priorities among them, does not seem to change much over time. Although survey data were retrospective for the first year of the program, respondents indicated nearly identical profiles of need for that year (the 1985-86 school year) and for Year 4 (the 1988-89 school year), the time at which questionnaires were filled out.
- Second, the types of activities for which the funds were used are similar across the first four years of the program: approximately the same proportion of LEAs put the funds into inservice training, out-of-district professional development, and curriculum development in Year 4 as in Year 1.
- Third, with the exception of computer education, stated top-priority needs in the target subject areas are addressed by activities the program funds support, as shown in Table 53. **In other words, local educators typically use Title II/Eisenhower funds to address the**

highest-priority needs in these subject areas. At the same time, activities are frequently aimed at an area of need when it is not noted as high priority, which suggests that there is some tendency to disperse funds rather than to maintain a high degree of focus on the most important need.

The same is not true of foreign languages or computer education. There, large numbers of LEAs indicated that each area was a top-priority need in Year 4--approximately a quarter of all districts found a need for improvement in foreign languages, and about twice as many in computer education. In neither case were Title II/Eisenhower funds in that year used extensively for related professional development. There are several explanations for this fact: for one thing, most LEA staff perceived the program as primarily intended for mathematics and science. For another, some states communicated this signal more directly to LEAs by declaring the latter two subject areas as "second-priority" targets and insisting that mathematics and science needs be addressed first. Finally, foreign languages and computer education are much less often given the highest priority (that is, ranked "1" in the survey ranking scheme).

Assessing Progress Toward Meeting Needs

By and large, LEAs do not have elaborate or formalized means of assessing progress toward meeting the needs they perceive, although some routine benchmarks are referred to frequently--in particular, test scores, participation counts (e.g., in secondary-level courses), and counts of qualified teachers. **At the root of it, LEA staff prefer to "assess" progress toward goals in the same ways they arrived at the needs in the first place--through interaction with trusted colleagues, by the professional grapevine, and by firsthand observation of improvement activities.**

Assessment of the Activities Supported by the Program--The assessment of program-sponsored activities needs to be distinguished from the assessment of progress toward improvement goals, because the activities are typically only part of the overall improvement effort. According to survey responses, the great majority of LEAs (89%) evaluate what they do with Title II/Eisenhower funds. As shown in Table 54, LEAs do their assessments in a variety of ways,

Table 53

MATCH BETWEEN HIGH-PRIORITY NEEDS AND THE PROFESSIONAL DEVELOPMENT SUPPORTED BY TITLE II/EISENHOWER FUNDS

Subject Area/Level	Percentage of All Districts (Not Served by IUs or Consortia) in Year 4 That: Perceived Each Area as a High-Priority Need	Used Program Funds to Support Related Professional Development
Mathematics education		
Elementary school	53	67
Middle school	37	57
High school	28	51
Science education		
Elementary school	61	58
Middle school	34	55
High school	24	51
Foreign languages education (all levels)	25	4
Computer education (all levels)	52	17

Table 54

EVALUATION OF ACTIVITIES SUPPORTED BY THE PROGRAM

Evaluation Strategy	Percentage of Districts That Used the Strategy: Districts Not Served by IUs or Consortia	Districts Served by IUs or Consortia
No evaluation strategy at all	11	1
Teacher testimonials/ opinions	85	97
Observation of teacher performance	54	42
Student performance pre/post	32	16
Anecdotal evidence	25	41

though not surprisingly, teachers' testimonials and opinions are the most common source of assessment data, followed by observation of teachers' performance. Measures that trace effects of sponsored activities on student performance (for example, as revealed by comparing pre and post measures) are less common, and, even when they are used, are often suspect, as the site visits showed. The test scores measure much more than the increment of change in classroom practice attributable to professional development activities, and are often not particularly sensitive (and sometimes downright antithetical) to curriculum or instructional changes that were the focus of professional development.

LEA survey respondents claim that they use this evaluative data for the most part as informal input to local planning (75% of LEAs indicated this) and as input to the needs assessment process (56% said so). Two-fifths of

all LEAs report the results of these evaluations to teachers in some form or other. However, site visits revealed little evidence that the evaluation evidence is used extensively, except in the largest districts with reference to the most complex projects. For example, in one case, a developmental project funded by Title II/Eisenhower funds arranged for an external evaluation with pre and post measures of student participation, attitude, and performance, to determine whether the technology-based science materials under development were having the desired effect. But such instances are the exception rather than the rule, and in most cases would not have been justified, given the small amount of resources being expended for the activity.

Assessing Progress Toward Meeting Improvement Needs--Evaluating the Title II-funded activities themselves is only part of the larger task of determining whether progress is being made toward meeting improvement needs. In this regard, LEAs appear to have few systematic tools at their disposal.

From the site visits, it appears that test scores are most commonly taken as a benchmark of progress, especially in states that place a great emphasis on testing. In many respects, these measures are not particularly appropriate for many of the same reasons noted above regarding tests as a measure of the effects of activities. In particular, the science and mathematics tests that are most commonly used to measure proficiency, achievement, or competence in most states:

- Ignore improvement goals (such as increased participation or changes in attitude) that are unrelated to content or skills.
- Put emphasis on certain aspects of the instructional program that are being deemphasized by many reform efforts--for example, mathematical achievement tests stress skill in arithmetic computation, precisely what the current movement in mathematics reform is trying to deemphasize!
- Will reflect changes in the demographic profile of children being tested, making comparisons over time more difficult.
- Are relatively insensitive to certain kinds of skills (e.g., the ability to design and carry out experiments) that are the focus of improvement efforts.

By relying on these measures for indications that the situation has improved, local educators run two opposite risks: first, that the desired improvements have taken place but appear not to have; and second, that things appear to be getting better, when many of the desired changes haven't taken place.

In short, there is a general lack of appropriate evaluation tools and standards at the local level by which the degree of change in desired directions can be systematically ascertained. In the absence of such means, the intuitions and informal appraisals of knowledgeable LEA and school staff give probably as good an indication of progress as anything.

PART THREE: GRANTS TO HIGHER EDUCATION AND OTHER INSTITUTIONS

This part of the report describes and analyzes information on Title II/ Eisenhower activities based in institutions of higher education (IHEs) or other nonprofit organizations such as museums, associations, libraries, and the like. The information presented is drawn from a survey of higher education projects (96% of them based in colleges and universities) that received Title II funding in 1987-88 and/or 1988-89, and 21 site visits to higher education projects in 7 states.

Part Three begins by describing, in Chapter VII, how the higher education grants typically operate--their funding levels, the types of institutions that receive funding, how funds are used, the range of goals and activities pursued, and staffing patterns. Chapter VIII looks at the impacts of the higher education projects, principally on the grantee institutions and participating teachers, but also on curriculum, instruction, and students. Finally, Chapter IX highlights some special themes not thoroughly discussed elsewhere in the higher education section.

Highlights of Findings About the Higher Education Component of the Program

Data collection on the higher education component centered around several key research questions. The questions and major findings are summarized below.

Summary: Operation of the Higher Education Grant Component (Chapter VII)

(1) How large are grants to institutions of higher education and other nonprofit institutions?

Overall, the mean higher education grant provides a modest $31,052 for math and science improvement activities. Universities offering graduate degrees (master's and above) are most likely to receive

grants of all sizes. Doctoral degree-granting institutions are more likely to receive the largest grants ($40,000 or more). The mean award under the "cooperative" portion of the original legislation was smaller ($27,402) than the mean "competitive" grant ($32,593).

(2) How do higher education projects use their funding?

The largest budget item is salaries and fringe benefits, followed by stipends for participants. IHEs charge little or no overhead on Title II/Eisenhower grants. Projects supplement their awards with other sources of support, principally in-kind contributions from the host institution. Over one-quarter also depend on LEA contributions, mainly in the form of tuition payments for participating teachers. Districts often use flow-through funds for this purpose.

(3) On which areas and activities allowable under the legislation do the higher education grants focus?

Higher education projects target science first (64%) and mathematics second (49%). Among the various science disciplines, physical sciences receive the most emphasis, perhaps because elementary and secondary teachers are perceived to be less prepared in this area. The vast majority of projects offer workshops of various lengths. Typically, participants are involved in activities for 60 hours (median), often in some combination of summer and school year endeavors. Mathematics projects emphasize problem-solving skills, and science projects stress "hands-on" activities.

(4) Who participates in the projects?

Participants are principally experienced, certified, public school teachers. The majority (68%) are female. Teachers at the middle/junior high school level receive the most attention. The typical project serves 35 teachers (median); collectively, the projects serve nearly 58,000 public and private school teachers annually. About one-fifth of participants are from minority backgrounds.

(5) Who staffs the higher education projects?

Over half (53%) of all higher education project directors are arts and sciences faculty; only about one-third are based in departments or schools of education. The majority of project directors are associate or full professors and therefore presumably no longer concerned with a tenure process that typically gives little credit for community service, including working with schools and teachers. Project teams often include master teachers as well as college faculty.

Summary: Impacts of Higher Education Grants (Chapter VIII)

(6) How have the higher education grants affected the institutions to which they were awarded? In particular, how have the grants created both intra- and interinstitutional bridges for coordinating efforts to improve mathematics and science education?

Indications are that the Title II/Eisenhower program has encouraged communication between education departments and arts and sciences faculties, but that there remains room for improvement. The intra-institutional importance of the grants appears to be related to the prevalence of other types of outside funds flowing to a college or university. Looking at relationships across institutions, the program has principally strengthened preexisting relationships between IHEs and LEAs.

(7) What impacts have the higher education projects had on teacher participants and their attitudes or approaches to teaching mathematics and science?

As far as can be determined from site visits, teachers' responses to participation in the higher education workshops are strongly positive. Impacts on participants cluster around the themes of building confidence (particularly in science teaching), establishing networks, building school improvement teams, developing leadership capacity, and learning how to develop lessons and units using more active instructional strategies in mathematics and science.

(8) What evidence is there that the higher education projects have an impact on elementary and secondary school curricula, classrooms, or student learning?

The evidence on these types of impacts is largely anecdotal. According to site visit data, nearly all participating teachers report that they have made changes in their classrooms as a result of their participation in higher education projects. Most changes are in the direction of more hands-on science, more use of manipulatives in mathematics, and more instruction in problem solving across the board. For some, however, it is an uphill battle against state or local mandates that pull them back toward textbooks and facts. Teachers believe that the new strategies they have learned are particularly effective with unmotivated students.

Summary: Special Issues Related to the Higher Education Component (Chapter IX)

(9) How does the higher education perception of what is needed to improve math and science education meld with the views of other sectors?

In some states, all higher education projects are part of a larger plan, orchestrated at the state level. Requests for Proposals

(RFPs) in these states tend to be more specific and directive. In other states, the higher education component is essentially a free market, allowing college and university faculty a great deal of latitude in the mathematics/science improvement activities that they propose. Data collected during site visits indicate that some active coordination of higher education activities from the state level helps avoid some problems such as participant recruitment.

(10) What role do institutions of higher education play in increasing the participation of underrepresented groups in mathematics and science education?

In comparison with LEAs, the higher education projects are more focused on the legislation's intention to increase the participation in mathematics and science education of traditionally underrepresented groups such as female and minority-background students. At the teacher level, more than one-fourth of the projects (28%) specifically target teachers from minority backgrounds, and the fraction of participants who are from minority backgrounds (approximately one-fifth) far exceeds the proportion (8%) of such teachers in the overall teacher population. In a few states, state agencies have especially targeted program funds toward groups underrepresented in mathematics and science education.

(11) How have noncollegiate institutions been involved with the higher education component of the program?

Under the original Title II program, 4% of higher education grantees were noncollegiate institutions (in Years 3 and 4). Although certain kinds of projects may be more successful if based outside the college and university system, states are currently precluded from funding noncollegiate organizations directly (under the Eisenhower Act); however, the other nonprofit institutions may continue to join as partners if colleges or universities choose to do so.

VII OPERATION OF THE HIGHER EDUCATION GRANT COMPONENT

The structure of the higher education component of the Title II/ Eisenhower legislation has been described in detail earlier in this report. In brief, during the first four years of the program, the state agency for higher education (SAHE) received 30% of a state's total Title II allocation. The law required the state to distribute at least 75% of these funds to institutions of higher education (IHEs) through a competitive grants process. Another 20% could, at the state's discretion, be used for cooperative projects, involving an IHE or other type of grantee (for example, museums, associations) with one or more local school districts. States were allowed to reserve the remaining 5% of their allocations for administration and technical assistance.

Distribution of Title II/Eisenhower Grants Across the Higher Education Universe

Higher education in America is a complex phenomenon. There are over 3,400 degree-granting postsecondary institutions, and they are of many types. For the purposes of analysis in this study, the IHEs and other institutions that received grants in Year 3 or 4 of the program were assigned to one of the following six categories by institutional type:

- Doctoral/research university: major universities authorized to grant doctoral degrees. Examples of this type of institution include the flagship university campus in each state and the better-known, large private universities.
- Comprehensive universities: institutions offering undergraduate and graduate education through the master's level. Examples include most regional state college campuses, as well as many private institutions.
- Four-year and liberal arts colleges: institutions offering undergraduate education only. These are principally private institutions.
- Two-year colleges: community and junior colleges, offering the associate degree and nondegree programs.

- Other IHEs: a small number of institutions, such as technical colleges, that did not fit the four categories above.
- Non-IHEs (other nonprofit institutions): institutions such as museums, libraries, associations, and other nonprofit organizations that were eligible to be grantees under Section 207(c) of Title II.

Table 55 shows the universe of Year 3 and Year 4 higher education grant recipients by institutional type. Both competitive and cooperative awards are included in these figures.

Table 55

HIGHER EDUCATION GRANT RECIPIENTS,
GRANT YEARS 1987-88 AND 1988-89

Type of Institution	Number	Percent
Doctoral/research university	521	34
Comprehensive university	622	41
Four-year liberal arts college	106	7
Two-year college	171	11
Other IHEs	19	1
Other nonprofit institutions	91	6
Total	1,530[a]	100

[a]This number is based on responses from 48 SAHEs; extrapolating to include the nonreporting states would bring the total of awards to about 1,600 in 1987-88 and 1988-89 combined.

As this table clearly indicates, graduate-degree-granting institutions (the research/doctoral and comprehensive university categories) are most commonly the recipients of Title II/Eisenhower higher education awards. This is neither surprising nor inappropriate, given the professional development focus of the program. Nearly 90% of the grantees report that the main purpose of their projects is professional development for practicing teachers; 70% of projects offer participants college or graduate credit for

participation. Since very few projects target undergraduate teachers-in-training (11%), the emphasis in the program is very distinctly on further training or retraining of experienced teaching personnel.

The clustering of three-fourths of the awards in the top two categories of Table 55 should not be interpreted to mean that Title II/Eisenhower higher education funds are going disproportionately to elite IHEs. The comprehensive university category, in particular, encompasses a wide variety of public and private institutions, many with a regional or local catchment area and a teaching/community service orientation that contrasts with the more common image of American universities as research driven. Site visits included several institutions in the comprehensive category, as well as major research universities.

The total of 1,530 projects represented in Table 55 does not represent the same number of discrete institutions, since a significant number of colleges and universities successfully proposed and received multiple Title II grants during the third and fourth years of the Title II program. Nevertheless, from both survey and field data, it appears that higher education funds have been broadly dispersed across a diverse group of institutions. As indicated in Part One of this report, approximately 20% of all degree-granting institutions in the nation participated in the Title II program in its first four years of operation.

Title II Grant Funding to IHEs and Other Nonprofit Organizations

In an absolute sense, the typical Title II grant to an IHE or other nonprofit institution is not large. In Years 3 and 4 of the Title II program, the mean higher education project lasted 11 months and received $31,052 in Title II funding.* Funding levels varied somewhat among the

*Because of differences in start-up dates for using Year 1 funds and because Title II/Eisenhower has liberal carryover provisions, states varied greatly on the actual fiscal-year funds being expended during the data collection period. In most cases, the data presented in this section represent averages that combine funding appropriated to Years 3 and 4 (1987-88 and 1988-89) of the program.

six institutional types, with noncollegiate institutions receiving the largest mean awards ($40,322) and two-year colleges the smallest ($27,097).

For analytic purposes, the higher education projects were divided into three categories according to the amount of their Title II funding: (1) large grants, totaling $40,000 or more; (2) medium grants, from $20,000 to $39,999; and (3) small grants, totaling less than $20,000. Table 56 shows the relationship between size of grant and the type of grantee institution. Grants of all sizes overwhelmingly go to institutions offering both undergraduate and graduate education. The four other institutional types are most likely to receive small awards.

According to survey data, grants ranged from as low as $750 to a high of $419,000. Information gained through the site visits suggests a cautionary note about the largest grants, however. In one state, for example, what on the surface appears to be a large $100,000 grant to the state's flagship university is in reality a number of very small grants to several colleges, funneled through a central clearinghouse. Three of these projects, which were among the sites visited, had budgets ranging from $3,400 to $6,300. (See Figure 10 for the distribution of awards by size.)

"Competitive" and "Cooperative" Awards

The structure of the Title II higher education program dictated that a minimum of 75% of total funds had to be awarded through a competitive process. Not less than 20% could be awarded in a noncompetitive manner through cooperative arrangements involving IHEs, LEAs, and/or other nonprofit organizations. According to survey data, in Years 3 and 4 of the program, 84% of higher education grants overall were awarded as "competitive" grants under Section 207(b) and 16% as "cooperative" projects under Section 207(c). Although it is probable that some project directors who were respondents to this survey were unclear on the technical distinction between the two types of awards, the proportional relationship is approximately correct since several states combined both allocations and awarded them competitively.

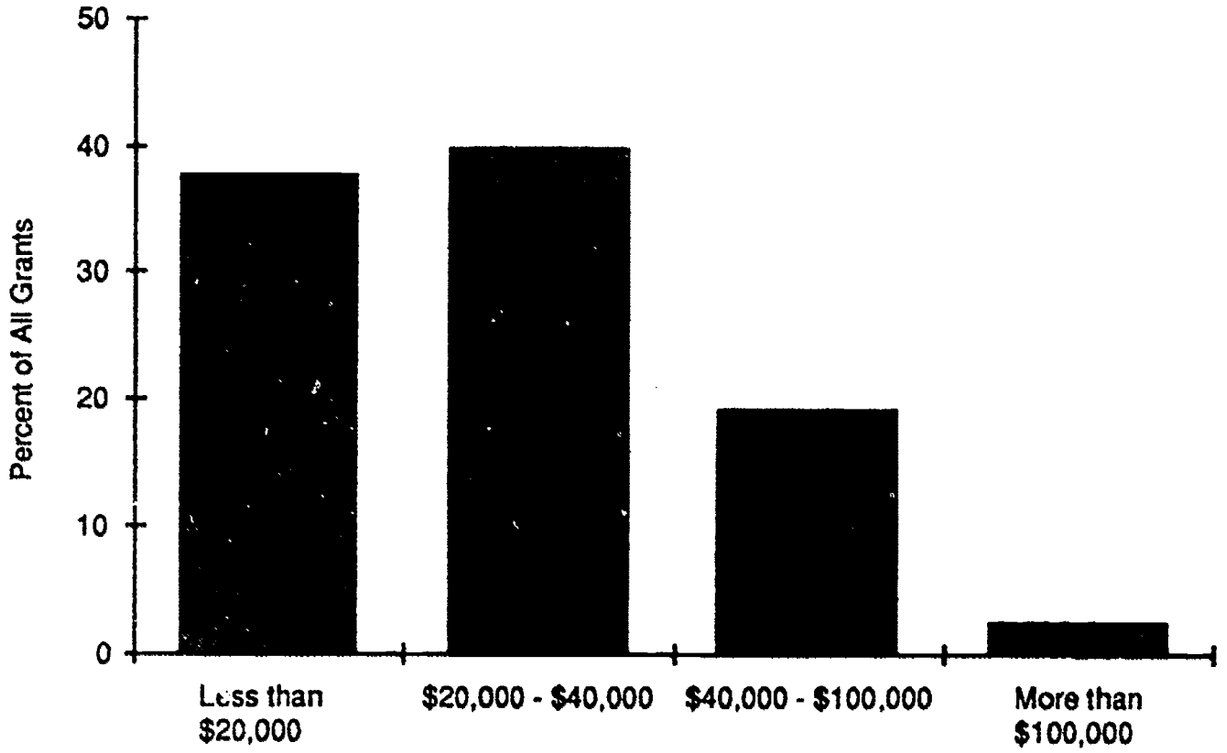

FIGURE 10 HIGHER EDUCATION GRANT SIZE— 1987-88 AND 1988-89 COMBINED

Table 56

DISTRIBUTION OF GRANTS BY TYPE OF INSTITUTION[a]

Type of Institution	Percent of Grants of Each Size Awarded to Each Type of Institution: Large ($40,000 or More)	Medium ($20,000-$39,999)	Small (Less Than $20,000
Doctoral/research university	43	30	33
Comprehensive university	34	44	41
Four-year liberal arts college	6	8	7
Two-year college	7	14	10
Other IHEs	2	1	1
Other nonprofit institutions	9	3	7
Total	100	100	100

[a]Data represent awards in Years 3 and 4 combined.

As Table 57 indicates, "cooperative" grants were somewhat more likely to fall into the small grant category. This is consistent with analyses showing that 48% of awards to other nonprofit institutions, such as museums and associations (which were eligible to be grantees only under the "cooperative" portion of the program), also were grants of less than $20,000. However, the nonprofits also received a disproportionate share of the very largest grants, thus raising the overall mean grant size for institutions in this category. "Competitive" grants averaged $32,593 (compared with the overall average grant amount of $31,052) across Years 3 and 4 of the program combined, while "cooperative" grants tended to be somewhat smaller, averaging $27,402.

Project Budgets

On the average, IHEs and other nonprofit institutions use 40% of their Title II/Eisenhower project funds for salaries and fringe benefits.

Overhead fees charged by the host institution average a very low 4%; in fact, during the site visits, several project directors noted that their institutions waive overhead entirely. The second-largest line item is typically for participant stipends, a mechanism that many project planners feel is critical if teachers are participating in professional development activities during the summer or on weekends. Usually, stipends are treated as per diem payments for the personal costs associated with project participation--food, transportation, sometimes lodging. Participants' tuition for credit-bearing courses may also be reimbursed through the higher education grant, although it appears to be more common for school districts to cover this aspect of participation costs (see Table 58 below). In a few states, Title II/ Eisenhower projects are not permitted to offer stipends, on the principle that professional improvement is a requirement and a responsibility that goes with the job of teaching.

Table 57

TYPES OF TITLE II GRANT AWARDS TO IHEs AND OTHER INSTITUTIONS[a]
(By Grant Size)

Type of Grant Award	Percent of Institutions Receiving Each Type of Award			
	All	Large	Medium	Small
"Competitive" grant (Section 207b)	84	85	88	79
"Cooperative" project (Section 207c)	16	15	12	21
Total	100	100	100	100

[a]Data represent awards in Years 3 and 4 combined.

The vast majority of project directors (81%) report that their projects received some other money or in-kind support in addition to the Title II funding. Furthermore, 48% indicate that the Title II grant itself can be an important factor in leveraging other types of support. **The mean level of total support from other sources--$32,560--actually exceeds the mean size of the Title II grant ($31,052). The median support from other sources, however, is much lower, at $13,378 (the median grant size is $30,000).** As Table 58 indicates, for most projects, the bulk of any matching funds comes in the form of contributed time, salaries, space, and equipment from the host institution. Relatively few projects have significant amounts of other monies to expend on project activities or related services. A very small number of the higher education projects are combining a Title II/Eisenhower grant with major funding from other sources. For example, among the 31 projects that reported receiving other federal funds, the range in dollar amounts was from $500 to $625,000 with a median amount of $49,000. One project visited had received extremely modest amounts of Title II funds (about $6,000) for two successive years and had just learned that NSF would support expansion of its model for improving middle-grade science education at a level of $500,000 over three years. Examples like this, however, are rare.

The general lesson with Title II/Eisenhower higher education grants seems to be that it is possible to do a great deal with ingenuity, modest amounts of money, and very dedicated project directors. In one case--a summer physics institute--the project director was able to supplement a $20,000 Title II grant with tuition assistance from school districts and funds from local businesses to cover housing and food for some participants. Another project combined Title II money ($12,500) with state funds, school district funds (for participant tuition), and private-sector funds (for participant stipends). The Title II portion represented only about 20% of the total budget. Very often, it appears, the overall impact of a project is the result of intense commitment on the part of project directors who work hard to make limited resources go a long way.

Table 58

TYPES OF MATCHING OR IN-KIND SUPPORT REPORTED BY PROJECTS IN IHEs AND OTHER NONPROFIT INSTITUTIONS[a]

Source of Funds	Percentage of Projects Reporting Support
Department/institutional budget	38
Other institutional funds	7
Institution in-kind contributions	47
Other federal funds (e.g., NSF grants)	5
State funds	5
School district funds	26
Private-sector monies	15
Other sources	15

[a]Data represent awards in Years 3 and 4 combined.

Focus of Grants

Although some state agencies for higher education consulted IHEs when conducting their legislatively required assessment of needs in mathematics/science education, the design of the study did not assume that individual project directors of higher education grants would necessarily have a statewide or national perspective on educational issues at the elementary and secondary levels. Generally speaking, IHE projects should be considered responses to state-initiated requests for proposals (RFPs) or (in the case of some "cooperative" projects) specific invitations to develop and implement particular types of educational improvement initiatives. As noted in Part One of this report, states differed in the degree to which they actively sought to shape the uses of the higher education money.

Subject Area Emphasis--As Table 59 shows, higher education projects, like school districts, focus heavily on science and mathematics. Although the higher education sector paid somewhat more attention to foreign languages

than did LEAs, the emphasis in this area was still slight and principally confined to a few states. Four states, for example, supported five or six foreign language projects in Years 3 and 4 combined; one supported eight.

"Science," of course, covers several discrete disciplines. Of those projects that emphasized science, 70% focused on physical science (i.e., chemistry and physics) and 59% targeted the biological and life sciences.

Table 59

SUBJECT AREA FOCUS OF PROJECTS
BASED IN IHEs AND OTHER NONPROFIT INSTITUTIONS[a]

Discipline	Percentage of All Projects Focusing on Discipline
Science	64
Mathematics	49
Computer education[b]	15
Foreign languages	11

[a]Data represent awards in Years 3 and 4 combined.

[b]"Computer education" refers to instruction in the use of computers for curricular areas and purposes other than mathematics and science education.

Other areas included earth sciences/astronomy (52%) and "general" science (36%). Many projects for elementary and middle school/junior high teachers touched on all of these areas, since the science curriculum at these levels is usually very broad and general.

Examination of the subject matter focus of higher education grants by type of institution yielded several interesting patterns. For example, nearly all grants (84%) to other nonprofit institutions had a science focus, perhaps reflecting the dominance of science museums as recipients in this

category. Both two-year colleges (36%) and other nonprofit institutions (31%) reported proportions of projects focused on computer education over two times greater than the sample average of 15%. Finally, 22% of projects based in four-year liberal arts colleges addressed foreign languages--twice the percentage found among the projects overall.

Project Purpose--As Table 60 shows, **IHEs--like the state agencies and LEAs--overwhelmingly indicate that professional development for practicing teachers is the central thrust of their Title II activities. Few projects focus on the preparation of new teachers or individuals entering teaching from other fields.** Because direct services to students were specified in the original Title II legislation as an appropriate activity under the "cooperative" grant portion of the program, projects funded under this authority were more than three times as likely as competitive projects (36% vs. 10%) to select this response category.

As the table shows, curriculum development is the second most commonly indicated response. The fieldwork associated with this study revealed that curriculum development activities are often used by IHE projects to engage teachers in science and mathematics improvement issues. This does not mean that projects aim to articulate a full-blown, new curriculum in the course of a one- or two-week workshop. Rather, projects often have participants develop materials to supplement standard school district curricula and texts. For example, in one science academy, middle school teachers are teamed with undergraduates who are potentially interested in teaching. Each team must prepare a hands-on activity, complete with reproducible lesson plans, concepts to be taught, instructional objectives, and materials and procedures needed. These activities are "field tested," first with peers and then with students; ultimately, they are assembled and published as a volume entitled Lab Activities for Middle School Classes.

Table 60

MAIN PURPOSE OF PROJECTS IN IHEs AND OTHER NONPROFIT INSTITUTIONS[a]

Project Purpose	Percentage Indicating Each Purpose, by Grant Size		
	Large	Medium	Small
Ongoing professional development for teachers currently in service	88	89	87
Preparation of new teachers	12	11	12
Training for recertification	24	32	24
Alternate route to certification	4	2	2
Direct services to students	15	15	18
Curriculum development	42	33	30

[a]Data represent awards in Years 3 and 4 combined.

Project Participants

Projects are principally geared toward teachers who are already certified or who are in graduate school, as shown in Table 61, not to uncertified teachers or individuals preparing to enter the teaching field. Teachers at the middle/junior high school level receive the most attention. Since definitions of middle school and junior high vary greatly across the nation, it is likely that survey respondents used this category to indicate a focus on grades five through nine or any combination in between. In fact, one middle school oriented project visited defined the "middle years" as grades four through nine.

Table 61

PROFESSIONAL AUDIENCES TARGETED BY
PROJECTS IN IHEs AND OTHER NONPROFIT INSTITUTIONS[a]

Target Audiences	Percentage of Projects Targeting Specific Audiences, by Grade Level of Teachers			
	Elementary School	Middle/ Junior High School	High School	No Specific Level
Certified teachers	47	60	49	5
Uncertified teachers	10	20	15	2
Preservice teachers	6	7	5	2
Teachers in graduate school	15	21	15	2

[a]Data represent awards in Years 3 and 4 combined.

Policymakers will naturally be interested in the total numbers of teachers served by the Title II higher education projects. Table 62 shows the actual numbers served in four participant categories over a two-year period, as well as an annualized estimate. Public school teachers represent 84% of all participants in the higher education projects.

Some projects report serving large numbers of participants; the range is from 1,550 down to 3. **However, the median of 35 teachers and/or teacher candidates per project yielded by the survey data compares quite accurately with the information obtained through site visits.** Among the 21 higher education project sites, one trained four teachers in a computer programming language, while another potentially reached up to 500 teachers in a geographically large, rural area. Most served 20 to 40 teachers annually. Based on the mean grant award figure of $31,052 reported earlier in this chapter, an average participation rate of 35 yields a cost per participant of $887.

Other IHE survey data revealed that over two-thirds (69%) of the projects are geared toward teachers at particular levels of proficiency or expertise. These projects are most often directed at underprepared teachers currently assigned to mathematics or science classrooms (66%). Other targeted groups include "lead" or "master" teachers (48%), teachers certified in one area of mathematics or science retraining to teach in another (46%), and out-of-field or uncertified teachers (29%).

Female Participation--Women and girls are generally identified as one of the underrepresented groups in mathematics and science classrooms, as well as in careers related to mathematics and science. In the IHE projects, female teachers constituted 68% of all participants. However, this should not be construed to mean that women dominate the mathematics and science specialty teaching fields. A large number of projects target the elementary and middle school/junior high levels, where women trained as educational generalists are a majority of all teachers.

Minority Participation--Title II/Eisenhower specifies a particular interest in increasing the number of qualified mathematics and science teachers from minority backgrounds. Overall, across all higher education projects, about one-fifth (21%) of teacher participants are minorities.

Table 62

PARTICIPATION BY TEACHERS OR TEACHER CANDIDATES
IN PROJECTS IN IHEs OR OTHER NONPROFIT INSTITUTIONS

Type of Participant	In Years 3 and 4, Total Number of Participants	Estimated Participants/Year
Public school teachers	107,036	54,000
Private school teachers	8,708	4,000
Teacher candidates	4,633	2,000
College/university students	6,569	3,000
Total	126,946	63,000

Slightly over one-quarter (28%) of the projects indicate that working with minority teachers is one of their main purposes. Among this group, most (87%) provide inservice or professional development support to existing minority teachers. In some cases, the proportion of minority teachers served is a simple function of geographic location; i.e., in areas where many public school teachers are from minority backgrounds, Title II/Eisenhower higher education projects will serve those teachers. Site visits included one project in which active recruitment of new teachers from minority backgrounds to science classrooms was a major goal. Although most of the 25 undergraduates involved in this project have not yet graduated, the project director estimates that as many as 20 of them remain interested in a teaching career several months after the summer institute in which they participated.

Student Target Groups--Some Title II projects are also designed with particular kinds of students in mind. Nearly half (43%) are directed at teachers who work with specific student groups. Since few higher education projects (fewer than one-fifth) provide direct services to students, this figure should be interpreted as the proportion of projects targeting teachers who work with certain students. Among the Year 3 and 4 projects, 72% targeted teachers of minority students and 48% teachers of gifted students.

Only a few projects focused on teachers of handicapped students or students with limited English proficiency. One site visit, however, was to an innovative inner-city project where the local public university trains college students from particular linguistic backgrounds to tutor and mentor more recent immigrants in two local high schools. This project, supported under the "cooperative" portion of the state's Title II/Eisenhower higher education funding, is specifically designed to serve language minority students. Interestingly, teachers in the high schools served are also learning from the tutors, who bring with them special strategies and techniques for overcoming both language and self-confidence barriers to success in mathematics and science classrooms.

District Participation--IHE projects work with school districts in different ways. Over half (52%) of the projects report that their activities

are open to teachers from any and all districts wishing to participate. Although this is undoubtedly true, site visits showed that, typically, teacher participants actually come from a relatively circumscribed number of districts located fairly near the project's host institution. About one-quarter of the projects indicate that they work closely with one or two school districts, while slightly over one-third involve a large consortium of districts. The average number of participating districts ranges from 12 in small-grant projects to 20 in large-grant projects. District participation can go as high as 150 districts in the large-grant category, 120 in the medium-grant category, and 100 in the small-grant category.

Sometimes when projects are funded for more than one year, they broaden the base of participating districts. For example, one state college has had a very small grant to send a limited number of teachers to an internship week at a regional science museum for three successive summers. Originally, this project focused on five or six districts in the college's immediate area; now it is open to teachers statewide. In another case, a private comprehensive university in a rural state has received four successive years of funding for a project designed to train middle-grade teachers to become resource agents on science education for their colleagues. Rather than have teachers come to them, each summer the professors involved with this project take their workshop on the road to a different set of districts in a different part of the state.

Participation of Other Organizations--The Title II legislation encourages "cooperative" projects to establish a partnership with at least one school district, but many projects--both "competitive" and "cooperative"--use Title II/Eisenhower grants as an opportunity to establish or strengthen other alliances outside the receiving institution. Grantees were asked to indicate the types of organizations (beyond school districts) that were involved with their projects.*

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* The survey item on which this paragraph is based did not ask respondents to specify whether a "partnership" was formal or informal. The information collected probably represents a range of interinstitutional relationships, including ad hoc consultation as well as joint administration of a project.

Partnerships with the state agency for higher education (SAHE) are cited most commonly (39% of the projects), followed by relationships with other colleges and universities (29%). Other partners include private business and industry (17%), professional societies and associations (17%), and museums and other nonprofit institutions (14%). Only about one-quarter of the grantees (26%) report that they have formed no partnerships to carry out the activities of their projects.

Project Configurations

When Activities Occur--The information from the IHE surveys yields a profile of the typical Title II/Eisenhower-sponsored IHE project. On the average, nearly half (48%) of all project activities take place during the summer. This was certainly the case in the majority of projects that were visited. Other times include during the school day (23%) and late afternoon or evenings (19%). Weekends are the least used time periods. **Many projects combine a one- or two-week summer institute (sometimes residential) with some type of follow-up during the school year, i.e., the occasional after-school or Saturday workshop.** Based on field experiences, it seems likely that for many of the nearly one-quarter of the projects reporting activities during the school day, release time payments for substitute teachers often come out of LEA Title II allocations rather than the higher education grant.

Where Activities Occur--Most project activities (76%) take place on a college campus or, in the case of the other nonprofit institutions, on their premises. However, a number of projects (43%) also report using space provided by LEAs. One teacher interviewed expressed her relief and gratitude that the institute she had attended took place at her own school "because the university is so intimidating."

Intensity of Training--According to IHE survey respondents, the median time that participants are involved in project activities is 60 hours. Typical use of this time would be an intensive one-week summer institute

(40 hours) plus 20 hours of follow-up over the succeeding school year. Since most projects (70%) indicate that some or all project participants can receive college or graduate credit for their participation, they must conform to institutional requirements on what constitutes a credit hour. Often, earning graduate credit is presented as an option involving some type of activity beyond simply attending workshop or institute sessions--for example, preparing a paper or a curriculum unit or making presentations to colleagues. Even without opting to participate for credit, most teachers are able to apply workshop attendance toward state or local annual inservice requirements needed to maintain certification. For many teachers, the opportunity to earn license renewal credits is a primary motivation for participation.

More than one project director offered the opinion that teachers would not participate in any professional development activity that did not result in something tangible, such as graduate credit, that would further their careers. However, in talking with teachers, the study team found many different motivations for attendance at mathematics or science workshops. One, who had opted not to seek credit for a science institute, told us that she has taken "jillions" of workshops over the years because "I'm afraid that someone will find out something I don't know." Last year she accumulated 60 staff development hours in a state that requires 27.5 per year, yet she has no interest in translating these experiences into the graduate credits that would earn her a master's degree.

Project Goals and Strategies

The survey asked project directors to respond to items that were designed to identify the goals of the projects and the main curricular or instructional strategies that workshops or other activities sought to convey. Different response categories were developed for each of the content areas targeted by Title II (mathematics, science, foreign languages, and computer education). However, each set of items was rooted in an understanding of both conventional instruction and cutting-edge trends in that discipline.

Projects Targeting Mathematics Education Improvement--Table 63 shows the goals and strategies specified by Title II higher education projects that focused on mathematics education. In general, these rankings remain the same for large, medium, and small grants. However, the home base of the project seems to make some difference in terms of goals and the instructional strategies promoted. For example, four-year liberal arts colleges, other nonprofit institutions, and the schools that fall into the "Other IHE" category are far more likely to indicate an emphasis on reaching at-risk students than the doctoral-degree-granting or comprehensive universities.

Table 63

FOCUS OF PROFESSIONAL DEVELOPMENT IN MATHEMATICS EDUCATION PROJECTS[a]

Goals and Strategies	Percentage of Projects Using Funds for Mathematics Education That Focused on Each Strategy or Goal
Goals of activities	
Improving teaching skills	76
Improving teachers' knowledge	67
Developing activities/units for classrooms	54
Developing a corps of lead teachers	29
Reaching at-risk students	28
Introducing a new curriculum	19
Improving skills of teacher candidates	8
Instructional strategies promoted	
Higher-order thinking	82
Mathematical applications	45
Use of technology	41
Use of manipulatives	38
Cooperative learning	32
Use of calculators	17

[a]Data represent awards in Years 3 and 4 combined.

Projects based in four-year liberal arts colleges also report stressing the use of manipulative materials in mathematics instruction far more often than other types of institutions. Despite differences like these, there is consensus across all the IHE projects on the importance of helping teachers learn better strategies for imparting higher-order thinking skills and problem-solving techniques.

Projects Targeting Science Education Improvement--Table 64 provides similar information about IHE projects that specifically target science education. There is little variation from biology projects to physical science projects to general science projects on overall goals and strategies.

Table 64

FOCUS OF PROFESSIONAL DEVELOPMENT IN SCIENCE EDUCATION PROJECTS[a]

Goals and Strategies	Percentage of Projects Using Funds for Science Education That Focused on Each Goal or Strategy
Goals of activities	
Improving teachers' knowledge	77
Developing activities/units for classrooms	72
Improving teaching skills	67
Developing a corps of lead teachers	31
Introducing a new curriculum	17
Reaching at-risk students	17
Improving skills of teacher candidates	11
Instructional strategies promoted	
Use of "hands-on" approaches	85
Higher-order thinking	63
Use of demonstrations	62
Use of technology	30
Cooperative learning	19
Social implications of science	19

[a]Data represent awards in Years 3 and 4 combined.

In comparison with the mathematics projects, however, science projects focus somewhat more heavily on improving teachers' content knowledge and on helping them develop curriculum activities that they can take back to their classrooms.

These survey data results correspond with information from the site visits. Quite a number of the projects visited were designed to make elementary and middle school teachers more comfortable with teaching science. The general premises on which these projects rested were that (1) teachers at these levels often have little undergraduate science background and (2) the typical curriculum is textbook based, dry, and boring for students. Therefore, project goals were to review some basic scientific precepts and encourage the use of instructional approaches that get students excited about science. This analysis also explains the prominence of "hands-on" approaches (including laboratory experiences) and increased use of demonstrations as instructional strategies emphasized by the science projects.

The science projects are somewhat less likely than the mathematics projects to report a goal of reaching at-risk students (although the survey data show that neither type of project places a strong emphasis on this program goal). One interpretation of this finding is that, because the IHE-based science projects are frequently rooted in the premise that very little good science teaching (or even, perhaps, <u>any</u> science teaching at all) is going on in American classrooms (especially at the elementary level), project designers therefore take the position that <u>all</u> students are "disadvantaged" with regard to science education--the at-risk student no more or less so than the average student.

<u>Projects Focused on Computer Education</u>--Only 14% of all the higher education projects focus exclusively on computer education (outside the context of mathematics and science education). As Table 65 indicates, the principal goal of these efforts is getting teachers up to speed on the uses of computers in instruction. Two-year colleges and the nonprofit institutions are somewhat more likely to indicate that their Title II grants have been used to purchase hardware or software for general curricular use.

Table 65

FOCUS OF ACTIVITIES IN COMPUTER EDUCATION PROJECTS[a]

Goals of Activities	Percentage of Projects Using Funds for Computer Education That Focused on Each Goal
Supporting staff development (e.g., in computer literacy)	62
Providing computer hardware and software across all curricular areas (e.g., for a general-purpose computer lab)	33
Providing computer hardware and software for courses outside of mathematics/science	24

[a]"Computer education" refers to computer education not specific to mathematics and science. Data represent awards in Years 3 and 4 combined.

In fact, responses from the two-year schools throughout the IHE survey indicate a technological thrust to their activities, which is entirely in keeping with the program orientation of most community colleges.

Table 66 shows that in foreign language projects (11% of all projects), the major professional development goal of Title II higher education projects has clearly been to improve the oral proficiency of teachers. (The very small number of foreign language projects based in two-year colleges were somewhat less apt to cite this goal.) The instructional strategies emphasized varied to some degree among the institutional types. The large research universities and the comprehensive universities favored a cultural approach to foreign language instruction, while four-year liberal arts colleges and the other nonprofit institutions placed oral language instructional techniques ahead of other strategies.

Table 66

FOCUS OF PROFESSIONAL DEVELOPMENT IN FOREIGN LANGUAGE PROJECTS[a]

Goals and Strategies	Percentage of Projects Using Funds for Foreign Languages That Focused on Each Goal or Strategy
Goals of activities	
Improving teachers' oral proficiency	73
Developing articulation across grades	58
Enlarging pool of qualified teachers	44
Promoting instruction at the elementary level	33
Strengthening skills of teacher candidates	21
Teaching a new language to teachers	11
Instructional strategies promoted	
Cultural approach	80
Oral language instruction	77
Multimedia approach	55
Proficiency-based instruction	49
Use of technology	43

[a]Data represent awards in Years 3 and 4 combined.

Project Staffing

This data collection effort confirms earlier information on the specific locus of Title II/Eisenhower higher education projects within institutions of higher education (Jones, Franklin, & Rudin, 1988). The survey data show that over half (52%) of all project directors for the grants are based in departments of science (all types), mathematics, statistics, computer science, engineering, or foreign languages. Only about one-third (33%) are based in departments of education.

The majority of project directors (59%) are associate or full professors and therefore presumably tenured. Site visits reaffirmed what others have found--that it is far easier for tenured faculty to become involved in activities related to improving elementary and secondary education than it is for junior faculty, who must focus on their research (and, to a lesser extent, their teaching) to assure their own job security. At many institutions, service--which includes working with schools, districts, and teachers--comes far down in the hierarchy of faculty responsibilities. This varies somewhat, however, according to the institution's mission. Site visitors found the service ethic to be extremely healthy in regional institutions such as state colleges and smaller, less well-known private institutions.

On the average, project directors spend 29% of their time on activities related to their Title II projects for the duration of the grant. (During peak times--such as summers--the percentage may be much higher.) The median number of individuals involved with implementing project activities is six. Often the project team includes some combination of college faculty and master teachers. **Project participants stated on more than one occasion that the pairing of professors and excellent K-12 teachers is optimum since the teachers are able to keep the professors firmly grounded in the realities of day-to-day teaching of precollegiate students.** A number of project directors themselves mentioned that their eyes had been opened to the massive logistical and motivational problems faced by teachers in the elementary and secondary schools.

VIII IMPACTS OF TITLE II HIGHER EDUCATION GRANTS

The study sought information on the impacts of the projects funded through the higher education component of the Title II/Eisenhower program by various means: surveys, interviews with project directors and others connected with the grants, and, most importantly perhaps, interviews with the teachers who participated in project activities. Because of the nature of the program, with its emphasis on the professional development of elementary and secondary school mathematics and science teachers, it seemed likely that the most clear-cut impacts would be on individual teachers who participated in the projects. But the structure of the program--the very fact that it includes a higher education component as well as formula grants to school districts--also pointed to the possibility that new relationships might be expected to develop within and among different types of institutions. On the other hand, impacts on classrooms, curricula, and students would most likely be indirect and dependent on the strength of the impacts on teachers.

Generally speaking, project directors rate the overall impacts of their projects very highly. To the extent that they are able to judge what is happening in schools and classrooms from their vantage point in institutions of higher education or nonprofit institutions, the directors believe nearly universally (90% or more) that teachers' approaches to math, science, and foreign language instruction are changing and improving as a direct result of participation in Title II-funded activities.

There is, of course, a halo effect involved in such global ratings of improvement efforts by individuals who want to believe that their efforts make a difference. Nevertheless, participating teachers give project directors no reason to think otherwise. Nearly all projects (98%) employ some method for obtaining feedback from participants on the success of planned activities. End-of-workshop evaluation forms, for example, are common (55% of all projects). Those that were reviewed in the field indicated very high (90% to 100%) approval ratings from teachers.

Two-thirds of the projects also incorporate some method for observing teachers as they use new strategies or materials, and over half (51%) report gathering anecdotal evidence from participants. Only about one-third of the projects (32%) indicated that they attempt to measure instructional improvement by comparing pre- and post-activity test scores of children in participating teachers' classrooms. **None of the projects that were visited was able to establish a successful pre- and post-test design at the classroom level, although at least one attempted to do so.** Several, however, tested teachers on their content knowledge before and after participation in a workshop. One long-running summer science institute reported that when the test requirement for teachers was highlighted in its publicity brochure, recruitment of participants became a problem. The project directors interpreted this to mean that teachers were threatened by the prospect of subject matter tests. They have not dropped the testing, but they no longer "make a big deal of it" in their recruitment literature.

Ninety percent of project directors report that they use the results of assessments in planning for further project activities, which seems to imply an expectation of continued funding; 72% either are required to or voluntarily send project assessments to the SAHE. Fewer than half (47%) share assessment results with the individual teachers who participated or with participating organizations, such as LEAs.

Impacts on Grantee Institutions and Their Collaborating Partners

When the term "grantee institutions" is used in the Title II/Eisenhower higher education context, it refers, of course, principally to institutions of higher education--96% of the grant recipients. Given that fact, it is useful to understand a little background on the sector. Ideally, the different funding mechanisms in the Title II/Eisenhower legislation should create a complementary and supportive relationship among state agencies, local education agencies, and colleges and universities, with all entities focused on a common goal of improving mathematics and science education in the schools. However, certain normative conditions exist in American

higher education that are potential barriers to the intent of the Title II/ Eisenhower legislation. Two that might sabotage the effectiveness of any given project include the following:

- Within a college or university, communications and relationships between an education faculty and the arts and sciences may be poor or nonexistent.
- External relations, particularly with schools and school districts, may have a "history." Quite frequently, elementary and secondary educators feel that higher education faculty are both ignorant about the issues and realities of precollegiate education and convinced that they have all the answers. Further, the schools resent the tendency of higher education to blame them for the academic deficiencies of college students.

Because of these potential constraints on the optimum use and interplay of Title II funds, the study was particularly interested in the intrainstitutional and interinstitutional impacts of the Title II/Eisenhower higher education projects.

Intrainstitutional Relationships

Chapter VII reported the significant finding that the majority of higher education projects (53%) are directed by discipline-based faculty--that is, professors of mathematics, physics, engineering, Spanish, and so on. To some, this finding may be counterintuitive. Title II/Eisenhower is, after all, a program of the federal Department of Education that channels funding through state education agencies and might logically be expected to funnel down largely through college and university departments or schools of education. That is apparently not the case. In fact, in at least one state the SAHE has been frustrated in its attempts to elicit any interest from college and university education departments. Generally speaking, however, the state agencies have succeeded in engaging a broad spectrum of higher education interest in the availability of grant funds.

That grants are being widely dispersed does not ensure that changes in relationships or communication patterns are taking place. The survey asked project directors whether their Title II projects had succeeded in

promoting certain kinds of changes within the institution. The percentage who indicated that they "agreed" or "strongly agreed" with each of our intrainstitutional impact statements appears in Table 67.

Although all these ratings are high, the strictly intrainstitutional impact statement--"Greater interaction between education and discipline-based departments"--scores lowest. Apparently, Title II has helped a great deal in bringing the pedagogical and content sides of math/science teacher preparation and professional development closer together, but there remains room for growth in this area. In one site visit to a liberal arts college, for example, the small education department made the initial connection with the Title II program during its earliest years. Later, when a physics professor was brought into the project at the instigation of the local school district, the dynamics of the instructional team changed and the education department faded from the scene.

Table 67

PROJECT DIRECTORS' ASSESSMENTS OF INTRAINSTITUTIONAL CHANGES AS A RESULT OF TITLE II PROJECTS[a]

Change	Percentage of Project Directors in Agreement
Greater interaction between education and discipline-based departments	81
Greater faculty interest in the schools' problems with science and math education	91
Increased commitment by the administration or department(s) to helping the schools	88
A better understanding among faculty of the problems of K-12 math/science education	91
Greater faculty interest or understanding of the problems with foreign language education	83

[a]Data represent awards made in Years 3 and 4 combined.

Still, this is only one instance among 21. There were many more examples of sites where new or stronger relationships had developed between teacher educators and their discipline-based colleagues. At a large research university, the project director for a Title II-funded science academy personally bridged the gap as a professor of both chemistry and education. This project began in the education department but moved to the physical science department, apparently without acrimony. Education and science departments at this institution are currently conducting a joint search for a science educator for the disciplinary School of Science who would act as permanent liaison to the School of Education. The Dean of the School of Natural Sciences told us that the Title II grant has "facilitated mutual respect between the Schools of Education and Science."

In another case, the project team for a mathematics project based at a regionally oriented state university included the Chairman of the Mathematics and Computer Science Department and two faculty from the education department. At a similar institution in another state, a mathematics professor and a chemistry professor each received separate funding to run summer workshops in their respective disciplines during the earliest years of Title II. Now, with the encouragement of the SEA and the SAHE, they have joined forces with a professor in the education department to establish a Center for the Study of Excellence in Science and Math Programs.

Referring back to Table 67, nearly 90% of Title II projects indicate that the administration or departments in their institutions have increased commitment to helping the schools. **Generally speaking, it seems that the visibility and importance of a Title II/Eisenhower grant on a campus varies according to (1) the size of the institution and (2) what the institution perceives to be its primary mission.** At regionally based, largely non-selective institutions where teacher education is a prominent major and faculty do not routinely obtain many grants from other sources, obtaining a Title II/Eisenhower award seems to have more intrainstitutional impact than

at large, research-oriented universities where millions of dollars in grant money flow in regularly.*

When the study team made contact with project directors to arrange site visits, directors were asked to organize interviews with any and all key figures who could help the team understand the importance and impact of the Title II/Eisenhower project. Sometimes this request led to the offices of college presidents and deans who assured interviewers of the institution's dedication to improving area schools. In other instances, site teams met only with faculty directly connected with the project itself and gained no real sense of institutional (as contrasted with individual) commitment to improving elementary and secondary education. In two cases, the project director was an administrator at the level of associate dean.

On balance, the evidence suggests that at a fair number of colleges and universities, the Title II/Eisenhower program is having a felicitous effect on intrainstitutional relationships. From the limited site visit sample, it appears that building interdepartmental relationships rooted in a common goal of helping the schools improve math and science instruction may be both more likely and less complicated in institutions such as regional state colleges or universities where teaching and community service are at least the equals of faculty research.

Interinstitutional Relationships

The nature of the Title II/Eisenhower program, with its varied funding mechanisms, creates more than an average probability that different organizations will combine forces to address problems and issues in the improvement of math and science education. The survey of higher education institutions asked project directors whether their Title II project had affected the level

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* This comment should not be interpreted as an evaluation of project effectiveness in delivering professional development services. There are no data to indicate that institutional size or mission has any direct correlation with program quality.

of interaction between their own institution and various other types of organizations. Table 68 shows their responses.

Table 68

CHANGE IN INTERACTIONS WITH OUTSIDE ORGANIZATIONS AS A RESULT OF TITLE II PROJECTS[a]

Type of Organization	Percentage of Institutions Indicating That the Level of Interaction Increased
School districts	93
State agency for higher education	67
Private schools	61
Professional organizations	51
Colleges/universities	45
Business and industry	29
Other nonprofit institutions	23

[a]Data represent awards in Years 3 and 4 combined.

As the table indicates, the greatest interinstitutional impacts appear to have been on the amount of interaction between grantee institutions and LEAs, SAHEs, and private schools. In response to another survey item, 80% of project directors reported that Title II/Eisenhower activities strengthened existing collaborative relationships with LEAs; only 38% reported that they had established new contacts with school districts as a result of their grant. The increased contact with private schools probably represents the difference between none and very little; each higher education project serves a median of only two private school teachers.

Collaboration with School Districts--The site visits revealed many ways in which institutions of higher education were working collaboratively with one or several school districts. It was quite common, for example, for LEAs to use some of their local Title II flow-through money to pay the tuition at IHE-sponsored workshops or institutes if teachers wished to earn graduate credit. Similarly, school districts sometimes paid for room and board or travel expenses for teachers attending residential institutes on college campuses. In a particularly effective model (which has now received major funding from NSF), a rural district with several small elementary schools used its Title II allocation in conjunction with other federal and local funds to support a part-time science coordinator to do follow-up throughout the school year with participants in a summer IHE-sponsored institute.

This potential for commingling of different portions of the overall Title II/Eisenhower "pot" is one aspect of the legislation's structure that makes it so interesting. It should be noted, however, that this strategy did not always work. Sometimes, IHEs successfully secured agreement that LEAs would sponsor teachers to participate in Title II activities. In other cases, IHEs were able only to "suggest" that districts provide this type of financial support to their teachers, and not all districts chose to follow through. Getting prior commitment from LEAs appears to be the stronger approach.

There were other ways in which IHEs and school districts collaborated, as well. Sometimes school district personnel--administrators or teachers--were involved in planning an IHE project to meet a very specific need, as in the case where an LEA sought IHE assistance in training teachers to use the math manipulative kits provided by the state.

Probably the most common type of collaboration was for the instructional teams associated with IHE projects to include both professors and master teachers from local schools. One particularly elaborate design--in an IHE project that provided tutorial assistance in both mathematics and science to high school students with limited English proficiency (LEP)--utilized (1) trained college student tutors with the same first language background as

the target students, (2) classroom teachers, (3) school district English-as-a-second-language (ESL) coordinators, and (4) high school age "tutors" (or buddies). More typically, however, one or more college professors shared instructional responsibilities with one or more particularly gifted (or interested) teachers from a local school district. Workshop participants appreciated the practicality of the strategies and activities demonstrated by mentor teachers and trusted these peers to understand the realities of day-to-day instruction in elementary/secondary classrooms.

Although all types of interinstitutional contacts are considered positive impacts in this section, it should be noted that not all connections are really at an institution-to-institution level. **Many of the relationships established between IHEs and LEAs involve one or two professors who gain a reputation among local districts and teachers.** In one project, the grantee institution itself was described as "aloof," as was the school district in which project activities occurred. The project (codirected by a professor and a school principal) was, nevertheless, quite successful in training a cadre of science mentors and forming a regional network to sustain the momentum.

Relationships with the SAHE--Much of the increased contact with the state agency for higher education occurred before the grant award. Seventy percent of the project directors reported that the state agency actively encouraged them to apply for an award when the RFP was issued. In interviews, some higher education project directors indicated that they had also established relationships with the state agency for elementary and secondary education (SEA). In one rural state, for example, the SEA mathematics coordinator made a point of knowing which higher education projects were particularly successful so that he could refer LEAs to potential math and science consultants (or vice versa).

The majority of project directors also reported that the SAHE evaluated their activities in some way. Usually, this took the form of a required end-of-project report from the grantee to the funding agency. However, in some cases, state agency people seem to make an effort to get out and visit

at least some higher education projects each year. This may be more common in smaller states (either geographically or in terms of population), where the statewide science and math networks tend to be much more intimate. In one state, for example, where Title II/Eisenhower higher education money is dispersed through a higher education cooperative housed at the major state university, project directors from around the state meet regularly with SEA personnel to report on current activities or plan for future initiatives.

Relationships with Professional Organizations and Associations--The story of Title II's role in the increased activity of state affiliates of asscciations such as the National Council of Teachers of Mathematics (NCTM) and the National Science Teachers Association (NSTA) has already been told in Part One of this report. The majority of higher education project directors (51%) report that they, too, are part of this new infusion of life into math and science professional organizations. One project, designed to upgrade biology teachers' knowledge of botany, required all participants to cooperate in presenting a session at the annual state Science Teachers Association meeting. Despite nervousness and apprehension, the session went exceedingly well and gave the presenters a greatly enhanced sense of themselves as scientists and professionals.

Impacts on Individual Teachers

The overarching impression obtained from talking with teachers who had participated in the higher education activities was that a cupboard full of new approaches to teaching mathematics and science had been unlocked. Teachers talkeo knowledgeably about hands-on or laboratory approaches to teaching science, the appropriate use of manipulatives to teach math concepts, integrating science into other areas of the curriculum, the virtues of cooperative learning groups in science and math instruction, and other topics that had been central to their Title II/Eisenhower professional development experiences. If they had known about these things before, the workshop experience gave more depth to their knowledge. They were highly appreciative of the inexpensive materials that they were able to take away

from many of the sessions and amazed by the number of local resources brought to their attention. One teacher who attended a science academy reported that she has since obtained $500 from the local business community to buy live animals for her classroom--fish, a spotted gecko, snakes, rats, and a hermit crab.

In general, it was difficult to find a teacher with a bad word to say about his or her experiences in Title II/Eisenhower-sponsored higher education activities. One mentioned a lack of adequate training in how to go about developing hands-on activities; for her, the math workshop she attended was a good experience, but not profound. Another, speaking for a number of project participants, criticized what she perceived to be inappropriate content emphasis in a science workshop for elementary school teachers:

> *Some lectures needed to be adjusted to our level; others were very good. The physics and chemistry portions of the institute were especially difficult and they did not apply to what we need to teach.*

Overall, however, teacher reactions were overwhelmingly positive. Perhaps the best way to get a sense of what teachers have taken away from Title II activities is to let them tell about it in their own voices. The following are some additional quotations from interviews:

> *The project staff treated us so professionally.*
>
> *Dr. ___ added files to my memory. The course gave me confidence to teach science. Those of us that took it aren't as scared. We're feeling more at ease.*
>
> *I now see science as being as basic to the elementary school curriculum as reading and writing.*
>
> *I finally realized that teachers and kids can explore and learn together. Teachers don't have to have all the answers.*
>
> *I am now feeling very secure and I know that I can do this kind of math teaching. It is a big step to put a textbook on the shelf. As an elementary teacher, you feel you have to be an expert in every field.*
>
> *My weakness was in problem solving. It was a real boost to my ego to have taken the math workshop.*

Although teachers did not necessarily know that the activities in which they had participated were supported by a federal program, they were

appreciative that funding was coming from somewhere to support truly helpful professional development opportunities in math and science teaching. The discussion of impacts in this section is organized around major themes that emerged from conversations with (1) teachers and (2) the professors (many of them also project directors) or mentor teachers who presented workshop sessions.

Self-confidence--**Gaining self-confidence was a major theme in teachers' comments.** The average elementary school teacher has little faith in his or her competence to teach science. A chemistry professor who directed a project to upgrade elementary teachers' confidence in teaching science estimated that of the 300 teachers he has dealt with directly, no more than four or five came to the workshop really competent to teach elementary school science. It is also difficult, as the teacher quoted above notes, for experienced teachers who have relied for years on textbooks to set those books aside in favor of a more free-wheeling, experimental, and noisier approach to instruction. One professor told of an older teacher--five years from retirement--who attended a workshop where she would be required to use computers:

> *She came totally petrified. But by the end of the workshop, it didn't bother her. Her school got computers and the principal told her they were hers. She was happy.*

For many, the Title II/Eisenhower courses or workshops offered a supportive, nonthreatening environment in which to experiment with some new things. Often, the project design included opportunities to prepare instructional units using new approaches and try them out on fellow participants--a kind of dress rehearsal before presenting the unit to students. Because of their participation, teachers saw themselves as "willing to take more risks."

Networking and Linkages--Whether or not it was a formal component of an IHE project's design, the effect of Title II/Eisenhower workshops was to put participating teachers in touch with other like-minded professionals. Some participants tended to view themselves as among the few intellectually alive teachers in their respective schools. They therefore relished the contact with peers who had similar interests and enjoyed similar challenges.

Relatively few of the projects visited included formal mechanisms to encourage and sustain networking beyond the initial, intensive workshop/ institute experience. One project established a newsletter--printed by a publisher in exchange for free advertising and disseminated through the state's teacher center program. Yet **teachers repeatedly told us that they felt heartened by realizing that there are others out there who want to change or improve math and science instruction.** Some keep in touch through their own initiative:

> *We [teachers in the workshop] have met several times since the summer. We published a newsletter and made science materials for each other. Even though this workshop did not provide as much money as one I attended [in another state], it was more effective because it allowed teachers to develop a support group with other teachers.*

Increased participation in state professional association meetings also offers opportunities for teachers who have met through the Title II projects to maintain communications.

Team Building--A number of higher education projects make a point of working with more than one teacher in a school or involving an administrator as well as teachers. The philosophy behind this approach seems to be that although two or three people might not be a critical mass for schoolwide change, they certainly are preferable to a single voice shouting in the dark. Further, the support of an administrator could ensure that teacher-participants receive time on the school or district's inservice calendar to present one or more sessions for colleagues--a requirement that a number of projects impose for participants seeking graduate credit.

One four-week-long summer institute required participating schools to commit a team of two teachers for the duration, as well as one day a week of the principal's time. The purpose of the activities supported by this project was the development of a school improvement plan by each team. In another project, participants were organized into grade-level teams (the majority were from a single urban math/science magnet school). Yet another project enrolled principally teachers from several small districts organized into one administrative unit and feeding into a single secondary school. In

this case, one of the ultimate goals is to achieve some standardization in students' exposure to science so that they reach junior high school on a more even footing.

Leadership Development--As noted in other portions of this chapter, many projects require or suggest that participants return to their schools and conduct inservice workshops for their colleagues or share what they have learned and acquired in some way. There are many examples of this type of strategy and many terms used to describe it: turnkey training, multiplier effect, pyramiding, etc. Records at one project showed that 27 out of 44 teachers offered at least one workshop for colleagues in the school year following their participation in a summer institute specifically designed to establish a network of elementary-level mentor teachers throughout an eight county region. One teacher interviewed, however, felt that the expectation that participants would serve as mentors to their peers had not been clearly communicated in advance of the workshop. He has been reluctant to formally assume this role, but has gladly shared what he learned with colleagues at his grade level.

Over a four-year period, another project has directly trained 300 elementary school teachers as science resource agents in four areas of the state. Each of these participants has been required to offer two inservice presentations to colleagues, one of which is observed by a college professor. The project directors estimate that each trained teacher has had at least some impact on four coworkers, for an outreach total of 1,200 beyond the original enrollees.

Almost instinctively, then, many IHE projects seem to include some strategy to increase the numbers of teachers whom they reach, at least indirectly. It is not clear, however, that the average IHE project is sufficiently aware of what it takes to be a successful change agent in school settings where many teachers may be either openly or covertly resistant to innovation. Even where the clear expectation is that teachers participating in a Title II workshop will carry the message about better ways to teach math and science back to their colleagues, most projects do not incorporate any

type of explicit leadership training component into planned activities. The study team visited only one project where such training was introduced in any depth. In this case--a four-week math institute with a considerably less compressed time frame than the norm, the project director responded to participant fears about their change agent role by hiring a consultant to work with the group on anticipating and solving resistance problems. A parallel science institute at this same site offered participants one evening with a local elementary school principal to deal with this same issue. However, neither of these institutes provided much follow-up with participants during the ensuing year, and the teachers who were interviewed continued to express discomfort with their change agent responsibilities.

In most higher education projects where participants were expected to spread the word about new approaches to teaching math or science, the basic change strategy was "bottom up," which is in keeping with some interpretations of the current national interest in restructuring schools. This was not the only approach taken, however. In one state, the SAHE awarded a large, three-year higher education grant to the state chapter of the National Council of Teachers of Mathematics for the purpose of preparing 100 key players in mathematics education in the state. Participants included county and district math specialists and coordinators, higher education faculty, members of the state mathematics framework committee, and others with the potential to reach the state's 100,000 math teachers--essentially, then, a "top down" strategy. The study collected no data indicating that "bottom up" is superior to "top down," or vice versa. The point is that SAHEs and IHEs have leadership roles on their minds and are experimenting with different approaches.

Learning to Develop Curriculum--**The majority of higher education projects seem to provide time and resources for participating teachers to develop math or science curricula.** This does not necessarily mean a full-blown scope-and-sequence for third-grade science or a physics course. Typically, individual teachers prepare a unit on, for example, electricity or geometry or levers and pulleys, including lots of hands-on activities or use of mathematics manipulatives. Often, the activities are tried out on other

workshop participants. Eventually, all the developed units are combined and bound into a resource book. (In one botany project, each participant prepared a videotape of flora in a different region of the state. If all goes as planned, these will be edited and disseminated statewide.) **Nearly universally, the higher education projects that employ curriculum development activities steer teachers away from textbooks and toward other types of materials, whether print or nonprint. This has the effect of making teachers much more critical and independent of traditional approaches to math and science instruction.**

One state has gone a step farther in encouraging teachers to develop curriculum. As a strategy for involving many teachers in Title II/ Eisenhower higher education activities, one of its higher education projects offers a series of short courses--16-hour, graduate-credit-bearing summer professional development opportunities with an environmental focus. The courses are developed and taught by high school teachers or community college faculty; participants are principally elementary school teachers. The curriculum developers are paid for both curriculum writing and teaching. As an added perk, they hold adjunct instructor status at the state university.

A teacher in another state found the perfect match between his own curriculum development interests and a Title II project based in a science museum. This high school science teacher had been concerned for years about the lack of quality materials, such as manipulatives and laboratory exercises, for use in his earth science classes. He decided to take a half-time sabbatical from teaching to collect materials and make them available to colleagues. As he looked for support for this endeavor, the grants office in his district put him in touch with the SEA, which in turn linked him up with the museum-based project. He has spent a satisfying year as the part-time assistant coordinator on this IHE project, collecting the materials that he yearned for in his own classroom while simultaneously preparing a notebook on earth science to be used as the text for a Title II/Eisenhower summer institute.

Impact on College Faculty--Discussion of impacts on teachers should not be limited to the elementary and secondary levels. The college faculty who participate in Title II/Eisenhower higher education projects also learn valuable lessons. As one project director put it:

> *A deliberate part of the Science Academy was to provide opportunities for university faculty to see what expertise exists out in the schools if it is "allowed to blossom" and to see what the reality of secondary education is.*

Another project planner said, "Updating is important for us professors and to show the teachers we are willing to roll up our sleeves. I learn a lot from them."

One particularly interesting offshoot of a college chemistry professor's involvement with elementary and secondary school teachers is the change in his teaching style in the college classroom. He says that he does not lecture nearly as much anymore. Instead, he has his undergraduates submit questions that are puzzling them about, for example, organic chemistry. He makes overheads of these and then holds discussions with the 150 students in the lecture hall. Working cooperatively, the students are usually able to answer their own questions. As most college students will tell you, this is a far cry from the typical large lecture course.

Impacts on Minority Teachers (or Teachers of Minority Students)--On the average, higher education projects report that about one-fifth of participants (21%) are from minority backgrounds. (Although the study has no specific data to support the assertion, it is likely that even more than 21% of the teachers served instruct minority students in their classrooms.) This is a significant finding. Recent data on the national teaching force indicate that only 8% of public elementary and secondary school teachers are from minority backgrounds (Feistritzer, 1990). Thus, the Title II/Eisenhower higher education projects are serving minority teachers at over 2.5 times their representation in the overall teaching population. Despite this success in reaching minority teachers, the study did not find that most projects narrow their focus on the basis of participant background characteristics. Rather, they target grade levels and assume that any and all

teachers might benefit from the activities they have to offer. Nevertheless, three of the higher education projects visited yield some insights on the impact of the Title II/Eisenhower program on math and science education for minority groups.

One project--located at a historically black college--is designed to retrain certified teachers for physics classrooms. The project director was the first black female in the state and only the third in the nation to obtain a Ph.D. in "pure physics"--obviously a wonderful role model for minority teachers. Although the project was not specifically designed for minority teachers, seven out of ten participants are black. The institute is a long-term effort; to achieve physics certification, teachers may need to attend for several summers, although correspondence courses have also been developed. So far, two minority teachers have been recertified.

Another project specifically targeted the families of at-risk students in the primary grades. Sixty percent of the participating children and their parents were black. The project sought to increase children's cognitive growth and problem-solving skills in mathematics and science through more hands-on and process-oriented activities, while simultaneously teaching parents strategies for reinforcing school-based learning. Based on formal assessment instruments, both children and adults showed marked improvement in their attitudes toward science and mathematics. Further, the adults demonstrated much greater awareness of the presence of mathematics, science, and technology in daily life activities. The project had the additional benefit of making parents more comfortable in their relationship with teachers and the school.

A third project with a major focus on minorities is described in detail in the next section of this chapter. In brief, this science institute paired 25 minority undergraduates with a potential interest in teaching with 25 experienced middle school teachers. The signs are positive that most of the recruits (perhaps 80%) will eventually become certified to teach.

Impacts on Teachers in Training--As noted in the previous chapter, very few Title II/Eisenhower higher education projects (11%) have dealt with the preparation of undergraduates as math or science teachers. Nevertheless, this may be an area that receives more attention in the future, and it is therefore appropriate to include a few observations about the single "preservice" project that was visited. Originally designed to serve 70 middle school science teachers, this science academy has been redesigned to include a number of potential teachers from minority backgrounds as well. Minority undergraduates (who were not necessarily teacher education majors) were actively recruited and paired with experienced teachers for all project activities. Both groups received stipends. The hope was that this strategy would encourage the undergraduates to seriously consider a teaching career. The results: several months after the completion of the academy, 20 out of 25 of the undergraduate participants indicated that they would pursue teacher preparation. Most intend to be elementary school teachers rather than science specialists. However, because of the science academy experience, they are positively disposed toward teaching science to young children. As one candidate said, "No one ever invited me to be a teacher before."

Overall Impacts on Teachers--Overall, teachers responded extremely positively to a wide range of professional development experiences provided through the Title II/Eisenhower higher education funds. Interviewers reported many adulatory comments, such as "This was the best inservice activity I ever participated in" and "I didn't want it to end." However, this praise must be tempered by the fact that the prevailing norms for inservice training are considered quite low. In general, teachers report that good inservice or professional development opportunities in mathematics and science have not been plentiful over the years. One professor was probably very realistic when he observed that the project with which he was associated "was not necessarily a turning point for the participants, but it was at least a nudge in the right direction because of the sharing of experience." If the experiences to be shared are on the track of improved strategies for presenting mathematics and science to children, as they seem to be in the higher education projects, then things are moving in the right direction.

Impacts on Curriculum and Classroom Practice

What evidence is there that teachers who participate in the higher education projects funded under Title II/Eisenhower use their new knowledge and awareness of ways to improve math and science instruction? Most of the participants interviewed say that they do teach differently than they used to. The principal thrust of the change is in the direction of increased use of hands-on or laboratory experiences in science and more attention to problem solving and the use of manipulatives to teach concepts in mathematics. Some participants have long been committed to these approaches and attend workshops simply to expand their repertoire of activities, but for many others, these approaches are new.

A few examples help illustrate the ways in which Title II/Eisenhower workshops affect what teachers do:

- Science "centers" for first graders. As the result of a science workshop, a first-grade teacher has set up science centers in her classroom. The children are so excited about this that they rush to finish their other work so that they can perform the simple "experiments" at each center. With another teacher who also participated in the workshop, this teacher is working with the PTA to set up, equip, and staff a science lab for her school.

- A new teaching style. A participant in a mathematics workshop listed many ways in which her teaching has changed as a result of the experience. She uses cooperative learning more successfully. She is more comfortable taking risks and can work with the class to uncover the solution to an unfamiliar problem without knowing the answer in advance. Her teaching is more inductive, and she places greater emphasis on whether or not students understand a problem and the steps to solving it rather than on the right answer. Her classes are much more interdisciplinary, combining, for example, mathematics, social studies, and writing.

- Science as a verb. An elementary school teacher participated in an exciting workshop that allowed her to spend a week behind the scenes at a science museum. As a result, she says that she now has "a sense of science as a verb--something that should be active, not passive." At the museum, she learned something about electrical circuits. When school reopened in the fall, she taught her students how to build a light-up board--an all-purpose instructional device where the correct match between a question and answer results in a bulb lighting up. This teacher noted, "I would never have done this before I spent at week at the museum."

Often, the evidence that new things are happening in classrooms comes from the fact that, as one teacher put it, "things are being used." This teacher has been both a participant and an instructor in several Title II workshops for middle-grade teachers. Her rural district, serving several small communities, has a shared science materials cupboard that was once nearly her private domain. Now that about half the teachers in the district have participated in workshops on a process approach to science, the materials are constantly off the shelf and a sign-up system is in use. Similarly, at another site, state-provided math manipulative kits that originally gathered dust are used much more regularly as the result of a tailored summer workshop.

In many cases, the impacts on curriculum and instruction are idiosyncratic to the design of the higher education project. For example, one project deliberately used instructional teams with expertise in both elementary and middle school science curricula. As a result, participants came away with an enhanced understanding of how to articulate curriculum and teaching strategies between the two levels. In another, teachers realized that the instructional approaches promoted for teaching physical science would work just as well in their other science classes, too.

Despite their enthusiasm for the new instructional materials or strategies that they learn about in Title II/Eisenhower math and science workshops, teachers do often encounter significant barriers to sustaining their excitement when they return to their schools. In one state, for example, where state-level mandates for curriculum and testing tend to force teachers toward a textbook-oriented, fact-based approach to science instruction, the codirectors of a higher education project fight an uphill battle to help teachers find the time to include hands-on activities in their classrooms. Fortunately, this particular summer workshop includes significant follow-up throughout the school year, allowing the professors sustained opportunity to encourage teachers in alternative approaches.

In another setting, a science education professor was offered the opportunity to teach his summer workshop in one of the university's fully

equipped science laboratories. He refused because "Most elementary teachers have classrooms with only tables, chairs, and a blackboard. It is more realistic for them to learn how to present science activities in a classroom like this. Very few, if any, will have a lab or access to one."

Impacts on Student Learning

As with curriculum and instruction, evidence of the impacts of Title II/Eisenhower higher education projects on students is largely anecdotal. Many teachers said that their students' interest in science has escalated because the approach is now more activity based. One teacher delighted in telling about the day her principal came to observe in her class. When she announced that it was time for science, the class cheered loudly. Another, who teaches in an inner-city math/science magnet school, said:

> *I never skip science because the kids love it. It is a subject in which all children can succeed and that is very important. Science is a tool to motivate students.*

Teachers all over the country seem to be particularly concerned about the problems they encounter in trying to stimulate unmotivated students. Sometimes--but by no means always--they are referring to at-risk students. The more general terms are the "non-science- or non-math-oriented" children in their classes. Time and again teachers told us that the new strategies that they had learned in Title II/Eisenhower workshops were especially effective in reaching these students. One teacher who had participated in a mathematics workshop noted that the "lower-level" students in her eighth-grade classes responded very positively to her increased use of manipulatives. Too often, these students have not yet mastered the multiplication tables. Through the use of calculators, manipulatives, and printed "times" tables, they are able to solve much more complex and interesting problems; along the way, many finally memorize the facts that they should have mastered years before.

A few teachers indicated that they drew a causal connection between their participation in Title II/Eisenhower-sponsored activities and the

improved performance of their students on tests. At one middle school, no physical science was taught at all until two teachers participated in a science academy at the local university. They have shared what they learned about hands-on strategies and how to use unfamiliar laboratory equipment with colleagues. Whether or not it is a direct result of their new knowledge, students' scores on the state science test rose 27 points in a year. They attribute it to Title II. In another state, a fourth-grade teacher gave credit to her workshop experience in raising her students' scores on the state science competency test by five points.

Because it is one of the few sites visited that directly served students, the inner-city tutoring project for language-minority students yielded some particularly interesting information on student impacts. In the remedial mathematics and science classrooms where the college-age tutors regularly worked, attendance improved significantly. The project director said, "The high school students sometimes come to school just to see the tutors." Student performance on classroom tests has improved measurably, leading to higher grades on report cards. Tutors mentioned the personal gratification they experience when a high school student runs up proudly waving the results of an exam instead of hiding the paper in shame.

IX SPECIAL ISSUES RELATED TO THE HIGHER EDUCATION COMPONENT OF THE PROGRAM

This chapter addresses some observations about the higher education portion of the Title II/Eisenhower program that either have not yet been fully discussed or are deserving of particular emphasis:

(1) The higher education component as part of a larger plan. The higher education component is a key part of Title II/Eisenhower's unique structure. To what extent are the grants to institutions of higher education and other nonprofit organizations an integral part of statewide visions for the improvement of mathematics and science education?

(2) Serving underrepresented groups. The legislation makes it clear that increasing the involvement of groups traditionally underrepresented in mathematics and science classrooms should be a priority for funded projects. Are the higher education projects responding to this mandate?

(3) The special case of non-IHE grantees. The original legislation created a special segment of the higher education component to allow opportunities for involving noncollegiate organizations. While the Eisenhower Act does not continue the distinction between competitive and cooperative grants, it is worth examining whether the non-IHE grantees made unique contributions to improving mathematics and science education.

The Higher Education Component as Part of a Larger Plan

With its several components, the Title II/Eisenhower legislation is designed to encourage a broadly based attack on American problems in mathematics and science education. If carefully orchestrated and targeted, the combination of LEA flow-through money, state set-asides, and higher education projects might be expected to take significant strides toward solving specific problems. This part of the report is concerned with how the higher education component complements what is happening in other sectors. To what extent are IHE projects part of a larger idea about what is needed to improve mathematics and science education? Alternatively, to what extent are they random or isolated undertakings, more representative of individual

faculty interests than of actual state or local education improvement needs and plans?

State Directiveness

As noted in an earlier chapter, IHE projects are designed in response to requests for proposals (RFPs) issued at the state level, usually by the state agency for higher education (SAHE). Theoretically, the RFPs are grounded in the required state needs assessment process and therefore reflect an understanding of specific needs for improving local mathematics and science education throughout a state. The opportunity certainly exists for states to be quite directive in their instructions to the higher education community. On the other hand, one philosophy of grantsmanship holds that the most creative ideas emerge from open-ended solicitations that encourage "field-initiated" endeavors. The evidence indicates that there has been great variability in the specificity of the higher education RFPs, with perhaps a tilt toward the open solicitation end of the continuum.

Another way of looking at this issue is in terms of the "focused/unfocused-agenda" analytic framework employed for examining the uses of LEA flow-through funds. Among the seven states visited, three very definitely had focused agendas for the ways in which Title II/Eisenhower higher education funds would be used to further a statewide vision for educational improvement. In one case, by agreement between the SAHE and the SEA, all LEA flow-through and IHE funds were initially targeted at mathematics and science education in grades four through six, gradually expanding upward to include junior high school. In two others, although the uses of Title II/Eisenhower funding are far less circumscribed than in the previous example, the SEAs control the higher education funds and exercise strong influence over local plans for flow-through funds as well.

It is no doubt significant that these states with focused agendas for their IHE projects are rural, relatively small in population if not in geographic area, and, in two cases, homogeneous. State leaders in these settings are able to maintain a finger on the pulse of overall mathematics

and science education improvement activities at all levels in a way that would be impossible and probably undesirable in larger and more diverse settings. Sections of Part One and Chapter X illustrate ways in which states sometimes establish focused agendas for education improvement. There are, in addition, other strategies through which IHEs can be attuned to local and state needs in mathematics and science education. Some of these are examined in the next section.

Sensitivity to Local Needs

Even in states where RFPs provided wide latitude for all types of proposals, IHEs themselves certainly had the option of responding with project ideas that closely matched the needs of elementary and secondary schools in their local area, regionally, or across the state. **Among the projects visited, three are especially notable for their attentiveness to local needs (and another four would also fit comfortably in this discussion).** Aspects of these projects have already been alluded to in the preceding two chapters. Here, these projects are described specifically in terms of some different ways in which IHEs (or individual faculties) have conceptualized and planned activities to deal with local educational needs that have come to their attention.

- Joint LEA/IHE planning. In a conversation over a backyard fence, a physics professor at a small liberal arts college and the science coordinator in a small, rural school district discovered a mutual interest in a process approach to science. The professor was already famous for his unorthodox and theatrical instructional strategies in the college classroom. Further, his interest in how to improve science teaching at all levels was so strong that he had designed his own doctoral program, combining theoretical physics with science education courses. A year or two earlier, the LEA science coordinator had created his own job by taking a sabbatical to pursue ideas about how to teach science and share them with other teachers in the district. His long-term agenda is development of a science framework--something the district lacks and to which it has committed all of its Title II flow-through funds. Together, the two men planned a summer workshop for teachers in grades four through nine that emphasized new developments in the teaching and learning of science, with particular attention to how adolescents learn science. They considered this first workshop moderately successful and proceeded to design a second one that included both more content and more hands-on experiences for participants.

- Education and liberal arts collaboration. The primary mission of a state university serving an eight-county region of a large state is teacher preparation and professional development. The teacher education committee at this institution includes representatives from the public schools--administrators, teachers, and one student. Educational indicators in the region are disturbing--high dropout rates, high teenage pregnancy rates, low scholastic achievement. Members of the university's Mathematics Department and Education Department met to brainstorm ways in which they might jointly help area schools improve mathematics education. They took their list to a meeting with LEA administrators and supervisors. The result was a Title II/ Eisenhower project emphasizing the organization of the curriculum, alternative learning styles, the pacing of instruction, and the use of math manipulatives. The school district contributed some of its Title II flow-through money to support graduate tuition for teachers participating in the workshop.

- Self-interests coincide. A public higher education institution in a major metropolitan area has a long history of interaction with the public schools. Forty percent of the city's teachers are graduates of the college. The city has major concentrations of many immigrant groups, including the largest population of immigrants from a French-speaking Caribbean island nation in the United States. Both the school district and the college are convinced that major talent in science and mathematics is going to waste because of language barriers. Together, they conceptualized a complex proposal to offer tutorial services to language-minority high school students, using language-minority college students as the tutors. Both institutions had agendas. The two participating high schools sought to improve the science and mathematics literacy and broaden the horizons of ESL students. With its own attrition concerns, the college hoped that the act of tutoring and mentoring would encourage 12 postsecondary ESL students to stick with higher education. The actual proposal was jointly developed by the Office of the Associate Dean of Undergraduate Studies at the college, the district superintendent's office, and staff at the two high schools involved.

Each of these examples illustrates ways in which faculty or staff of higher education institutions have deliberately collaborated with local educators to develop Title II/Eisenhower grant proposals that address very precise educational needs. In two instances, strong institutional relationships predated the effort described; in the other, the contact was at an individual rather than institutional level. In two cases, school districts used flow-through funds to augment the higher education grant. The most important point, however, is that in each case, considerable effort went into co-planning and establishing a mutually agreed-upon program or agenda. These projects did not need strong guidance from the state to meld LEA and IHE interests.

Private Agendas

The issue of how well integrated the higher education projects are with other state, regional, or local agendas is a very important one. Title II/ Eisenhower is encouraging the different educational sectors to work more effectively together. They can learn to do this better if the lines of communication are open at the planning stage--either because of a strong state agenda or because of specific institution-to-institution or even person-to-person strategies. When the agendas are private or the communication is poor, problems seem to multiply.

Although many Title II/Eisenhower-funded higher education projects are closely tied to strong state or local educational agendas, other projects are designed and executed by college and university faculty in isolation from any larger educational-improvement initiative or even from any supporting structure within the grantee institution. Seven of the projects visited appeared to be rooted principally in the private agendas of one or more college faculty members. There is nothing inherently wrong with this approach to conceptualizing and implementing a project, but several grantees in this group encountered some problems that seemed linked to their lack of connection to a larger plan. Two types of problems, in particular, are worth noting because of their potential to recur in other, similar situations.

- Recruitment problems. Four of the seven projects in this group experienced some recruitment difficulties. The reasons for these problems varied. For example, one project sought to prepare secondary school science teachers to add a physics credential to their other certifications. The difficulty of the subject matter and the potential duration of the commitment (up to five years of summer institutes) offered a formidable barrier to many potential participants. The project director needed better ways to identify strongly motivated teachers drawn from a wider catchment area.

  In another instance, a higher education project director had a strong personal relationship with both the school district and the target school from which project participants were to be drawn. However, he either did not know or failed to account for the fact that the school was already involved with a new state program for school-based improvement that claimed the time and allegiance of many teachers and cut into the Title II recruitment efforts. If channels of communication between state, local, and higher education players had been more

efficient, alternative strategies might have been devised--for example, shifting the Title II/Eisenhower project to another school that was not participating in the state program.

The general lesson that examples such as these seem to suggest is that at least some higher education projects would benefit from assistance in publicizing and recruiting for sponsored activities. This may be particularly important in states where Title II/Eisenhower RFPs are less specifically targeted, thus allowing more latitude for college and university faculty members to pursue individual mathematics and science education improvement agendas. **State agencies (both the SEA and the SAHE) might make a significant contribution to the success of higher education projects by (1) providing publicity and recruitment assistance, as needed and appropriate, and (2) ensuring that the directors of higher education projects are aware of any and all state elementary and secondary educational improvement efforts.**

- Content knowledge vs. pedagogy. Whenever college faculty and school teachers come together, there is always the potential for a conflict of perspectives. This may be especially true when the college people represent rigorous disciplines such as mathematics and the sciences. In one project, the design called for presentations in their specialty areas by 11 faculty from several different university departments. Some of these lecturers inundated the participating elementary school teachers with a barrage of discipline-based content that the teachers felt unable to absorb and found only marginally related to what they could use in their classrooms. Fortunately, the teachers were not a shy group and provided strong feedback to the project director (an education department faculty member) on their problems with the institute. However, the message they sent did not necessarily reach the arts and sciences faculty. One mathematics professor said that, despite teacher complaints, he is not sure that he would change anything that he did or said because teachers "ought to know" the content he presented, regardless of whether they ever will use it in the classroom.

Collaboration between higher education and the schools is always a delicate matter. Convincing teachers that they need and can master new or more mathematics and science content knowledge often requires patience, tact, and innovative strategies on the part of college faculty. Treating elementary and secondary school teachers like undergraduates is almost always counterproductive. In projects where a number of college and university faculty are to be involved, and particularly where the projects

are largely autonomous from any state or local mathematics or science educational improvement plan, project directors would be well advised to build in some campus-level staff development activity designed to ensure that all instructors give some deliberate thought to the approach that they will take with practicing teachers.

Serving Underrepresented Groups

As the previous chapter indicated, some higher education projects have a specific focus on increasing the participation of underrepresented groups--principally minorities--in mathematics and science education. Twenty-one percent of all participants in the higher education projects are minorities--over two and one-half times their representation in the teaching work force. In fact, of all the Title II/Eisenhower components, the higher education projects appear to be most effective in involving minority teachers and teachers of minority students. A number of states report that their RFPs require all higher education projects to make special efforts to address this mandate of the Title II/Eisenhower legislation. Overall, just over one-quarter (28%) of all higher education projects indicate that they specifically target teachers from minority backgrounds. However, among the sites visited, about 40% cited teachers and students from underrepresented groups as major constituents of their activities.

On the average, higher education project directors appear to be aware of the underrepresentation issue in the sense that they know of statistics showing that girls, and especially minorities (of either sex), take less rigorous or simply fewer mathematics and science classes by the time they graduate from high school. In general, however, there do not appear to be special instructional strategies in place in most IHE projects for addressing particular needs of underrepresented groups. Most frequently, hands-on science and problem-solving techniques or math manipulatives are presumed to represent significant improvements in meeting the needs of all types of students, including those from groups underrepresented in science and mathematics.

Of the Title II/Eisenhower higher education projects that are specifically focused on improving the participation and achievement of underrepresented groups in mathematics and science, the project designs seem to draw on several growing bodies of research that are exploring the importance of factors such as self-esteem, motivation, cooperative rather than competitive learning environments, and culturally based role models and support systems. Generally speaking, these projects are designed to increase positive attitudes toward mathematics and science, which, in turn, may lead to greater perseverance and success with these subjects in the classroom--especially for girls and for cultural and linguistic minorities of both sexes. (See, for example, Cromer and Steinberger, 1990.)

Among the projects visited, three are notable for their unique activities specifically designed for one underrepresented group or another. One--a tutorial project for limited-English-proficient high school students--principally tried to offset the language barrier that prevented recent immigrants from achieving well in mathematics and science classrooms; it simultaneously sought to improve the college retention rate of the bilingual university students serving as tutors. Another, serving young at-risk children and their families, has been described rather thoroughly in the previous chapter. Although this project appears to have been very effective and has generated national interest, it represents a variation on a larger theme of family literacy that is not specifically tied to math and science education improvement. (For example, similar impacts are being derived in projects that target reading.) The principal objective is to bring the parents of at-risk children into closer contact with the school and the classroom.

Another project targeting underrepresented students--also directed at the early elementary school years--used a variety of materials to raise teachers' awareness of how the school environment and their own attitudes affect girls' and minorities' achievement in science. Participants then learned how to develop curriculum that avoided these tacit barriers to continued interest in science. The project director in this case has long been active in recruiting underrepresented groups into science careers and

coordinates a university-based program to recruit young women to science and engineering majors.

The level of attention of the higher education projects to underrepresented groups in mathematics and science is appropriate and could be increased. Because institutions of higher education must respond to state calls for proposals, the SAHEs have every opportunity to encourage higher education's efforts in this direction. This is, in fact, an area where state leadership may be required if the legislation's intent is to be met.

The Special Case of Non-IHE Grantees

Although the Eisenhower Act has altered the opportunities for noncollegiate institutions to be fiscal agents under this program, the contributions of non-IHE grantees under Title II are part of the story of the first four years. Only 4% of all grants went directly to other types of institutions, such as museums, associations, and libraries. Site visits included two such projects--both in the same state.

In one case, the SAHE made a major three-year award to the state's affiliate of the National Council of Teachers of Mathematics. The explicit purpose of this project is to develop a cadre of 100 mathematics leaders and create a network that can help sustain implementation of the state's new curriculum framework for mathematics education. It is, as noted earlier, an explicitly top-down approach to educational improvement, but works in conjunction with many other types of efforts--some funded by Title II/Eisenhower--to also create change at the grass-roots level.

The second non-IHE project among our sites is also a major three-year effort based in a well-known science museum. Its goal is to help secondary-level teachers of physical science to become familiar with motivating, up-to-date, and conceptually sound programs and curricula specifically for non-science-oriented students. The need for the project comes largely from state legislation mandating that all students must have two years of laboratory science for high school graduation.

Both of these projects are exciting, worthwhile, and well articulated. However, given the changes in the Eisenhower legislation, neither would now qualify for funding unless a college or university were the grantee. **Simply on the basis that a fair and open competition among nonprofit organizations is a reasonable way to award funds, the study has found no compelling reasons to exclude projects based at non-IHE institutions.** Furthermore, each of these projects illustrates potential strengths of noncollegiate institutions.

Museum staff are expert at motivating students and the general public. They have to be, to attract an audience. Increasingly, museums are becoming adept and important contributors to teacher training (paid for, in some cases, by Title II/Eisenhower flow-through funds). Thus, it seems quite appropriate for a science museum to help teachers learn about more motivating and up-to-date science curricula.

The mathematics leadership project seems to be another story. Rivalries and status claims among college and university campuses, particularly within state systems, are common. A professional association, on the other hand, provides an umbrella under which leaders from all levels of the education system can come together without exacerbating interinstitutional quarrels. It represents neutral ground--at least for these purposes--where professional concerns dominate. It appears unlikely that the leadership consortium could be as effective if transferred to a single campus of the state's extensive university system.

PART FOUR: UNDERSTANDING THE PROGRAM AS A WHOLE

The preceding three parts of the report have examined each of the components of the Title II/Eisenhower program in turn. This part summarizes the connecting themes running through the analysis of each component and draws conclusions from findings about all components taken together.

There are two ways that the parts of the program can work together to have a joint impact on mathematics and science education. First, the separate components can simply address different aspects of the common problem to which all are addressed. From this perspective, each adds a separate layer of activity aimed at professional development needs. Second, the components can connect to one another, each reinforcing the others in ways that generate a whole impact greater than the sum of the parts. It is also possible that the three components work at cross-purposes, with each canceling out some or all of what the others have achieved.

Data collection and analysis procedures were designed to yield evidence of all three possibilities: the additive effects of separate and unrelated efforts by state agencies, local education agencies (LEAs), and institutions of higher education (IHEs); the interactive, reinforcing effects of one component's activities on another; and the negative interactive effect of one component interfering with (or at a minimum unnecessarily duplicating) another component's efforts.

Overarching Themes

Two overarching themes frame the conclusions and guide the summary chapters.

First, the three parts of the program work reasonably well together. **Generally speaking, they pertain to different but related functions, and one can discern a number of ways in which state, LEA, and IHE efforts both add to and reinforce one another.** That is not to say that the three strands are always connecting to one another; more often, they simply add--more professional development events, more teachers, more time spent with them. Thus, a given IHE project typically involves different teachers from those who attend LEA-based inservice sessions in the area served by the IHE, or the IHE project may include some of the same teachers but offer them a different or more intensive experience. Moreover, there is little evidence that the three components get in each other's way (perhaps this would be a problem if the program were larger, but there is no sign of it).

In short, the design of the program, which sets out a multi-pronged attack on professional development needs, appears to be sound. One task for this part of the report is to display the evidence that leads the study team to this conclusion.

Second, the degree to which the program works and the way its components complement one another can be understood only in the context of the reform movements and initiatives that have proliferated since the program's inception. These reforms are, first of all, manifested in statements from the professional communities of mathematicians and mathematics educators, scientists and science educators, and other educators, who have identified targets for change and have laid out various paths toward an improved educational system. The ideas circulating in these professional communities provide one template for examining the net contribution of the Title II/Eisenhower program.

Sometimes in concert with professional thinking and sometimes independent of it, reform initiatives have taken form through state and local policy actions, in ways that reflect the unique conditions and ethos of each state. The actions and aspirations of policymakers and educators within each state provide another important context for understanding the program.

Finally, federal initiatives have come to the aid of reform efforts--not only the Title II/Eisenhower program but other efforts by the U.S. Department of Education, the National Science Foundation, and other agencies. These initiatives are also a key part of the context of the Title II/Eisenhower program. To capture the unique accomplishments of the Eisenhower program and to interpret what has been learned for future federal policy action, it is essential to examine the program's relationship to these other initiatives.

Organization of This Part of the Report

The first two chapters in this part of the report are set out as follows:

- The first (Chapter X) summarizes across components the net contribution of the program to the mathematics education reform movement and to the corresponding movement in science education. The analysis in this chapter concentrates on curriculum, instruction, and individual teachers, for that is the level at which lasting changes must ultimately occur. The chapter also reviews what is known about effective professional development as a basis for appraising what the program contributes to professional development.

- The second (Chapter XI) steps back to examine the program in state and federal contexts, first by describing the context of state reforms and their relationship to the program, and second by examining how the Title II/Eisenhower program connects with, duplicates, or competes with other federal initiatives aimed at mathematics and science education reform. (The discussion here is limited to what can be learned or inferred by looking primarily at the Title II/Eisenhower program as it operates in state and local contexts; this is not a full comparative study of federal initiatives aimed at these subject areas.)

Finally, the concluding chapter (XII) characterizes the overall roles that the program plays most effectively, as part of the full range of efforts to address mathematics and science education needs. In addition, it discusses the program's future and draws implications from what has been learned for further debate about the program's continuation and design.

X CONTRIBUTIONS TO CURRICULUM, TEACHING, AND PROFESSIONAL DEVELOPMENT

This chapter takes an integrated look at the Title II/Eisenhower program across all components. The chapter describes what the program is contributing to the current national, state, and local efforts to both strengthen and reform mathematics and science education, with emphasis on its contributions to curriculum, instruction, and professional development opportunities.

First, the chapter examines the nature and status of the current reform effort in mathematics education and the ways in which program funds have contributed to the specific efforts within this movement; following that, the same analysis is presented for science education. The chapter concludes with a review of criteria for good professional development and an analysis of how closely Title II/Eisenhower-supported activities come to this ideal.

The Contribution of the Title II/Eisenhower Program to the Reform Movement in Mathematics Education

For most of the 1980s, a nationwide movement has been gaining momentum to reform mathematics education. This provides an important context and focus for the use of Title II/Eisenhower resources. The direction and tone of this movement have been set by a series of reports, among them the National Council of Teachers of Mathematics' (NCTM's) Agenda for Action (1980), the Second International Mathematics Study report The Underachieving Curriculum (1987), the National Research Council's report Everybody Counts (1989), the NCTM's Curriculum and Evaluation Standards in School Mathematics (1989), and the NCTM's new companion report, now in progress, Professional Standards for Teaching Mathematics.

There is strong consensus in these reports about the direction and nature of the reforms needed in mathematics education. In interviews with

educators in both urban and rural regions, working in districts, universities, and state offices, the study team found remarkable awareness of, and agreement with, these new standards. Interviewees were strongly committed to revamping the teaching of mathematics along these proposed lines, particularly at the elementary level. (The degree to which districts were able to implement these standards varied considerably, across both districts and standards.)

Four interrelated ideas are central to all of the proposed reforms for mathematics education:

(1) Curriculum change is the key to reforming mathematics education.

(2) Alongside changes in what is taught, modes of instruction should be diversified.

(3) Mathematics should be designed to serve all students.

(4) For curriculum and instruction to change, teachers must change.

The discussion below of each idea describes how the Title II/Eisenhower program is contributing toward the proposed reforms.

Idea 1: Curricular Change Is the Key to Reforming Mathematics Education

A great deal of reform attention has focused on the content of mathematics education. The central idea involves broadening the range of mathematical topics included in the curricula, and integrating topics throughout the K-12 course of study so that they are not studied only in separate years (e.g., algebra, then geometry, then probability, etc.). Title II/Eisenhower funds are supporting activities that address this reform target on a wide scale.

The thrust of the reform movement with regard to broadening the content of the mathematics curriculum is aptly summarized in the following quote from Everybody Counts:

> *Mathematics curricula at all levels must introduce more of the breadth and power of the mathematical sciences. As mathematics is*

more than calculation, so education in mathematics must be more than mastery of arithmetic. Geometry, chance, and change are as important as numbers in achieving mathematical power. Even more important is a comprehensive flexible view that embodies the intrinsic unity of mathematics: estimation supplements calculation; heuristics aid algorithms; experience balances innovation. To prepare students to use mathematics in the twenty-first century, today's curriculum must invoke the full spectrum of the mathematical sciences.

Site visits revealed many projects and activities, supported by Title II/Eisenhower funds, that are helping to infuse the mathematical curriculum with new topics.

- A Woodrow Wilson Summer Institute sponsored by one state's Title II cooperative funds provides one-week summer institutes at local colleges to high school teachers around the state. One institute focuses on applications. An innovative curriculum developed and tested at the North Carolina School of Science and Mathematics (NCSSM) is shared with the 40 teachers who attend. For one week the teachers work together solving problems that range from scheduling boat traffic through the Suez Canal to optimizing the loading of boxes to helping villagers decide where to fish.

- A university-based summer institute, taught by a mathematics professor (who has not been active in secondary education since the 1960s) provides 25 high school teachers from all over the rural state an intensive experience in learning discrete mathematics. They work hard in the mornings in an academic environment (lecture and discussion), and the afternoons are spent on homework and informal discussions about how to apply the materials to their own classrooms.

- A large district in a western state uses its Title II/Eisenhower funds to hire a teacher to serve as a district resource specialist in secondary mathematics. This teacher is a specialist in technology (computers, calculators, and overhead projectors) and spends her year providing teachers with inservice workshops that focus heavily on the use of the graphical calculator and the computer in algebra and geometry classes.

Table 69 shows the degree to which professional development activities funded by the program focus on different mathematical topics, according to survey respondents. Several findings can be noted in this table:

- The intended focus of a majority of activities is on problem solving and higher-order thinking.

- The IHE-based projects are taking the lead in introducing new topics to the mathematics curriculum (particularly probability, discrete mathematics, and geometry).

- Neither the IHEs, state agencies, nor LEAs place a heavy emphasis on projects that foster "advanced" mathematics. Rather, the emphasis is on enriching the core of mathematics for all students.

A second way in which Title II has helped to broaden the content of the mathematics curricula has been to help support local curriculum revision efforts, as described in Chapter V. Many of the districts visited had mathematics specialists, curriculum coordinators, and teachers rethinking the district's mathematical curriculum. Such task forces almost invariably used the NCTM standards (and often closely related state frameworks) as their starting point. In one rural district, a standing committee of teachers on mathematics education engaged in a research project that compared the developmental level of their students with the cognitive demands of the current instructional materials. With assistance from the university's mathematics and science center, the teachers were able to reshape the district's instructional materials and tests to reflect the realities of the student's needs and capabilities.

Table 69

THE TOPICAL FOCUS OF PROGRAM-SPONSORED PROFESSIONAL DEVELOPMENT IN MATHEMATICS EDUCATION

Topical Focus of Program-Sponsored Professional Development	Among Those Using Year 4 Funds for Improving Mathematics Education, the Percentage Focusing on Each Topic		
	Activities Sponsored by LEA Flow-Through Funds	IHE Projects	SEA Demonstration and Exemplary Projects
Arithmetic computation skills	59	40	46
Arithmetic problem solving	84	66	94
Geometry	30	52	48
Probability, statistics, data analysis	23	51	58
Algebra	30	46	31
Advanced mathematics (e.g., calculus)	25	23	31

Idea 2: Alongside Changes in What Is Taught, Modes of Instruction Must Be Diversified

Alongside efforts to broaden the topical focus of mathematics, the reform movement is placing great emphasis on altering the way the subject is taught. The Underachieving Curriculum puts it this way:

> *There are also concerns about the nature and quality of the pedagogy demonstrated in U.S. mathematics classrooms. The data suggest that the quality of instruction could be enhanced. Little use is being made of resources beyond the textbook--even calculators and microcomputers. Only a limited repertoire of pedagogical approaches is used and those strategies emphasized often focus on the abstract and the rote. Passive reception appears to be the learning style judged to be most suitable for students.*

The new curricula assume that activities should be structured so that they grow out of problem situations--preferably realistic, everyday problem situations. The assumption here, opposite from the sequential, mastery-of-skills model of previous years, is that skill acquisition does not have to precede its application. In current approaches to the teaching of reading, a similar shift is taking place--toward learning to read in real contexts (e.g., through literature-based reading approaches). Similarly, students need not master complex algorithms before solving problems; students are more likely to develop this mastery in real problem-solving situations.

Perhaps more than anything else, current reforms in mathematics (as in the reform of the rest of the curriculum) are focusing on designing instruction that facilitates student action and interaction. If students are to have the opportunity to invent and construct their own mathematical meanings (as current theory suggests is necessary), then instructional practices must provide them with many opportunities to interact with materials, each other, and the teacher.

Workshops and activities sponsored by Title II/Eisenhower are heavily focused on helping teachers provide these opportunities. One district that concentrated on mathematics inservice illustrates a common pattern. The district released each mathematics teacher a total of six days over the

course of the year. Teachers were required to participate, but could choose between two alternatives for each of the six meetings. Groups of teachers met at the district office by grade level. Three lead teachers led each meeting, which addressed topics such as hands-on teaching techniques, problem solving, and alternative assessment strategies. One teacher described her experience as follows:

- Ms. S. said she did learn some new mathematics content while attending these sessions, but the teaching strategies she learned were more important to her. The experience, she feels, hasn't really affected her attitude toward teaching or her professional identity. She does, however, use manipulatives and calculators much more; they are always available in her classroom to be used as a tool. She encourages more interaction between students, and uses small groups for discussing ideas. She says that she interacts more with students herself. Students this year consequently are more comfortable with cooperative learning, manipulatives, and calculators. All of this, Ms. S. says, takes the pressure off the kids to just get the right answer. *We stress the importance of solving problems, and kids can really get into that. They enjoy working together; they can talk. I have definitely seen evidence that they are more interested in mathematics. They say so: "I never liked math before; I couldn't do math before, and now it's fun."*

Site visits uncovered many other examples of workshops affecting the modes of instruction that teachers use in their mathematics instruction, as in the case of a young teacher in an eastern state who had wanted for a long time to stop relying on the textbook in her teaching. The mathematics workshop she attended, she said, was the main reason she asked her principal if she could stop relying so much on the textbook. Also, without the workshop she would not have had the ideas or equipment to implement a hands-on approach; and without it, she says, she would still be doing paper-and-pencil mathematics exclusively with her students.

Survey evidence suggests that attempts to address these kinds of pedagogical issues are widespread. Furthermore, as shown in Table 70, there is a striking convergence between LEA activities and IHE projects with regard to particular instructional strategies.

- Both LEA and IHE projects focus on fostering much more problem solving in mathematics teaching.
- LEAs focus their activities heavily on the elementary level, and on integrating the use of manipulatives into the curricula.

Table 70

INSTRUCTIONAL STRATEGIES THAT ARE THE FOCUS
OF PROGRAM-SPONSORED PROFESSIONAL DEVELOPMENT

Instructional Strategy	Among Those Using Year 4 Funds for Improving Mathematics Education, the Percentage Focusing on Each Instructional Strategy	
	Activities Supported by LEA Flow-Through Funds	IHE Projects
Increased use of manipulatives	59	38
Integrating calculators into instruction	21	17
Use of technology (e.g., computers)	38	41
Increased emphasis on problem-solving and higher-order thinking skills in mathematics teaching	81	82
Introduction of cooperative learning techniques	20	32
Increased emphasis on applications in mathematics teaching	55	45
Methods of teaching/ reaching minority or disadvantaged populations	12	28

- Although cooperative learning was an integral part of many programs, few workshops funded by Title II appeared to offer generic instruction in cooperative learning. Rather, workshops focused on subject-specific goals (e.g., how to teach probability, Family Math, etc.), and cooperative learning techniques were embedded within that context.

It is interesting to compare the patterns in study data with those proposed by the NCTM standards. At the elementary level, NCTM proposes that **increased** attention be paid to number sense, estimation, place value; operations, mental arithmetic, estimation and checking, selection of method, strategies; geometry and measurement, spatial sense; probability and statistics; patterns and relationships; problem solving, everyday problems, applications, strategies; manipulatives, cooperative work, discussions, questioning, oral and written justification, calculators, and computers. The standards also propose that **decreased** attention be paid to complex paper-and-pencil tasks; isolated computations; isolated division facts; long division; paper-and-pencil fractions; use of rounding to estimate; naming shapes and figures; memorizing conversion factors; worksheets; and teaching by telling.

Throughout site visits, the study team encountered numerous workshops and institutes specifically designed to encourage the former practices and discourage the latter. As much as transferring skills and activities, these workshops also transferred values to the teachers, very much along the lines described above. Some of these workshops were "home grown." Others were commercially created by skilled mathematics educators.

In terms of actually affecting what is taught in the classroom, program-funded efforts appear to support the possibility of real change. There is broad agreement that schools are paying more than lip service to the elementary mathematics curricula and that Title II-supported activities are being used in making the transition. Most people interviewed for the study agreed with the proposition that elementary mathematics classes in five years might look very different from the way they look today, which is essentially the way they have been for the last 30 years.

At the secondary level, the NCTM standards argue for increased attention to active involvement of students in constructing and applying ideas; problem

solving as a means as well as a goal of instruction; questions that promote student interaction; use of a variety of instructional formats; use of calculators and computers; communication of ideas orally and in writing, among others.

These qualities are an implicit part of many of the workshops and institutes visited during the study. For example:

- Ms. T. has been teaching high school mathematics in a rural district in a southern state for seven years. Last year she attended a program-funded workshop at a nearby university entitled "Manipulatives in Mathematics Education." The workshop was conducted on 10 successive Saturdays. In the workshop, teachers became familiar with the state's mathematics manipulative kits, developed their own lesson plans and activities, and even wrote "pacing guides" outlining their year's schedule of topics to teach. Ms. T. was curious about manipulatives and learned more about using them and calculators. She has thought some about how to integrate them into the chapters of her current textbook.

There were also examples (good and bad) of attempts to integrate more technology into the mathematics curriculum. At best, teachers' minds were changed about the use of calculators and computers as instructional tools; at worst, teachers were taking workshops in the use of videodiscs when none were available for their use.

Districts invest far less effort (and program resources) in the secondary level than in the elementary level. And, unlike for the elementary level, there is less consensus about the changes that should take place in the secondary curriculum. Moreover, for various reasons, the resistance of high school mathematics teachers to changing their courses and teaching methods appears greater than that of elementary teachers. These barriers and others will be discussed in more detail later in this chapter.

Idea 3: Mathematics Should Be Designed to Serve All Students

The reform movement has increasingly drawn attention to who is being taught mathematics and what role it plays in their progression through school:

All students should study math every year they are in school.

Mathematics must become a pump rather than a filter in the pipeline of American education.

Everybody Counts

For many years the mathematics curricula, with their heavy emphasis on abstract learning and algorithmic quickness, have not worked well with students, especially minorities and women, who are typically socialized to do poorly in this kind of instruction. Not surprisingly, mathematics has proven very difficult and unattractive to minorities and women. For both moral and economic reasons, this situation is unacceptable for the nation's future.

Educators interviewed for the study were particularly concerned over limited access to mathematics for women and minorities at the middle school level, and at the same time unclear about what strategies to bring to bear on the situation. Two strategies appear to dominate efforts to remediate the situation. One is to develop specific strategies and efforts to assist women and minorities with mathematics. Such efforts might be aimed at teachers, or might involve special experiences for the students themselves. An example of the former is the EQUALS program, which the study team encountered in various sites throughout the country. The ability of teachers to learn of this program and participate in its workshops is often directly a result of Title II/ Eisenhower funding. There were other efforts to provide access for minorities, particularly with programs aimed at students:

- In a large East Coast city, a college conducts a program-funded project that supports successful minority college students to serve as tutors and role models in mathematics and science classes for ESL students at two local high schools with high minority populations. At each site the college students are paired with high school teachers, who in turn participate in workshops that (1) show them learning strategies that have demonstrated success with ESL students, and (2) provide them with appropriate mathematics and science activities. The teachers work with the college tutors, who, in turn, work with selected high school tutors. The program appears to benefit both the college and high school participants.

Although projects such as these, aimed directly at improving the access of minorities and women, offer a successful model of direct service to these

groups, they appear to be relatively infrequent among the activities supported by the program. As shown in Table 70 above, approximately a quarter of the IHE projects and half as many LEAs had this end as a primary goal.

A second, far more prevalent strategy is to shift the whole mathematics curriculum so that it is better suited to the capabilities and needs of all students. At the elementary level, this generally means gearing classroom activities so that all students get lots of experience with manipulatives, calculators, and discussion. It also means deemphasizing classroom tasks in which the quickest children receive heavy rewards for their memory and calculating skills. More than one teacher interviewed by the study team indicated that when mathematics focused more on problem solving and understanding, some children who do not ordinarily do well in mathematics in fact "begin to shine." One teacher described the change in her classroom in this way:

> *My students benefit as well from [what I have learned from] these workshops, especially minorities. They participate in class much more. They understand what they are doing and why it is important and how it may be applied to the real world. They learn to love math.... By the time my students leave at the end of the year, they will have a healthy respect for math, and will not fear it....*

Idea 4: For Curriculum and Instruction to Change, Teachers Must Change

The reform movement has highlighted needs for fundamental change in the way mathematics teachers think about their subject, students' learning, and the teaching process:

> *Teachers...almost always present mathematics as an established doctrine to be learned just as it was taught. This "broadcast" metaphor for learning leads students to expect that mathematics is about right answers rather than about clear creative thinking. In the early grades, arithmetic becomes the stalking horse for this authoritarian model of learning, sowing seeds of expectation that dominate student attitudes all the way through college.*
>
> *In reality, no one can teach mathematics. Effective teachers are those who can stimulate students to learn mathematics.... Research offers compelling evidence that students learn mathematics well only when they CONSTRUCT their own mathematical*

understanding.... This happens most readily when students work in groups, engage in discussion, make presentations, and in other ways take charge of their own learning.

Everybody Counts

Program-sponsored activities tend to share these assumptions. To a large extent, they promote the practices and values expressed in key documents within the mathematics education reform movement. Mostly, professional development activities examined through site visits practiced what they preached, offering teachers a chance themselves to experience hands-on learning of mathematics, cooperative group work, problem solving using calculators, and group discussions of open-ended problems.

Program-funded activities do not contribute equally to all aspects of the reform agenda aimed at teachers' professional development. The principal patterns related to the eight teacher needs specified in the NCTM Professional Development Standards are described below.

Teachers need to develop positive dispositions toward the teaching of mathematics. Teachers often experienced a sense of rejuvenation, new-found confidence, and heightened excitement in teaching mathematics, all as a result of their experiences in workshops and institutes. As pointed out in earlier chapters, this is one of the strongest effects of program-sponsored activities. Following participation in these activities, teachers often took risks in their classroom instruction as a result of their new knowledge, skills, and sense of membership in a group of educators who wanted to support each other in experimentation. Instructional behaviors that are not valued by the larger educational system (e.g., deviating from the textbook) are valued in this subculture. Experiences where teachers share their teaching approaches and values help to build the professional identity of each teacher who participates. Eventually, teachers of mathematics who know they are teachers of mathematics have internalized these standards and can act independently without need for reinforcement. One teacher put it this way:

I feel extremely comfortable taking risks, especially in math. I can approach a problem without the answer in mind, and work to uncover the solution with the class. I could never do that before, and it also gives me more time to plan.... I just need to have the big picture in mind. I don't need to work out every little detail ahead of time....

A positive identification with mathematics teaching can come about through interaction and association with other mathematics teachers, as illustrated by one 48-year-old veteran who is clearly an excited "new" mathematics teacher. She recently received her degree from a state university and maintains contact with a science and mathematics education center located there. She says the center is a real resource and a home base for her. From her colleagues she feels she learns in the same way "as a carpenter apprentice learns the tricks of the trade, such as, which pocket to put the long nails in." She was emphatic about the importance of what she called "camaraderie" as she engages in these professional activities. She described it as follows:

> *I have gotten to meet really exciting math teachers.... And I think the key thing they know how to do--and what they show me how to do--is to make math fun, particularly in the lower-level math I teach. I think it is totally important to make it fun.*

Another teacher pointed out how such positive dispositions and confidence come about only over time:

> *The [workshop leaders] just didn't come into the district and turn everybody around. The district had planted the seed of mathematics manipulatives for years. I think our elementary school teachers were already on the edge; they were ready, eager, and wanting this kind of approach. The first workshop empowered us to make concrete in the classroom the stuff we had been learning for years. The second workshop solidified the ideas and increased my confidence further.... It has to be cumulative; there is too much to grasp in one try. It's nice to know that I can go back again next summer for more. For example, after the second workshop I felt secure enough to use [the workshop leaders'] idea of "menus." After the second year I was also confident enough to run a demonstration class for the administrators in our district. Now after five years, I have enough confidence not to use a math textbook at all.*

Teachers need appropriate mathematical learning experiences. Across a wide range of IHE- and LEA-based training, program-sponsored workshops provided teachers with experiences doing mathematics in a hands-on, discovery-oriented way. Many had the opportunity to try out calculators, computers, and manipulatives for themselves for the first time. Teachers also worked together in groups, collectively solving problems and sharing ideas. One teacher's experience typified many:

- C. took a program-sponsored problem-solving course in 1987. She found the workshop "great because it was so small, challenging, intense." The teachers were given problems to solve--which they didn't know how to solve. They were handed some ideas about how to approach such problems and learned about many strategies one could use to work on the problems. She also got some things that she could use in her own class. In fact, she uses the many problem-solving strategies she learned "over and over" in her own workshop. Each strategy has a label, and she has gone over each of them with her students. Now when they have problems to solve, they can look up to the front of the room and see "Work on the problem backwards, Simplify the problem, Draw a picture, Draw a graph, What do you know and what do you need to know?"

Teachers need a deeper understanding of mathematics. To a lesser extent, teachers participating in program-sponsored events are learning new mathematics content, or relearning what they already knew in more general and powerful ways. This is more often the case in IHE project training than in inservice sponsored by LEAs. But, in general, the Title II/Eisenhower-sponsored institutes and activities paid much more attention to the discovery nature of the teaching activity than to deeper mathematical structures and ideas. At the high school level, the study team encountered a few examples of rigorous mathematical courses that provided teachers already fluent in their mathematics a chance to deepen that knowledge. At the elementary level it is less clear how much formal mathematics was learned by participants in many projects.

Teachers need knowledge of how students learn mathematics. Many professional development activities sponsored by Title II appear to teach teachers a good deal about how children learn mathematics, but not typically through formal instruction on learning theories or cognitive research. More often, teachers gained a deeper appreciation of how students learn through the help they received in designing instruction to engage students in active learning. Moreover, effort was made to encourage alternative learning modes, as in the following case:

- One teacher noticed that the more confident, higher-achieving students are more guarded about experimenting, but all the students are getting a lot out of the process. The lower-achieving students, who used to tend to try once and then say, "I can't do it," because they were working only to find the right answer, are now working a

little longer. A few students have turned out some really original solutions. They are all coming to realize, she feels, that there is more than one "right answer," that there is not just one way of solving a problem. As a result, *They are more tolerant of each other, and more open to different ways of arriving at solutions. They are better equipped to recognize workable strategies for solving various kinds of problems. They've had some difficulty transferring these skills to word problems, but they know they can still draw a picture, or use any of the other ideas on the bulletin board.*

As teachers mature, their interest in understanding how students think also grows. Some teachers indicated that they wanted to know more about their students' thinking so that they could communicate more effectively with them. Some of the professional development supported by the program provided this opportunity.

Teachers need a personal repertoire of mathematical teaching ideas. If they accomplished little else, program-sponsored professional development has helped expand teachers' personal repertoires of instructional techniques and explanations specific to the mathematics they are teaching. Teachers engaged in training events are typically presented with new teaching ideas by workshop leaders, veteran teachers, and each other. The ideas they got included not only specific demonstrations or problems but also explanations, analogies, and metaphors. All of this knowledge becomes blended together in the teacher's experience, so that teachers often could not identify exactly the sources of their teaching ideas. One teacher described the effect as follows:

I am not always sure how we use what we learn (in workshops) in our classroom. Sometimes you don't even know what you've learned until a student asks a particular question--and then you find you are able to answer it--you realize you picked up something along the way.

There are other needs that the NCTM Professional Development Standards address that are less typically addressed in the workshops and institutes sponsored by the Title II/Eisenhower program:

- Teachers need a broad knowledge of school mathematics. Program-sponsored events helped teachers to broaden their knowledge of the existing mathematical curricular resources, but generally within a confined topical area. It may have helped them to broaden their

sense of legitimate topics and approaches. Site visits uncovered a few examples of mathematics being integrated with other subjects, but these examples were relatively rare.

- Teachers need to develop sensitivity to the differing needs across the student population. In general, program-sponsored workshops concentrate on issues of curriculum and instruction, without regard to differences in student needs. The need to serve all students, and the approaches that work in achieving this, are often implicit rather than explicit. Nevertheless, the notion of transforming instruction so that it works well for all students is very much in the minds of project leaders and teachers alike.

- Teachers need a knowledge of assessment. Teachers widely recognized the need for alternative forms of assessment as they faced considerable tension in trying to implement the NCTM standards in their own classrooms. Although the need for a new generation of assessment methods--ones that are compatible in goals and spirit with the mathematics education reform movement--is recognized, there is little evidence that the program has done much to help teachers with this issue.

Limitations on the Program's Contribution to the Reform of Mathematics Education

Site visits to mathematics institutes and workshops supported by the program and interviews with mathematics teachers sought to understand not only the contributions that the program is making, but also what factors limit its ability to contribute. The factors at the elementary and secondary levels are sufficiently different that they are discussed separately.

Barriers to Improving Elementary Mathematics--The most significant barriers at the elementary level include the following:

- Few resources; many teachers. At the elementary level, the number of teachers is large and the time they devote to any one subject is relatively small. The Title II/Eisenhower program does not provide enough resources to work with all elementary school teachers to any significant extent. Thus, in most successful activities, the districts or universities found a way to concentrate resources on relatively few elementary teachers. (It is interesting that in sparsely populated states there was two to three times the money per teacher available, and much more could be done at the elementary level.)

- The tradition of arithmetic and the textbook. For many teachers, parents, and principals, mathematics is equivalent to arithmetic.

Teachers typically find it very difficult to teach problem solving, estimation, and geometry at the expense of calculation skills. The new generation of texts is not yet on the market, and current standardized tests reward only algorithmic skills. Thus, the thrust of much of the professional development movement is out in front of the daily demands on teachers. Teachers are caught in the middle, as one teacher explains:

> *The activities I learn in workshops and conferences are the main source from which I draw in order bring other things (besides the textbook) into the classroom. But the reality is that the textbook is what I am supposed to cover. I try and infuse new ideas into my classroom whenever I get a chance.... I really think this professional development business is like trying to drink out of a fire hydrant. I go to conferences, I get fired up, I get lots of ideas, but when I come back to the district I still have to cover the material on page 20.*

- Professional development saturation. In some districts that had the resources and time to concentrate heavily on reforming their mathematics curricula, some teachers reached a point of saturation. They did not want to leave their classrooms for additional days of training, and they had absorbed enough mathematics ideas that they felt they couldn't use what they already had acquired. They felt obligated to pay attention to other subjects. For example, one teacher told us that the main constraint she feels in terms of her own professional development is that she doesn't want to miss out on being in the classroom with the kids. She feels that this year there was "too much professional training," and "too much outside stuff." She feels that it is good to have an extensive choice of inservice opportunities, but that there should be a limit to the number of days teachers can participate.

Barriers to Improving Secondary Mathematics--The overall sense of mathematics at the secondary level was one of rigidity. Like elementary mathematics, there is a long tradition of teaching certain topics in a fixed order (e.g., algebra, geometry, and pre-calculus courses), and this tradition works against much that professional development is trying to accomplish. In addition, the following four barriers to change stand in the way of significant improvements in secondary-level mathematics:

- Confusion about needs. The state and district Title II coordinators did not identify secondary mathematics as a priority area. This does not mean that they think the current status of secondary mathematics is satisfactory. In fact, many were quite disillusioned and even resigned about problems in mathematics teaching at the secondary level. In general, they could not see ways to get a handle on the problem, nor could they define clear solutions or directions in which to proceed.

- The overload on teachers. To make curricular changes or to use manipulatives and technology requires time. Teachers need time to learn about new ideas, to plan their use, and to discuss their strategy and share their experiences with other mathematics teachers. They often have no such time, as in the case of one teacher who cannot find time to talk with individual students because she is teaching six classes--five of which are different. She teaches two pre-algebra classes, one developmental class, one consumer mathematics class, one geometry class, and one algebra II class (she is also teaching a night class at a community college). Moreover, she was shocked to find that she had other administrative duties, such as serving as the freshman class sponsor and participating on a committee that helps new teachers.

  I feel frustrated that I can't teach the kids the way I am supposed to. At first I thought I would be able to have the kids do hands-on activities using manipulatives and solving real-life applications in almost all of my classes. Now I am down to the point where I'm simply trying to do this in each class once a week, and I find that even this can be hard.

- Lack of resources and equipment for technology integration. To integrate technology (e.g. computers, calculators, videodiscs) into the mathematics curriculum requires an investment of resources and effort that few schools are capable of. Sufficient compatible hardware must be coordinated with software and current instructional programs. Through professional development, teachers must be taught to use this technology in ways that augment what they are already doing and that do not require too great an effort on their part. Site visits uncovered no evidence of this, however; instead, it was more common to find teachers unable to put what they learned through professional development into practice. One such teacher learned about computers and how to use them in a course on interactive learning at the university. Through her participation she has now become the local computer advocate and organizer, and is working to get computer education going at her school. The school, however, is not organized to do this. For example, she ordered Sunburst Geometric Supposer--which she had learned about in a program-sponsored workshop--but found the hardware at the school to be incompatible with the software when it arrived. She finds this a frustrating battle but is still determined to make it happen in her school.

- Being in the shadow of the universities. In many ways, high school mathematics and science courses are designed to be dry runs of college courses. The curricula high schools offer are shaped as much by university entrance requirements as by a functional analysis of the mathematical skills most students need to live with. State and district tests also constrain the curriculum. In one district visited, teachers were being offered workshops on the NCTM standards, while at the same time their students were tested every week on specific objectives of their traditional algebra textbook. Many

high school faculty imitate university faculty. They teach more or less the way they were taught at the university. They identify heavily with their discipline. High school mathematics teachers tend to be well trained in mathematics and think of themselves as mathematics educators. They are typically less interested in reforms that require altering their pedagogical thinking. Consequently, they are often "put off" by reform efforts that they see as coming from outside the field of mathematics. Justified or not, many elementary teachers, middle school teachers, district coordinators, and state science specialists saw high school mathematics teachers as "very resistant" to new ideas.

All of these factors make the prospects less good for achieving significant curricular or instructional changes in secondary mathematics through the kinds of professional development offerings that the program typically supports, in the absence of the structural changes implied by the above discussion. Professional development, by itself, cannot bring about fundamental changes in instructional practice.

The Contribution of the Title II/Eisenhower Program to the Reform Movement in Science Education

The Title II/Eisenhower program has contributed in a similar way to the reform movement in science education, although there are differences between the two disciplinary areas and what is being done to change them.

As in the case of mathematics education, the nature of the problem and direction of change have been identified by a series of reports and analyses over the past decade. In 1978, NSF carried out three large studies that explored the current status of science and mathematics education in the United States. Extensive case studies and surveys showed a picture of science education that included neglect at the elementary level, confusion at the middle school level, and college preparatory courses at the high school level. Overall, it was clear that high-quality science education was being delivered only to the advantaged few. In 1985, the report of the National Science Board--Educating Americans for the 21st Century--generated a level of national concern about science education in the United States not known since the days of Sputnik. In particular, it highlighted the need to focus much

greater attention on the early years (K-6) as well as the need to make science education interesting and available for all students. Other reports and studies echoed and further defined these concerns--for example, the National Assessment of Educational Progress (Applebee, Langer, & Mullis, 1989) as well as international comparative studies, which showed that American students lagged in the amount of science studied and learned. Studies by professional societies such as the National Science Teachers Association (NSTA) (1986) and the American Institute of Physics (AIP) (Neuschatz & Covalt, 1988) showed that American science teachers at the secondary level were often isolated from their peers and ill prepared to teach the multiple subject areas to which many were assigned.

More recently, reform ideas have begun to take concrete form through a variety of developmental efforts, both large and small. Among the most visible of these are several national efforts to rethink the entire science curriculum in a fundamental way. For example, Project 2061 of the American Association for the Advancement of Science (AAAS), a collaborative effort involving scientists, teachers, and pilot districts, has completed its first phase with a report, Science for All Americans, which outlines a thematic and interdisciplinary approach to science education. Simultaneously, the NSTA has embarked on a project to restructure the high school curriculum so that students study all of the sciences each of their high school years.

To date, there is not the same degree of consensus about reform in the science community that exists in the mathematics education world, since the science education community is far more diverse and fragmented than the mathematics education community. Nonetheless, there are still a small number of key ideas that capture the primary thrust of the various reform thrusts. The discussion is organized around three ideas that are central points of consensus about the nature of the needed reforms:

(1) The most important goal of science education is scientific literacy for all students.

(2) Science instruction should engage students in an active, hands-on, social mode of learning.

(3) Teachers should learn science by experiencing scientific inquiry for themselves.

Idea 1: The Goal of Science Education Is Science Literacy for All Students

The Project 2061 summary report argues the need to provide all students with a coherent and consistent curriculum of science throughout their K-12 years:

> *Scientific literacy has emerged as a central goal of education. Yet the fact is that general scientific literacy eludes us in the United States. A cascade of recent studies has made it abundantly clear that by both national standards and world norms, U.S. education is failing to adequately educate too many students....*
>
> *There are no valid reasons--intellectual, social, or economic--why the United States cannot transform its schools to make scientific literacy possible for all students.*
>
> *To reach all students means reforming the education of every strand of the curriculum.... For students who expect to go to work right after high school a narrow focus on trade skills will no longer do....*

The current reform movement in science education is focusing on providing a core curriculum that will give all students a basic level of scientific literacy. The notion of scientific literacy, science education reform advocates argue, must be broadly defined to include knowledge of the important concepts and vocabulary of science, as well as the processes, history, social implications, and even "habits of mind" of those involved in the scientific enterprise. Science literacy, of course, is a prerequisite for a scientific or technological career, but increasingly it is also seen as the basis of an informed citizenry in today's technological world.

The goal of achieving scientific literacy has two prominent practical implications. One is that all students should receive an abundance of hands-on experiences at the elementary level. The other is that all students should continue to study science throughout their K-12 career. Title II/ Eisenhower-supported professional development is making a substantial contribution to the first, and some to the second.

Scientific Inquiry Begins at the Elementary Level--Early experiences with natural-science phenomena not only build an interest in, and a

foundation for, studying science later on, but they also help to create a "level playing field." Universal early science experience is seen as a way to eliminate some of the early advantage or disadvantage that comes from differences in cultural and economic backgrounds:

> A truism in science education is that most elementary school children are captivated by hands-on science activities. Science is basically culture free, at least at the elementary school level; hence few children are disadvantaged when it comes to doing science in the elementary school grades.... Hands-on science depends far less upon reading, writing and language skills than conventional textbook-based programs.... (Shamos, 1989)

Perhaps the strongest and most widely held sentiment expressed in the interviews conducted with district supervisors, IHE project leaders, state coordinators, and others was the urgency of improving science education for children in the elementary and early middle school years. Good experiences in science at an early age are seen as crucial to building students' confidence and enthusiasm for the subject so they are not "turned off" to it by the time they reach secondary school grades.

At the elementary level, the main issue in science education is that it is hardly taught at all. As has been pointed out earlier in the chapter, changing that state of affairs has been a major target of program-sponsored professional development. The most effective of these activities have the kind of results noted below:

- Y.H. attended a nearby institute where she learned to track animals. Subsequently, she took her kindergarten class out into the snow and spent considerable time tracking animals and distinguishing between flat-footed animals, animals with pads, and animals with toenails. She supplemented this with a study of several deer legs she had gotten from some of her friends who had been hunting in the fall.... Y.H. says that most of the activities she learns about through things like the institute are not ideally suited for kindergarten, but she is almost always able to adapt them to that level.

Not all of the training aimed at elementary science education has this effect, as discussed earlier in the report. Nonetheless, a large number of activities appear to be stimulating elementary teachers to venture into this important territory.

Science Learning Should Continue Throughout the Secondary Level--To obtain the goal of scientific literacy for all, it is generally agreed that the pattern of courses and enrollments at the secondary level must change. Site visits revealed a few instances in which efforts were being made to restructure both mathematics and science courses at the secondary level. These efforts typically involved designing and mandating a core curriculum of mathematics and science, which was to be taken by all students through the high school years. Program funds were being used to (1) involve teachers in the creation of those curricula, and (2) introduce the new curricula to the teachers of the district.

More frequently, the program supported efforts to help high school teachers provide their students more exciting and participatory activities within the confines of the standard courses. Many of the IHE projects that involved summer institutes in science education focused heavily on helping teachers broaden their repertoire of activities and approaches. The case below of a first-year high school science teacher illustrates what such projects can accomplish.

- When the first [Title II-sponsored] summer institute was held, N. had just completed his credential and was about to embark on his first year of full-time teaching. As a student teacher, he had felt that the students were bored with the physical science curriculum. Even he found the material tedious and uninteresting. The institute enabled N. to make the material covered in his physical science class more relevant to students' daily lives and more fun for him. As a result, he and his students are a lot more motivated, he says. The institute introduced him to a new curriculum exploring chemistry in the community. Using these materials, for example, N. has found that a lesson in water and atmospheric pollution can lead to a more interesting and useful discussion on gases in the atmosphere than had previously been possible with the original physical science curriculum. Now, instead of just talking about concepts, he shows his students things that are happening around them, and is able to tie scientific concepts to that common experience.

Program-sponsored professional development at the high school level seemed to work especially well when activities emphasizing collegial sharing and mentoring were used, such as:

- Idea-sharing forums. The physics department faculty at a community college in a rural area began sponsoring idea-sharing forums at which high school teachers in the region could bring some of their favorite ideas and share them with their colleagues.

- Leadership training institutes. In some instances, state-level Title II funds supported institutes that were conducted by master teachers trained in national leadership programs (e.g., the Woodrow Wilson Leadership Institute).

- Museum-based training. Program funds from the state and district levels supported some consortium projects housed in science museums. Often combining the pedagogical expertise of museum staff and the discipline expertise of nearby university faculty, the projects supported teacher workshops (and networks) in the supportive atmosphere of local science centers.

- Attendance at professional meetings. Recognizing their own limitations in providing appropriate workshops for advanced science and mathematics teachers, and recognizing the individual needs of these teachers, district coordinators were delighted to have Title II/ Eisenhower funds to help support the participation of their teachers in professional organizations. More than the national meetings, the districts have used Title II money to subsidize and revitalize state and local meetings, allowing many teachers to attend conferences who have previously been unable to do so.

Idea 2: Science Instruction Should Engage Students in Active, Hands-on, and Group-Based Modes of Learning

AAAS's Project 2061 suggests that science and technology should be taught "as a way of thinking and doing, as well as bodies of knowledge" and that this approach requires that students have some in-depth experience with the kinds of thought and action typical of those fields. The report stipulates that teachers should "start with questions about nature, engage students actively, and concentrate on the collection and use of evidence." Science lessons should not "separate knowing from finding out," and teachers should "deemphasize the memorization of technical vocabulary."

The move toward active and group-based learning of science also makes science more available to a wider range of students, as one teacher explained during an interview with the study team:

As a result of my professional development activities, I use cooperative learning more now in my classroom. While I used to try doing something similar, it never quite worked well. Now I am more grounded--I know how to get kids in groups, and I assign them different roles.... The students are challenged to think and verbalize.... They learn how to think, and also how they think.... As a result, I really feel that I can reach a wider range of kids now. Everyone's ideas are valid; it's not just the "right answer." Before, I would correct their answers; now the focus is more on understanding the process than the result. I make sure that everyone participates too. Students are more active. Even the slow readers can participate and be successful.

Cooperative learning is but one example of a range of approaches that encourage active, group-based learning of science. Site visits encountered the full range of approaches, and there is reason to believe from survey evidence that large numbers of LEAs and IHE projects are focusing on instructional strategies that encourage this kind of science learning, as demonstrated by Table 71. As in mathematics, LEAs and IHEs tend to place the priorities in a similar manner.

Idea 3: Teachers Should Learn Science by Experiencing Scientific Inquiry for Themselves

A recent report of the National Center for Improving Science Education expresses a widely held view about the importance of teachers having the opportunity to learn science in an inquiry mode:

If hands-on science is vital to good elementary science teaching, teachers must themselves be exposed to that approach.... Yet few of today's teachers took college science courses, and those courses usually emphasized the facts of science, not its processes.... Teachers need to study both science and science pedagogy in ways that emphasize experience, inquiry and the continuous weaving together of theory and practice. (Loucks-Horsley et al., 1989)

In the best of the institutes and workshops supported by Title II/ Eisenhower funds, teachers became engaged in, and excited by, their own learning. One teacher candidate in a preservice program recounts how the institute helped develop his skills of observation and his sense of wonder:

Table 71

CURRICULAR OR INSTRUCTIONAL STRATEGIES THAT WERE A GOAL OF PROFESSIONAL DEVELOPMENT AIMED AT SCIENCE EDUCATION

Instructional Strategy	Among LEAs and IHEs Using Year 4 Funds for Science Education, the Percentage That Focused on Each: LEAs	IHEs
Increased use of laboratory or other hands-on activities	80	83
Integration of technology into the curriculum	36	30
Increased use of demonstration and concrete examples	66	61
Increased emphasis on problem solving, higher-order skills in science teaching	72	62
Introduction of cooperative learning skills	17	19
Increased emphasis on social implications in science teaching	16	18
Adapting instruction for minority or disadvantaged populations	10	18

I actually feel more observant about the world now. One day when the class was acting bad and not paying attention, [the mentor teacher] took us all outside and asked if anybody could see an owl. No one could see it; we looked and looked and finally after about five minutes, I saw it standing next to post almost completely camouflaged--you just couldn't see it standing there. [The teacher] said he had been watching it for several days and was just waiting for a chance to show it to us. This kind of experience is really important. I had only known owls from books and in books they had always lived in a tree. I was just amazed when I saw this owl, camouflaged, coming up out of the ground. I think one of the lessons I got from this was that you really have to slow down and look carefully in order to see things.

Through his apprenticeship this same teacher intern came to know the "flavor" of science inquiry. He began to pick up the values of his mentor and was slowly acculturated into the science education community.

Such professional development experiences led some teachers to both experience the spirit of inquiry and communicate it to their students. A second-grade teacher described his efforts to teach a health-science unit on plaque and dental hygiene, to which he had been introduced through a professional development experience supported by Title II/Eisenhower funds:

[To do an experiment on testing the effects of sugar on teeth,] I had to figure out how to get some teeth. My first instinct was to go to the instructional materials center, but they didn't have what I needed. I went to the agricultural department on campus, and they sent me down to the local slaughterhouse where I asked for some teeth. They told me they were slaughtering lambs in a few days. When I returned, they did indeed have the jaws of four lambs all cleaned and prepared for me. It was J.T., my partner at the institute, who really taught me how to scrounge for good materials.

The teacher took the teeth and immersed them in different solutions of cola, apple juice, and water. The class checked the teeth every day for two weeks. They were greatly surprised to discover that the teeth in the apple juice decayed just as fast or worse than the teeth in the cola.

I told the kids the story about going out to get the sheep's teeth. I was really excited when I told them, and they got excited as well. I think they saw that you could just go out and do things. They also probably learned something about dental health as well.

In varying degrees, the experiences that are common in program-supported training events are encouraging this kind of spirit in teachers.

Limitations on the Program's Contribution to Reforming Science Education

As in the case of mathematics, site visits revealed that significant barriers stand in the way of realizing the goals of the professional development in science education that the Title II/Eisenhower program supports. Some of the same factors apply; others affect science teaching particularly, as noted below. As with mathematics, different barriers exist to the improvement of elementary and secondary science.

Barriers to Improving Elementary Science Education--One of the district coordinators summed up the difference between elementary mathematics and science in the following way:

> *The trouble with math is that it is an entrenched curriculum; the trouble with science is that it is a nonexistent curriculum.*

Some of the major barriers to improving science education at the elementary level are:

- Materials and facilities. The specific needs of elementary science are different from those of elementary mathematics. Most important, good hands-on teaching requires adequate materials, facilities, and equipment. The time and energy necessary to prepare these precludes many teachers from trying to teach much science except where there are special rooms or specialists to take the lead.

- Science is not a "basic." In England, all students are currently tested on three "basics" of the curriculum--English, mathematics, and science. In the United States, science at the elementary level is seen as important, but still secondary. Teachers must teach all subjects, and in the competition for time in the curriculum, science is often slighted.

- The culture of schools does not always support inquiry. The reforms proposed by Project 2061 and others are not in their essence new. The NSF science curriculum projects of the 1960s emphasized many of the same qualities. Still, in many--if not most--schools, classrooms remain rooted in a culture that emphasizes the authority of knowledge and, in spite of its lip service to inquiry learning, treats education as the mastery of facts and basic skills. The culture and mission of these schools are antithetical in some degree to the kinds of science learning proposed by the reformers. Without a deep change in the overall ethos of such schools, with accompanying changes in the way parents and teachers think about schooling, science education is likely to remain much as it has been. One of the teachers we interviewed poignantly described the different cultures in the following way:

Here at school I have a Chess Club, Rock Club, and a Space Club. I do all of these things before school, in my classroom. The students come in and engage in these activities and are wide awake at 7:30 in the morning. But at 8:00 when the bell rings, they go into a slump. The bell tells them that "now it is time for a lesson." In 20 years I have not been able to get the same kind of activity going after the bell rings that I had going in the morning before the bell rings. I suddenly expect them to be quiet, and they expect me to start "teaching." If we could just change school so it doesn't look like school. Both I and the kids start to act unnaturally after the bell rings.

Thus, the Title II story in elementary science is a mixed one. On the positive side, many districts and IHE projects are promoting good practices and values. Large numbers of teachers are getting inspired and encouraged to try more hands-on science in their classrooms. On the down side, there is little evidence that the systemic barriers to hands-on elementary science are being overcome on a wide scale, or even seriously addressed. More often than not, hands-on science is still not a steady part of the curriculum at the elementary level. There are simply too many difficulties for even well-trained and inspired teachers to overcome. Thus, the support that Title II is providing to those who seek to reform elementary science teaching is highly needed; it is simply insufficient to meet all the demands of the task.

Barriers to Improving Secondary Science Education--Many of the barriers to improving mathematics are the same for science--particularly the disciplinary orientation and the departmental structure. One teacher, a department head and lead teacher in his district, put it this way:

I find that trying to create change in the district is very difficult. This is because at the high school and junior high school level it is very hard to change a content-oriented person into an issue-oriented person. I think that the main mission for our teachers should be helping kids to think for themselves and learn how to make decisions based on empirical information, but this is not at all the priority of a content-oriented teacher.

One of the key recommendations of Project 2061 is that the "boundaries between the disciplines become softer" and that important themes of science (e.g., systems) be used to organize the subjects in a more interdisciplinary fashion. The rigid structure of the high school departments, as well as

university expectations, make interdisciplinary teaching difficult at best. Not surprisingly, there were few examples of a thematic approach in the sites.

Two other barriers to improvement are especially powerful for secondary school science:

- The absence of an infrastructure. As in the case of elementary science, many high school teachers lack the facilities, equipment, and support to transform their programs into laboratory-based experiences. They use lecture-text-test teaching approaches just to survive. Although they may have a computer, they do not usually have a situation where computers are easily integrated into the classroom and laboratory as a working tool that is a natural part of doing scientific investigations. They lack funds to buy basic materials and equipment. It is not surprising, then, that what they learn in computer-oriented professional development may not take hold in their classrooms.

- Reaching the least needy. A question that arises with all the activities supported by Title II/Eisenhower funds, but especially in secondary science, is the issue of who is attending and benefiting from these activities. There is some evidence that the people who participate in workshops, institutes, and conferences tend to be the most able and motivated teachers. There is a strong feeling in LEAs (and in the literature on staff development) that professional development should not be made mandatory; on the other hand, those teachers who need it most may never choose to attend. Again, one interviewee said it well:

  > *Perhaps the most severe problem is that a lot of people here are given the opportunity to go to very good professional development events and many won't go. I have always tried to encourage them, but until you attend one of these things, you just don't realize the benefit. A lot of the teachers, I am afraid to say, really are apathetic; they don't want to be involved, to have to do more, or to serve on committees. I try hard, and it's really like pulling teeth, to get some of the people around here to participate.... I try to sell new ideas to my colleagues, but I don't think you can really do this. I think they have to experience it for themselves, and the desire to do this has to come from within.*

In summary, at the middle and secondary level in science education, the study found that the activities supported by Title II/Eisenhower funds help individual teachers make incremental changes in their own classrooms, but not more fundamental shifts in approach. They are learning new topics, demonstrations, laboratory activities, and specific uses of new technologies. Most of

what is learned is infused into the present curriculum (if there is any transfer of training to practice), so that students are now receiving instruction that is a bit richer and multifaceted. However, except in unusual cases, the study did not find Title II funds contributing to deeper or more fundamental reforms at the secondary level.

Implications for Understanding the Program--The net effect of these factors at both levels is to slow down the pace of change, or in some cases inhibit it altogether. The key point for understanding the Title II/Eisenhower program is that, by and large, these barriers lie outside the professional development sphere altogether. The fact that the impacts of the program are limited by these forces says less about the program and more about the systemic complexity of achieving fundamental improvement in these subject areas. Acknowledging the power of these factors helps one to be realistic about what the program can accomplish and to see that the Title II/Eisenhower program is only part of any lasting solution to the problems that beset mathematics and science education.

These findings at both the elementary and secondary levels point out again that the Title II/Eisenhower program is more of an enabling resource than a focused intervention in its own right. Thus, it is only as good as the leaders it empowers; it can further reform only to the extent that the field itself is ready for such reform; and it is constrained by the systems it must work within.

Contributions to Professional Development Opportunities

For teachers to change what they teach and how they teach it, they must grow in many ways. As the preceding discussion implies, their attitudes, content knowledge, ideas about pedagogy, and images of their profession must undergo a transformation. Formally organized professional development activities are a primary vehicle for encouraging this transformation to happen, but not all kinds of professional development are likely to bring about the desired changes.

Two key questions arise: (1) what approaches to professional development are most desirable--that is, are most consistent with current thinking about effective practice (and most consistent with the current reform thrust)? (2) How close do the activities sponsored by the Title II/Eisenhower program come to "best practice" in professional development?

Changing Conceptions of Good Professional Development

Ideas about what constitutes good professional development are changing, along with conceptions of teaching and learning in mathematics and science. As educators and scholars have increasingly viewed teaching and learning in constructivist terms--that is, with emphasis on the active, cognitive processes of children, who seek to make sense of the world around them, thereby "constructing" mathematical or scientific knowledge--so, too, have conceptions of professional development shifted.

The view of professional development on which this study is based stems from a conception of teachers as professionals who are active agents of change, both in their own teaching and in the school programs of which they are a part. From this perspective, the task for professional developers is not to "train" teachers in the use of particular classroom techniques that they are lacking. Rather, the goal is to "educate" them in ways that expand their views of themselves, their profession, the content they teach, and the pedagogy they employ. The result is a cadre of teachers who view themselves as learners, shapers of curriculum, and colleagues contributing to a mutual process of reforming mathematics and science education.

Four key ideas in the literature on professional development capture the new spirit and at the same time incorporate valuable understandings from earlier research on staff development.

First, **effective professional development takes place at both an individual and an institutional level.** Stated another way, it is as important to develop groups of teachers who can support each other in an ongoing process of learning and change as to enhance the knowledge, skills,

or attitudes of individual teachers. This view has various implications for the design of professional development, among them, that training events should try to involve teams of teachers from the same school or district and promote support networks among teachers who participate in training (Far West Laboratory, 1987). Focusing on the institutional level also means connecting professional development to a long-range strategic vision of educational improvement rather than building training events around a set of disconnected topics (Odden & Marsh, 1988).

Second, **effective professional development is a long-term, reflective process, in which participants have the chance to engage in their own learning of subject matter, reflect on their learning, and explore how to use what they have learned in their teaching.** To accomplish this aim, professional development must be in depth and long term (Loucks-Horsley et al., 1989). Although the absolute amount of time spent in professional development activities is probably not the the most important prerequisite, more intensive experiences are more likely to offer the participant a chance to engage in reflective learning in a meaningful way.

Third, **follow-up activities and support at the school and classroom levels are a key to building bridges between personal learning and classroom applications** (Loucks-Horsley et al., 1989; Far West Laboratory, 1987; Crandall, 1982). Experts on professional development agree that the more substantial the follow-up, the greater the likelihood that what is learned in professional development will be tried out in the classroom. Similarly, ongoing logistical, moral, and professional support from school administrators and others is essential to enable new ideas to take root in teaching practice.

Fourth, **professional development should be closely tied to current instructional assignments, so that experimentation and reflection can take place** (Far West Laboratory, 1987). Some experts urge that professional developers build into the workshop format the chance to try things in the classroom; multiple-session formats are particularly helpful in this regard (Ball & Wilcox, 1989). Professional development that gives teachers the

chance to adapt curriculum for the particular circumstances of their own classroom is especially promising.

In line with these ideas about effective practice, there is growing understanding among reformers these days that professional development is a cumulative, long-term process that should include a variety of experiences. Good professional development thus includes many things--not only the inservice training that districts offer their teachers, but also coursework and degree programs, attendance at professional associations, and participation in practitioner networks. Together, these and other experiences can broaden and deepen teachers' knowledge, pedagogical skill, and commitment to their work.

Overall, the mix of professional development experiences should include these characteristics, though not every experience should be the same:

- Awareness of developments in the professional community. Teachers are acquainted with developments in the wider professional field.
- Deeper learning of content. Teachers are exposed in new and deeper ways to the content they teach, including "relearning" what they already know, but at a more sophisticated level.
- Appropriate pedagogy. Professional development experiences give teachers new ideas, both large and small, about pedagogy appropriate to the content being taught--what is often referred to as "pedagogical content knowledge."
- Opportunity for experimentation and reflection. Teachers are able to try out ideas and reflect on their appropriateness and value in their own classroom practice.
- Contact with other teachers. As part of professional development, teachers meet and interact with other practicing professionals whom they did not know well before.
- Participation in planning. Teachers have the opportunity to help define the direction and shape of the professional development experience, for example, by participating in planning for training events.
- Relationship to long-term improvement goals. Professional development is most likely to "stick" when it is related to a long-term program of activities to change mathematics and science teaching. "One-shot" activities tend not to transfer to practice if they do not connect to other attempts to improve the program.

- Administrative and policy support. Administrators should understand and support the goals of professional development, even to the point of requiring changes in practice advocated in professional development. In addition, policies need to be in place that can reinforce desired changes in classroom practice, including policies related to testing, the allocation of resources, textbook acquisition and use, scheduling, and class assignment.

Experiences marked by these qualities lead over time to change in the way teachers view their profession, commit themselves to their work, and imagine possibilities for their teaching. The absence of these characteristics does not necessarily mean that professional development activities are doomed to fail. Rather, it simply means that the odds are changed. Isolated teachers, participating in activities without follow-up or administrative support, are thus less likely to change the way they teach, no matter how rich the professional development experiences they may have.

Not all professional development experiences need to be the same--that is, all equally intensive, fully supported by administrators, rich in content and pedagogy, etc. In fact, a mixture of experiences is needed, some with brief one-time exposure, others more substantial opportunities to learn new content and approaches.

The Quality of Program-Supported Professional Development

Set against these criteria, it is not easy to generalize about the quality of the professional development supported by the Title II/Eisenhower program. The simplest statement to make is this: **inevitably, the quality of the professional development supported by the program is mixed.** Across the thousands of districts and hundreds of higher education institutions using program funds for this purpose, one encounters the full range of approaches to professional development. In site visits, the study team saw numerous instances of professional development that met most or all of the above criteria; in other cases, program funds were supporting brief one-time events that had little promise of contributing significantly to improvement in practice.

Survey data from the study provide some indications of the incidence of the conditions associated with effective professional development, though these data are not a precise measure of what has been discussed in this chapter. As far as can be determined from this data source, **high-quality professional development, in which transfer from training to classroom practice is likely, occurs in large numbers of districts and grant-funded projects receiving Title II/Eisenhower funds** (probably somewhat fewer than half of all districts and perhaps a majority of higher education projects). This statement is based on data, summarized in Tables 72 and 73, related to key characteristics of effective professional development, first for LEAs and second for higher education projects. The data in the tables are by no means comprehensive; many elements of effective professional development are either incompletely measured by these indicators or ignored altogether. Nonetheless, the data suggest a very rough estimate for the incidence of certain characteristics of effective professional development. Furthermore, the tables permit a rough comparison to be made between professional development supported by LEAs and that occurring in higher education projects.

Table 72

INCIDENCE OF SELECTED CONDITIONS FOR EFFECTIVE PROFESSIONAL DEVELOPMENT AMONG ACTIVITIES SUPPORTED BY LEA FLOW-THROUGH FUNDS

Conditions for Effective Professional Development	Percentage of LEAs in 1988-89 in Which Program-Supported Activities Displayed Each Condition
Intensity: average hours per participant	
Greater than 18 hours	18
Greater than 30 hours	9
Teachers' participation in planning for professional development	41
Incentives for teachers' participation: use of program funds for teacher stipends	42
Opportunity to adapt what has been learned to teachers' own classroom situations: emphasis on developing units or materials for classroom use	
Mathematics inservice	61
Science inservice	70

Table 73

INCIDENCE OF SELECTED CONDITIONS FOR EFFECTIVE PROFESSIONAL DEVELOPMENT AMONG HIGHER EDUCATION PROJECTS FUNDED BY TITLE II/EISENHOWER

Conditions for Effective Professional Development	Percentage of Projects in 1987-88 and 1988-89 in Which Program-Supported Activities Displayed Each Condition
Intensity: average hours per participant	
Greater than 30 hours	75
Greater than 100 hours	25
Teachers' participation in planning: percentage of projects with classroom teachers included in staff development team	38
Incentives for teachers' participation: use of program funds for teacher stipends	60
Opportunity to adapt what has been learned to teachers' own classroom situations: emphasis on developing units or materials for classroom use	
Mathematics inservice	54
Science inservice	72
Follow-up: projects that provided--	
Formal follow-up training for all participants	40
Informal follow-up support to some individual participants	62
School/district support for professional development: projects in which school districts provided some funds to support the training	26

XI THE PROGRAM IN RELATION TO STATE REFORMS AND OTHER FEDERAL INITIATIVES

The discussion now takes a step back from contributions to curriculum, instruction, and teachers to focus on the state and federal context for the program. The reason for doing so is this: the Title II/Eisenhower program does not exist in a vacuum. Instead, the program began at a time when state and federal policymakers were paying increased attention to mathematics and science education. The initiatives launched at state and federal levels have much to do with the unfolding story of the Title II/Eisenhower program. They can provide direction, additional resources, and complementary activities; at the same time, they can also constrain, inhibit, or compete with the program.

This chapter reviews what has been learned about the Title II/ Eisenhower program in relation to key features in its state and federal context, first, by examining the program's interaction with state reforms, and second, by looking at the relationship between it and other federal initiatives aimed at mathematics and science education.

The Interaction of State Reforms and the Title II/Eisenhower Program

The discussion of the state component of the program in Part One indicated that states have managed the program resources in distinct and different ways. Overall, there are more similarities than differences across states. Still, **more than is the case for many federal education programs, the way that the program funds have been used (particularly the state-level funds) has been colored by the character of state education reform efforts and priorities established by the states.**

State reforms during the 1980s have been extremely diverse, both for K-12 education policy in general and for science and mathematics education in

particular (Blank & Espenshade, 1988; Firestone, Fuhrman, Kirst, 1989; Freeman, 1989; Marsh & Odden, 1990). This chapter first examines the interaction of the Title II/Eisenhower program with state reforms for science and mathematics education and then with more general types of state reform.

State Reforms Related to Science and Mathematics Education

State reforms that are aimed specifically at mathematics and science education interact with the Title II/Eisenhower program in two general ways. First, they provide direction for the expenditure of program funds by both state and local education agencies. Second, the program can (and often has) become a key resource for state leadership in these subject areas. The actual implications for the program vary somewhat by type of reform action.

A great many states are requiring far more science and mathematics testing of teachers and, especially, of students than in the past. Testing of students' knowledge and skills at various grade levels, and even in very particular disciplines (such as algebra or biology) has become quite common (see Table 74). (In fact, according to one study of state accountability systems, state tests of student learning have become the dominant technique for assuring accountability [Office of Educational Research and Improvement, 1988].) In many states, this type of education reform has very clearly affected the way that state and local funds are spent under the Title II/ Eisenhower program, with the particular character of the effort depending on the state context. Examples include the following:

- One southern state with very low SAT scores implemented a statewide mathematics SAT improvement effort, funded by the Title II program. The objective is to train teachers how better to teach mathematics specifically to raise SAT scores.
- A state in the mid-Atlantic region developed and implemented an elementary science test that focuses on "science process skills" (rather than only on facts). Title II program monies have been used to train large numbers of elementary teachers to administer the new test, and to use appropriate teaching methods.

Table 74

STATE STUDENT TESTING IN SCIENCE AND MATHEMATICS BY GRADE AND TYPE OF TEST

	Achievement Assessment			Competency-Referenced (c) or Proficiency (p)		
	Science	Math	Source	Science	Math	Source
Alabama	2, 5, 8, 10	2, 5, 8, 10	Stanford	—	3, 6, 9(c), 11, 12(p)	State
Alaska	—	4, 8	State/loc. opt.	—		
Arizona	—	1 - 12	ITBS	—	—	
Arkansas	—	4, 7, 10	MAT	3, 6, 8	6, 8(c)	State
California	8	3, 6, 8, 12	State	—	9, 10, 11, 12(p)	State
Colorado	3, 6, 9, 11	3, 6, 9, 11	ITBS	—	—	
Connecticut	4, 8, 11	4, 8, 11	State	—	4, 6, 8(c)	
Delaware	11	1 - 8, 11	CTBS	—	8, 11(p)	Local option
District of Columbia	1 - 6	3, 6, 8, 9, 11	CTBS	—	—	
Florida	—	3, 7, 11	NAEP	—	3, 5, 8, 10(c)	State
Georgia	2, 4, 7, 9	2, 4, 7, 9	ITBS	—	1, 3, 6, 8(c), 10(p)	State
Hawaii	—	3, 6, 8, 10	Stanford	—	3, 9, 10, 11, 12(p)	State
Idaho	6, 8, 11	6, 8, 11	ITBS	—	8, 9, 10, 11, 12(p)	State
Illinois	3, 6, 10 (92)	3, 6, 8, 10(91)	State	—	—	
Indiana	—	—		3, 6, 8, 11	1, 2, 3, 6, 8, 9, 11(c)	State
Iowa	—	—		—	—	
Kansas	—	—		—	2, 4, 6, 8, 10(c)	State
Kentucky	—	—		—	K-12(c)	State
Louisiana	4, 6, 9	4, 6, 9	State	—	3, 5, 7, 11(p)	State
Maine	4, 8, 11	4, 8, 11	NAEP	—	—	
Maryland	—	3, 5, 8	CAT	—	7, 9(c)	State
Massachusetts	4, 8, 12	4, 8, 12	NAEP	—	3, 6, 9(c)	State
Michigan	4, 7, 10	4, 7, 10	State/NAEP	—	—	
Minnesota	4, 8, 11	3, 4, 8, 11	State/loc. opt.	—	—	
Mississippi	—	—		—	3, 5, 8, 11(c)	State
Missouri	3, 6, 8, 10	3, 6, 8, 10	State	—	9 - 12(c)	State
Montana	—	6 - 11	State/loc. opt.	—	—	
Nebraska	—	—		—	—	
Nevada	—	3, 6, 9, 11	Stanford	—	11 - 12(p)	State
New Hampshire	4, 8, 10	4, 8, 10	CAT	—	—	
New Jersey	—	—		—	9(p)	State
New Mexico	3, 5, 8	3, 5, 8	CTBS	3, 5, 8, 11	3, 5, 8, 11(p)	State/loc. opt.
New York	4, 6	3, 6, 8/9	State	9 - 12	9 - 12(p)	State regents
North Carolina	3, 6, 8	1, 2, 3, 6, 8	CAT	—	10(p)	State
North Dakota	5, 7, 9, 11	3, 5, 7, 9, 11	SRA/ITBS	—	—	
Ohio	—	4, 6	Local opt.	—	3, 6, 10(c), 9, 12(p)	Loc. opt./state
Oklahoma	3, 7, 10	3, 7, 10	MAT	—	—	
Oregon	—	8	State	—	—	
Pennsylvania	4, 6, 7, 9, 11	4, 6, 7, 9, 11	State	—	3, 5, 8(c)	State
Rhode Island	—	3, 6, 8, 10	State	—	—	
South Carolina	4, 5, 7, 9, 11	4, 5, 7, 9, 11	CTBS	3, 6, 8	1, 2, 3, 6, 8, 10(c), 9 - 12(p)	State
South Dakota	4, 8, 11	4, 8, 11	Stanford	—	—	
Tennessee	2, 5, 7	2, 3, 5 - 12	Stanford	—	3, 6, 8(c), 9 - 12(p)	State
Texas	—	1, 3, 5, 7, 9, 11, 12	State	—	—	
Utah	—	5, 11	CTBS	—	9 - 12(p)	Local option
Vermont	—	—		—	—	
Virginia	4, 8, 11	4, 8, 11	SRA	—	1 - 6(c), 9 - 12(p)	State
Washington	—	4, 8, 10	MAT	—	—	
West Virginia	3, 6, 9, 11	3, 6, 9, 11	CTBS	3, 9	3, 9(c)	State
Wisconsin	—	4, 8, 11	CTBS	—	3, 7, 10(c)	State/loc. opt.
Wyoming	4, 8, 12	4, 8, 12	NAEP	—	—	
Number of states	28	43		6	19 (c) 17 (p)	

Note: Numbers are school grades; numbers in parentheses are years when testing goes into effect.
Source: State Departments of Education, reported to CCSSO, 1988.

Besides testing, many other state reforms specific to science and mathematics education have been implemented in recent years, some of which also influence the use of Title II/Eisenhower program funds. Examples include:

- **Many states have provided leadership training activities related to state goals and frameworks using Title II/Eisenhower program funds.** A major program in one western state has involved training a "leadership cadre" of teachers to understand and implement new curriculum frameworks for the state in science and mathematics. In another state, new legislative requirements for high school science offerings were the subject of a statewide conference.

- **In many cases, specific state curriculum priorities--such as an emphasis on secondary science laboratory safety, or on training for particular courses undergoing curricular changes, or on mathematics manipulatives--become the focus of projects supported with Title II/ Eisenhower program funds.** One southern state that had developed a mathematics manipulatives kit was unable to provide much training in the use of the kits until this program provided funds to do so. Large numbers of teachers have been trained with program funds, and the kit is now in use in thousands of classrooms in the state.

- **Title II funds have been used to assist some states to implement reforms being promoted by national groups.** Several states have decided to implement reforms recommended by Project 2061 (supported by the AAAS).

The latter example illustrates that the program can help states to support fundamental reform (i.e., major changes in the way that schools structure and provide instruction) as well as incremental reform. However, the former tends to be more expensive than the latter, and the sharp reduction in SEA funding under the Eisenhower program is likely to limit what states can do with these monies. Observers have found an increase in state efforts to "fundamentally change the classroom" in recent years (e.g., Marsh & Odden, 1990), but fewer Eisenhower program funds are available to help SEAs pay for these efforts.

The area of education reform in which the most states have been active is increasing high school graduation requirements, notably in mathematics and science. Even in this domain, in which there might seem to be little connection with Title II or Eisenhower, we found examples of states using program funds to help the state reform effort along--for example, by

developing or implementing new curricula especially suited for students who had not taken much science or mathematics before, or by educating teachers about new state graduation and curriculum requirements.

These examples demonstrate that the Title II/Eisenhower program is often used to support state education reform efforts in science and mathematics. Since, on average, about half of the SEA budget for improving science, mathematics, and computer education came from Title II in 1988-89, it should not be surprising to find that these funds are commonly tapped to support state reform efforts. There are typically few other funds to draw on.

State Reforms Not Related to Science and Mathematics Education

Analyzing the entire array of state reforms carried out during the 1980s is a daunting task that is far beyond the scope of this report. A count of major state education initiatives first published in Education Week in February 1986 reaches into the hundreds--and hundreds more have been enacted since that time. Another analysis suggests that more than 700 state statutes were enacted between 1984 and 1986 affecting some aspect of the teaching profession alone--to say nothing of curriculum, student testing, or other aspects of education (Timar & Kirp, 1989). A great many of the reform efforts have been initiated in state legislatures; somewhat fewer have been generated by the executive branch.

Most of the more general state education reforms (e.g., merit pay, career ladders, mandatory kindergarten) have no direct interaction with the Title II/Eisenhower program. But at times they do interact with the program--and sometimes quite strongly--in three ways.

Some of the state education reforms work hand in hand with projects supported by Title II/Eisenhower to produce an overall climate for reform that is much stronger than one or the other set of resources acting alone. This is what one state policymaker meant when he called Title II "one wonderful arrow in our quiver." In that state, special awards are available

for outstanding science and mathematics teachers, fellowships have been made available for outstanding liberal arts students interested in teaching (regardless of field), there is a movement to put more decisionmaking into the hands of school principals, and many other state reforms are also in place. Nonetheless, the Title II program, in the unanimous opinion of dozens of people we interviewed in the state, was making a distinct and important contribution. No other comparable source of professional development money for "grass-roots teachers" is available; as a result, Title II is credited with greatly increasing both the amount and the quality of professional development for science and mathematics teachers throughout the state.

In a few cases, projects supported by Title II/Eisenhower outside the fields of science and mathematics have been so significant that the state has considered the impact to be a major one. For example, one sparsely populated state has used significant amounts of both D&E funds and higher education funds to help improve the use of computers, telecommunications, and other technologies in education, regardless of the discipline involved. This state was dismayed by changes in the reauthorization that precluded similar projects under Eisenhower unless specifically focused on science and mathematics. A few states feel the same way about the elimination of foreign languages under Eisenhower (e.g., one state used the mail survey to highlight "creative initiatives, especially for foreign language instruction" that were funded by the higher education component).

State reforms can work inadvertently to reduce the effectiveness of the LEA and IHE components of the Title II/Eisenhower program. In one state, teacher salaries were raised--first for new teachers, then for the entire teaching force. Subsequently, the state has been working to develop performance-based pay plans and supplemental pay plans based on teachers' additional work or training. These reforms are expected to lead to some degree of school restructuring. Large amounts of money (tens of millions of dollars) are available to districts for performance-based and supplemental pay plans. As a result, the state funds have diminished the incentive for some teachers to participate in Title II/Eisenhower projects. Essentially, teachers can make money (in the form of salary increases) by participating in

some professional development activities or special projects not paid for by Title II. Even in cases where Title II has provided a stipend, a salary increase may be more attractive. Enthusiasm for Title II/Eisenhower is still strong in the state, and many thousands of teachers have been served. But, as the study found in other situations, there does seem to be a ceiling on the amount of professional development that teachers can use, although the Title II/Eisenhower program has not by any means reached the ceiling.

Because the Title II/Eisenhower program is relatively small and invisible in most school districts, it is not generally an important factor in efforts to restructure schools or to provide more flexibility in school-level decisionmaking. In fact, just because it is small, dividing the money among individual schools in a district (e.g., by some kind of a formula) would often be counterproductive. The district's central office often plays a role for schools that is, in some respects, comparable to the role of an intermediate unit serving many very small school districts. Both can aggregate resources, set priorities, and make available expertise in ways that make the funds stretch farther. As explained in Part Two, districts with more focused improvement agendas (e.g., that aim at particular subjects or grade levels) typically make better use of these program funds than districts with less-focused agendas.

The Title II/Eisenhower Program in Relation to Other Federal Efforts to Improve Mathematics and Science Education

The modest size and broad mandate of the Title II/Eisenhower program means that it is important to understand how the program operates in relation to other initiatives, especially other federal efforts designed to improve science and mathematics education. The relationship of the Title II/Eisenhower program to these programs is explored below, with special attention to the role of the National Science Foundation in the professional development of science and mathematics teachers.

The Spectrum of Federal Initiatives for Mathematics and Science Education

Until a few years ago, it was exceptionally difficult to get a coherent picture of what the various federal agencies contributed to the improvement of K-12 mathematics and science education. No federal agency took responsibility to analyze and discuss the budgets and programs of the many agencies with education missions (e.g., ED, NSF, NASA, Department of Energy, USDA, Forest Service, HHS Public Health Service). Now it is considerably easier, thanks to efforts by the American Association for the Advancement of Science (AAAS), which develops and publishes a periodic analysis, Science Education News (e.g., AAAS, 1988; AAAS, 1989). **However, the rapidity of change, the large number of agencies involved, and the scarcity of independent studies of most of the federal initiatives still make the task of comparing and contrasting the contributions of the many federal agencies difficult.**

Table 75 shows the FY 1989 science, mathematics, and technology education budgets for four federal agencies (ED, NSF, NASA, and DOE). A number of features are apparent when one begins to reflect on the figures in this table. First, size is not the only indicator of importance. The contributions of the NAEP program to informed debate about science and mathematics education, for example, are far greater than its relatively small size ($2.4 million for science and mathematics in FY 1989) might suggest. Second, the variety of the federal programs and initiatives is very great, including: programs focused only on particular fields of knowledge (e.g., NASA's programs for space sciences education); programs focused only on particular groups of students (e.g., Chapter 1 or Indian Education); extremely broad and inclusive programs, touching most school districts (e.g., Eisenhower, Chapter 2); long-term programs to increase basic knowledge about teaching and learning (e.g., National Research Centers); and so on.

Table 75

ESTIMATES OF EXPENDITURES FOR K-12 SCIENCE, MATHEMATICS, AND TECHNOLOGY EDUCATION IN THE FY 1989 FEDERAL BUDGET[a]

Program	FY 1989 Budget ($ in millions)
National Science Foundation	
Teacher Preparation and Enhancement	$ 63.5
Materials Development, Research and Informal Sci. Ed.	44.0
Young Scholars Program	7.0
Studies and Program Assessment	4.5
Subtotal	119.0
Department of Education "Research and Improvement"	
Eisenhower National Programs	8.9
Regional Labs and National Research Centers	4.4
National Diffusion Network	2.1
ERIC System	0.3
Fund for Innovation in Education	5.9
National Assessment of Educational Progress (NAEP)	2.4
FIRST Program	0.3
Subtotal	24.3
Department of Education "Assistance Programs"	
Eisenhower State Grants	128.4
Chapter 1 (mathematics)	1008.3
Chapter 2 (science/mathematics)	103.3
Magnet schools (science/mathematics)	28.4
Indian Education (science/mathematics)	21.1
Star Schools (science/mathematics)	2.9
Subtotal	1292.4
Department of Energy	
Laboratory Cooperative Science Centers	1.0
Energy Manpower Development	1.2
Subtotal	2.2
National Aeronautics and Space Administration	
Elementary and Secondary School Program	4.3
Total	1442.2

[a] Only the share of each program focusing on science, mathematics, or technology education is shown. The estimate of expenditures on mathematics and science education for programs not specifically targeted on these subjects (e.g., the Department of Education's Chapter 1 and Chapter 2 programs) may be only rough approximations.

Source: AAAS Science Education News, 7(6), (June/July 1989).

The Title II/Eisenhower program relates in some way to many of the other federal programs. For example, each of the following situations was encountered in the research for this study:

- Chapter 1 mathematics teachers have received special training paid for by Title II/Eisenhower (LEA) funds. This is not a common use of funds, but it is certainly permitted. One Chapter 1 teacher of junior high school students whom we interviewed claimed that the quality of her training helped contribute to more than half of her students' "placing out" of Chapter 1 mathematics.

- Districts have used Title II/Eisenhower funds to pay for substitutes while regular teachers go off to observe National Diffusion Network (NDN) programs in science and mathematics (several of which were later adopted in one site we visited). Many districts have used Title II/Eisenhower funds to pay for substitutes.

- Successful projects initially funded by Title II/Eisenhower monies (D&E funds, IHE funds, or even LEA funds) have later been able to attract substantial federal discretionary grants from NSF or from some of the Department of Education programs (e.g., NDN, Fund for Innovation in Education).

- Conversely, some projects funded by discretionary federal grants (including the Title II/Eisenhower national programs set-aside) have been picked up by school districts using Title II/Eisenhower LEA funds. For example, training to use "Voyage of the Mimi," an ED/NSF television-based program for upper elementary grades, has been supported with Title II funds in some districts.

- Many districts have successfully used Title II/Eisenhower funds in conjunction with Chapter 1, Chapter 2, vocational education, or other specially targeted federal programs to pay for projects larger than one program alone could support.

These examples should not be particularly surprising. Because the Title II/Eisenhower program has funded many thousands of projects since 1985, it relates to a great many other program initiatives. It has rapidly become incorporated into the everyday fabric of science and mathematics education, just as many of the other federal programs have been.

There are two important questions to pursue: (1) What does the Title II/Eisenhower program do especially well or poorly in relation to the other initiatives? (2) Does the program duplicate efforts in some way (notably with respect to the NSF teacher professional development programs)? These questions are addressed in the following sections.

Strengths of the Eisenhower Program in Comparison with Other Federal Programs

A number of features of the Eisenhower program either are unique or reflect special strengths compared with other federal programs. These include its focus on "grass-roots" teachers, its size (large enough to make it useful for implementing reforms), the ease of obtaining funds, the support for state leadership, and its capacity to foster connections among various sectors of the education system.

Focus on "Grass-roots" Teachers--The Eisenhower program focuses particularly on the professional development of teachers. Even among those federal programs providing support to teachers, Eisenhower is far and away the largest, most inclusive, and most oriented to the "grass-roots teacher." **Large numbers of people interviewed singled out the program's support for the "everyday" teacher, the teacher "in the front lines," or the "grassroots" teacher as one of the program's most significant characteristics.** For example, a science department chair in a rural high school--an experienced and expert teacher--told us that "all the teachers" in the school had benefited directly or indirectly from Title II, which has given the school, for the first time, money to pay for substitutes while teachers go off to learn about new programs (including NDN programs, which they have adopted). Title II program coordinators and project directors identify "grass-roots" teachers as a primary audience, and feel that no other federal program provides comparable support for this group.

Large Number of Teachers Served--The sheer number of teachers served by the program--hundreds of thousands each year--confirms the ability of the program to serve the "grass-roots" teacher. Although Title II has served many "lead teachers" and others at the top of their profession, it has served a great many more typical teachers, including many in elementary schools who do not even specialize in science or mathematics.

It seems appropriate to think of the program as providing power to drive science and mathematics reforms nationwide, by supporting the dissemination

of ideas and techniques to tens and even hundreds of thousands of teachers. The program is typically not, in itself, the impetus for reform (which has come from hundreds of national reports, commissions, and the like), nor is it, in itself, supplying the vision of the direction to travel (that is being supplied by state and national reform plans, such as the NCTM Standards). Instead, the Title II/Eisenhower program is one engine that helps teachers to move along the reform road. Because it serves so many teachers, it plays a unique role in this respect.

The Ease of Obtaining Funds--The ease of obtaining Eisenhower funds is another unique feature, which was often mentioned in interviews. This is true among all groups that were interviewed, including state Title II coordinators, district staff, and even directors of "competitive" higher education grant projects. Several components of the program are formula-driven "entitlements," requiring little paperwork. Even the discretionary components are perceived as relatively "hassle free." Compared with other funding sources (notably NSF), Title II/Eisenhower grants are perceived as requiring less paperwork, less claim to national scope or impact, and less impressive credentials (e.g., as a previously successful grantee); and the entire application and award process is faster from start to finish (often requiring only a few months).

As an example, one higher education project director who actually served as a rotating grants administrator at NSF (in a science rather than an education program) said, "I would never have been able to get this type of grant from NSF," in part because her institution (a two-year school) was not well known, and in part because the size and impact of the project (which served only about a dozen teachers) was not large in national terms. The Title II/Eisenhower program is unique in its ability to attract such large numbers of science and mathematics professors like her to work with teachers.

For each component of the program, the relative stability of the program and the fact that it requires relatively little paperwork are very attractive features. Chapter 2 is similar in this respect, but it is used for many more things than the training of teachers; historically, only small proportions of Chapter 2 have been used for professional development.

The Title II/Eisenhower program has a demonstrably low "overhead rate," and this is another noteworthy feature. A high proportion of the funds pay for services. Very little is held for administration, particularly at the district level (where, typically, nothing is held), and almost none is held for the "overhead" that is often charged by IHEs and other nonprofits for normal research grants. The 4% overhead figure cited in Part Three is remarkably low, and it means the dollars stretch farther.

Support for State Leadership--As noted earlier in this chapter, the Title II program supplied a high proportion of all funds for state reforms of science and mathematics education (before the funding formula changed under Eisenhower). Until NSF first awards grants under its new initiative to support systemic change in selected states, the funding of SEAs at this dollar level, specifically for mathematics and science improvement, is something no other federal program has done; NSF has historically provided relatively little money to state agencies, compared with the size of the D&E set-aside in 1988-89 under Title II. In fact, because there is little paperwork and the funds are unfettered, state science and mathematics supervisors sometimes prefer smaller Title II grants to larger NSF or other highly focused grants. Several state science and mathematics supervisors who had received both types of grants made this point.

Capacity to Foster Connections Among Various Sectors of the Educational System--Finally, the Title II/Eisenhower program, which was designed to involve various sectors of the education system (state agencies, districts, and institutions of higher education), has in fact greatly strengthened connections among many key individuals and institutions involved in science and mathematics education. The program has promoted a kind of vertical integration of the system, so that national, state, and local agencies are more closely aligned in their goals and activities. Through support for institutions of higher education, professional associations, museums, and conferences of different kinds, the program also builds connections that strengthen various components of the education system. Title II/Eisenhower is not the only federal program that does these things, but it does more of them, in more districts and institutions, than any other.

What the Eisenhower Program Does Not Do Well Compared with Other Federal Programs

Although there are clearly things that the Eisenhower program does especially well in comparison with other federal programs, it does not do equally well in all areas. For example, it does not generate new national visions for reform or support the creation of large new curricula. Neither does the program take the place of many special-purpose federal programs.

Title II/Eisenhower has typically provided implementation money to support reform ideas that already exist, or that come from other sources (such as state legislatures). The program would look quite different if the NCTM Standards, Project 2061, and dozens of state reform efforts were not already in place. The national vision has been supplied, for the most part, by leaders who have been supported in other ways, often before the existence of the Title II/Eisenhower program. In part, this is a question of timing (since many reforms were well under way before Title II was created), and in part, the structure of the program emphasizes relatively small awards, as well as service delivery or implementation rather than new visions.

Widespread improvement of science and mathematics education will depend on changes in many aspects of the current education system. For example, as noted in Chapter X, there is widespread agreement that new curricula are needed for teaching science and mathematics, at many levels. (A few major changes are already in place: for example, one large western state has developed a new, integrated mathematics course called "Math A"; a large eastern state has implemented an integrated mathematics sequence for college-bound students; NSF supports development of many new models of curriculum in science and mathematics.) Despite the fact that the Title II/Eisenhower program has supported curriculum development, few of the projects it funds have been large enough to have a national impact. Smaller units of curriculum are more typically supported, such as units on botany in one state (as part of high school biology), or other materials to teach particular parts of a course. Sometimes, the Title II/Eisenhower program piggybacks onto

existing curriculum projects, such as when districts implement the Science Curriculum Improvement Study (SCIS) program (originally developed with NSF funds), or "Math Their Way," or "Voyage of the Mimi." This is usually a more appropriate role, given the purpose and structure of the program.

The relative weakness of the program in supporting large-scale curriculum development is an example of a broader principle--namely, that the Title II/Eisenhower program (not surprisingly) is unable to fill most functions for which it was not designed. Specifically, many other federal programs for science and mathematics education do a better job at what they are designed to do than Eisenhower, whether supporting research on teaching and learning or developing television programs for children. Programs whose scope is quite different and distinct must still be judged on their own merits; the Eisenhower program cannot be expected to carry out their missions as capably as the ones it was designed for.

The Special Case of NSF Programs Aimed at Professional Development and State Leadership

When multiple federal programs are targeted to the same area, the question often arises whether they duplicate or compete with one another. The question has been raised most directly with regard to the apparent similarities between the Eisenhower program and NSF programs aimed at professional development, in particular, the Foundation's Teacher Preparation and Teacher Enhancement programs (and, to some extent, the Networks program). In addition, NSF's recent venture into support for state leadership activities raises similar questions. By comparing these initiatives with the Title II/Eisenhower program, we arrive at the conclusion that the two agencies' initiatives serve largely different, though related, needs in the reform of mathematics and science education. On the whole, the two agencies' efforts have complementary strengths and functions.

Comparison with NSF's Programs for Professional Development--The FY 1989 budget for NSF's Teacher Preparation and Enhancement Division, which is shown in Table 75, includes about $10 million for the Networks program and for

presidential awards to outstanding science and mathematics teachers in each state; this section does not focus on those activities. The budget for the Teacher Enhancement program itself (which, like the higher education component of Title II/Eisenhower, provides awards to institutions of higher education for inservice teacher education projects) was approximately $45 million in that year. For the Teacher Preparation program (which supports institutions developing new models for preservice teacher-education programs), about $8 million was obligated in 1988-89.* At $53 million, these two programs together were substantially larger than the higher education component of Title II in 1988-89 (funded at under $30 million, after state administrative costs are deducted). At the same time, $53 million was about half the size of the Title II/Eisenhower program as a whole ($106 million in 1988-89), so whether these two NSF programs were larger or smaller than Title II in 1988-89 depends on one's perspective.

A number of comparisons were suggested earlier. For example, the higher education project directors find that it is much simpler to get Title II/Eisenhower grants than NSF grants, although less money is available. Because the average grant size is so much smaller under Eisenhower, far more grants are made each year than through Teacher Enhancement and Teacher Preparation (TPE) combined (about 750 Title II awards in 1989, compared with about 200 TPE grants). **Thus, a trade-off for the project directors is that they can more easily get supported under Eisenhower, but almost exclusively for small projects.** (Some project directors complained that the Title II grants were too small, constraining what they could do.)

Yet, given the smaller dollar size of the program, the Title II/Eisenhower projects serve remarkably large numbers of teachers (see Chapter VII, Table 62). Testimony by the director of NSF suggests that the Teacher Enhancement program serves 10,000 teachers annually.** The Title II/

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* These figures, as well as data about Teacher Preparation and Enhancement that follow, were provided by NSF.

** Testimony of Dr. Erich Bloch before a Subcommittee of the Committee on Appropriations, U.S. House of Representatives, March 1989.

Eisenhower higher education projects clearly serve more teachers than the Teacher Enhancement program at NSF; however, little information is available about the intensity of training of those projects, which may provide more contact hours per teacher. (Note that NSF's Teacher Preparation program aims at developing new models for preservice teacher education; it does not aim at individuals, per se.) The small size of Title II grants, the ease of obtaining them, and the lack of emphasis on demonstrations of national significance attract a different mix of prospective grantees than those applying for and receiving NSF grants. On average, compared to NSF grants, the Title II/Eisenhower program supports more individuals from smaller, regionally focused institutions, which typically place a high priority on service to surrounding schools and little or no emphasis on research.

Flow-through funds to districts under the Title II/Eisenhower program also support teachers who are enrolled in college and university courses. These data (shown in Table 38) further increase the number of teachers served by Title II/Eisenhower in experiences comparable to NSF's Teacher Enhancement projects.

This comparison of numbers of teachers served provides an easy explanation for the fact that many respondents perceive that the Title II/ Eisenhower program is having a deeper and broader impact in their particular geographic area than the NSF programs. Members of the study team heard this from staff in state agencies, districts, and intermediate units, and from higher education faculty.

The component of the Eisenhower program most comparable to the NSF TPE programs is the money for higher education projects. And, as far as individual teachers are concerned, those who have experience with both NSF-funded and Title II-funded higher education projects apparently find them quite similar. Teachers who were interviewed liked one or the other experience better, depending on particular circumstances. (Unfortunately, the data for making these comparisons are very limited. Not only did the sample include few teachers who could speak knowledgeably about both

experiences, but there are no published data for the NSF programs, such as average hours of training per teacher, that can be used to make comparisons with the particular kinds of experiences provided through Title II/Eisenhower projects.)

One significant difference is that the NSF Teacher Enhancement program is sponsoring more projects of national scope than the Eisenhower program. For example, NSF has supported a multiyear project by the American Association of Physics Teachers (AAPT) for Physics Teaching Resource Agents (PTRA). The PTRA program received more than $1 million from the NSF to educate and support a large group of expert physics teachers who, in turn, provide leadership, training, and support to other teachers nationwide. As many as 60,000 teachers have been part of workshops given by the PTRAs, according to a third-party evaluation (St. John, Bartlett, Daniels, Huntwork, & Smith, 1990). The national scope of this type of project is beyond what any single state agency is likely to fund under the Eisenhower program.

Another significant difference is that TPE projects are typically funded for several years at a time. (Typical grant sizes are in the $450,000 range, which covers three years of activity.) Thus, the initial heavier paperwork involved for TPE grants (compared with Eisenhower grants) is at least partly offset by the longer project periods and larger size of the TPE awards.

Preservice education is an area in which the Eisenhower program has not supported many projects. The NSF Teacher Preparation program invested more than $13 million in preservice projects in fiscal years 1988 and 1989 combined. A careful examination of the kinds of projects supported by NSF is beyond the scope of this study, but it appears that a more systematic, coordinated, and intensive approach to preservice education of science and mathematics teachers has been carried out by NSF than by states under the Title II/Eisenhower program. Data from NSF show a relatively even division of the Teacher Preparation funds across education levels (elementary, middle, and high school) during this time period. NSF has had a special initiative focusing on preparation of middle school teachers of science and mathematics, which may have yielded some valuable results.

One additional contrast between the higher education projects supported by TPE and by the Title II/Eisenhower program is that, because the latter are funded by state agencies, they are better known within each state and, in some cases, are more closely aligned with state priorities. It might be useful for state agency staff (notably state science and mathematics supervisors) to play a more active role in disseminating information about all types of externally funded projects for science and mathematics teachers within their state, be they Eisenhower higher education projects, NSF projects for teachers, or even private-foundation projects (such as those sponsored by the Woodrow Wilson and the Ford Foundations).

Comparison with NSF's State Leadership Initiative--The differences and complementarity of ED and NSF initiatives are nowhere more clearly seen than in the comparison between NSF's new initiative supporting selected states' efforts to achieve systemic reform of mathematics and science education.

The National Science Foundation has recently begun an initiative aimed at improving the capacity of the states to carry out coordinated reform of science and mathematics education. NSF's Science and Engineering Education Directorate (now the Directorate for Education and Human Resources) released its program solicitation for "Statewide Systemic Initiatives in Science, Mathematics, and Engineering Education" during the early part of 1990. The Foundation will set aside up to $80 million over a five-year period "to generate comprehensive statewide systemic initiatives designed to achieve significant improvements in science, mathematics, and engineering education." From four to eight states will be involved in the initial round of funding, which is scheduled for 1991. The commitment of the governor of each participating state is expected. The very fact that this initiative is being carried out seems to reflect the fact that states hold many of the keys to education reform--but have not yet discovered how best to use them. In those few states that will receive NSF support under this program, the level of funding available at the state level for improvement of science and mathematics education will undergo a quantum leap at least as significant as the one that occurred when Title II was implemented (and that made about $15

million per year available to SEAs for this purpose during the first four years).

On the face of it, this initiative appears to be doing exactly what the Eisenhower state set-asides do: supporting state leadership. Although this is true, NSF's more specific goal is to showcase a coordinated reform effort in a small number of states. The substantial investment in these states is justified because it is well known that certain states act as "lighthouses" for others and will be imitated by others, once they have shown the way. At the same time, all states need the wherewithal to move forward with subject-related reforms, before, during, and after the demonstration funded by NSF. The Eisenhower program provides that kind of ongoing support, and does so in a manner that NSF would be unlikely to do. The fact that funds go to every state, and go to them every year, ensures that a relatively stable resource exists across the nation for the exercise of state-level leadership. To be sure, leadership is not equally strong in all states, but in using Eisenhower funds, all state agencies gain the capacity to exert a positive force for the improvement of mathematics and science education.

XII CONCLUSION: THE PROGRAM AS AN ENABLING RESOURCE FOR REFORMING MATHEMATICS AND SCIENCE EDUCATION

The previous chapters in this part of the report have attempted to put the Title II/Eisenhower program in perspective--first, by describing what the program contributes to reforming curriculum, teaching, and professional development in mathematics and science education, and second, by examining the program's relationship to other state and federal initiatives aimed at these subject areas. This chapter draws overall conclusions about the program and discusses implications for its future.

What Has Been Learned About the Title II/Eisenhower Program

The conclusions presented here reflect an overarching theme that connects and summarizes the study's findings: the Title II/Eisenhower program provides a central "enabling resource" for reform. In other words, the program (1) supports opportunities for reform ideas to be spread widely among teachers, school districts, higher education institutions, and state agencies, and (2) offers the wherewithal for educators to take the first steps toward implementing these ideas. This conclusion rests on three subthemes that run through the findings in all the chapters in the report.

First, **the program derives much of its power and usefulness from the context of reform that surrounds it.** Title II came into being at a time of intense activity aimed at reforming not only mathematics and science education, but also many other aspects of the educational system. Across the lifetime of the program, reform activity has intensified in various arenas--among them, teaching and learning in particular subject areas, the professionalization of teachers, and the restructuring of schooling. These activities have been carried forward both by nationwide movements and by initiatives originating within states, which have increasingly become the

center of gravity for educational change efforts. The program by itself does not provide direction for most of these reform efforts, but it does provide a key resource for carrying out the reform process.

Compared with other state and federal initiatives, the program performs several functions especially well. In particular, the program expands the pool of teachers who are aware of, and informed about, reform ideas; it empowers science and mathematics subject-area leaders at state and local levels; and it strengthens the connections among diverse actors in the reform arena. By itself, the program cannot solve all the fundamental problems plaguing science and mathematics education, but, in conjunction with other resources, the program is having a significant impact on several pieces of the problem as they relate to professional development opportunities for teachers now in service.

The program provides resources that are necessary, but not sufficient, for sustaining widespread change in mathematics and science education practice. What the program offers to district staff, state agency officials, or higher education project directors is small relative to improvement needs or to other major federal and state initiatives, but large in light of what was invested in professional development for mathematics and science teachers before the program, or would likely be put to this purpose without the program. The size of the program's impact is a function not only of the absolute amount of dollars invested but also of how little was being done before, combined with the increasing national, state, and local leadership efforts in science and mathematics education that are being mobilized by the program.

Each of these themes is developed and illustrated in the discussion that follows, both as a summary of what has been learned and as a prelude to examining implications for the program's future.

Reform Context as a Source of Direction for the Program

The program is not usually the motivating force or source of direction for activities that the program supports. As an enabling resource, the program helps those with a vision of better education to make that vision a reality, but it does not put the vision in place to begin with. As noted in earlier chapters:

- Districts with an already developed agenda for improving the target subject areas tend to make excellent use of the program's funds; others show less sign of effectively using these resources.
- Some states have used the program to great advantage as a tool for furthering state reforms aimed at mathematics and science education. Others exert varying degrees of leadership in these subject areas, and use Title II/Eisenhower funds accordingly.
- Teachers attending professional association meetings have been exposed to reform ideas because these meetings have been a central forum during the last half decade for sharing recent thinking about the reform of mathematics and science education.

Thus, to understand what the program has accomplished and can accomplish, one must first look at the surrounding context of local, state, and federal reform activity that generates the direction for the use of the funds. These activities have been both extensive and varied during the years that the Title II/Eisenhower program has been in existence. The timing of the program's inception, soon after the wave of reform activity began, made it especially likely for these funds to play a useful role.

To take a case in point: the nationwide movement to promote the use of the Curriculum and Evaluation Standards of the National Council of Teachers of Mathematics (NCTM) has provided the direction for much of the program-supported professional development in mathematics education. For example, the program has helped thousands of mathematics teachers become familiar with the standards through attendance at professional meetings. Title II/Eisenhower funds have supported state agency efforts to expose teachers to the standards. Program grants to IHEs and local flow-through dollars to LEAs have supported workshops that have introduced teachers to curriculum and instructional approaches consistent with the standards. The program had

little to do with the creation of the standards; rather, the existence of the document and the momentum behind it created the opportunity for Title II/ Eisenhower funds to play a useful role.

The Program's Unique Contributions to the Educational System

Because many groups such as the NCTM, the National Science Teachers Association, and the American Association for the Advancement of Science have articulated a clear vision of excellent science and mathematics teaching, the program's biggest contribution is to help move the state of practice toward this vision. The program makes this contribution in three ways: by expanding the base of informed teachers, by empowering subject-area leaders (especially at the state and district levels), and by connecting different sectors of the education system to work together on improving K-12 mathematics and science education. Because of the way the program is designed, it does these things more effectively than other local, state, or federal initiatives. Each of the three types of contribution is discussed in turn.

Expanding the Base of Informed Teachers--It is one thing to issue a call for improvement or reform, and quite another to carry the message to more than 100,000 schools (to say nothing of implementing it at the school level).

One of the least visible, yet essential, parts of implementing educational reforms on a mass scale is the task of attracting the attention of, and energizing, the "consumers" for reform rather than the producers--that is, classroom teachers who do not keep up with professional trends, school leaders who are busy with other problems, or district-level curriculum planners who may be charged with setting curriculum or district guidelines in a dozen different subjects. In short, something must be done to cultivate the "market" for reform, or else the exhortations of reform commissions and the mandates of state legislatures will fall on deaf ears. Worse still, the messages for changing things may never even reach the intended audiences.

Although cultivating the market for reform is not especially glamorous, nor all that visible, there is abundant evidence that Title II/Eisenhower funds are playing a key role in building awareness of, and demand for, reform ideas. For example, the program:

- Supports the attendance of large numbers of teachers at national, state, and regional professional meetings, many of them for the first time.
- Has directly or indirectly supported and strengthened the professional associations themselves, especially at the state level.
- Supports wide dissemination and popularization of certain reform ideas--for example, the idea that representing mathematical ideas through various manipulatives in elementary classrooms boosts understanding.

It often takes relatively little in the way of professional development funding to perform this function, and yet without the program these kinds of resources often are not available to teachers or administrators.

Empowering Subject-Area Leaders--Especially at the state level, but also in LEAs and institutions of higher education, the program is indisputably providing a key discretionary resource to individuals with ideas for addressing mathematics and science education needs. Along with other resources garnered by these leaders, the funds are helping to expand what the leaders are able to do and extend their outreach to other parts of the system under their purview. The important thing is that these individuals are generally those with curriculum-specific expertise, something that has been in short supply in LEAs (and underfunded in many SEAs) over the past decade. The effect shows up as follows:

- Empowering state leaders. Science and mathematics curriculum supervisors in state education agencies have had much more to work with under Title II and (to a lesser extent) under the Eisenhower program than before. This has allowed them to support demonstration and exemplary activities, a range of technical assistance activities, an expanded regional support capability, and in some states ambitious networks of individuals providing professional development to mathematics and science teachers.

- Supporting district leaders. In many LEAs, individuals overseeing science and mathematics education have found that their staff development resources for these subject areas grew substantially in the five years of the program. Furthermore, the program has supported the training of specialists who provide school-level curricular expertise that is often missing (notably at the elementary level).

- Activating leadership in institutions of higher education. Program funds have clearly helped to bring new players into the arena, more often than not from disciplinary backgrounds. Furthermore, grants to institutions of higher education are often supporting the development of "lead" or master teachers in science and mathematics. Although the extent of the subject-area leadership exercised by these individuals when they return to their schools varies, many do carry out this role and credit their experiences in IHE-based workshops as an important part of their preparation.

As noted earlier in this chapter, the degree and direction of leadership supported by the program rests on the vision and energy of the individuals who gain control of the funds. The program has no magic for attracting the most qualified, nor can it engender leadership where a vacuum exists. Thus, its contributions to leadership are uneven. On the whole, however, subject-area leaders have benefited greatly.

Strengthening the "Connective Tissue" in the Reform Movement--The program performs an essential function of connecting diverse actors with one another. The program has increased connections between:

- Individual teachers and sources of professional support. Not only through attendance at professional meetings, as noted above, but through a variety of workshop experiences funded by the Title II/ Eisenhower program, teachers are encouraged or enabled, and in some instances required, to make contact with external groups that could provide them with ideas, advice, resources, and encouragement in their mathematics or science teaching. Examples include intermediate unit staff, professional association representatives, faculty from a nearby (or sometimes distant) university, and peers from neighboring districts or other schools within their own district.

- Individual IHE faculty and LEAs. Faculty in institutions of higher education can easily become isolated from schools and classrooms, especially those who teach in disciplinary departments rather than among the education faculty of a university or other institution. The program has involved a number of such individuals and brought to them both greater awareness of the problems of teachers in schools and increased engagement with efforts to solve these problems.

- Small LEAs and institutions that can help them with professional development needs. Paradoxically, many of the school districts that have received the least (in absolute terms) from the program--those with enrollments less than 2,500--may have benefited more than larger LEAs in the sense that the funds have brought them into connection with institutions, typically regional IUs or nearby IHEs, from which they otherwise would receive little help on matters related to science and mathematics education.

- State agencies of higher education and those responsible for elementary and secondary education. State agencies responsible for higher education have become active players in the effort to improve mathematics and science education and have generally increased their communication with SEAs on this score. The Title II/Eisenhower program has directly stimulated this relationship in most states.

One may well ask: why aren't these connections made anyway? To some extent, motivated educators have made the connections without help from program-sponsored activities. In such cases, the Title II/Eisenhower program provides a further occasion for continuing and strengthening an existing relationship. Elsewhere, where the connections had not yet been made, the presence of program funds or the program-funded activities themselves often became the impetus for different kinds of actors to get together in ways they would not otherwise have been able to do. The strengthening of subject-matter expertise in many intermediate units (such as education service centers) is a good example; the Title II/Eisenhower program has made it much more common for small districts to turn to IUs for assistance in science and mathematics.

Program Resources as Necessary But Not Sufficient Conditions for Widespread Change

The unique contributions of the Title II/Eisenhower program to the educational system derive from the essential features of the program, described in the introduction to this report: its balance of focus and discretion, its emphasis on breadth of coverage, and its multi-component strategy for stimulating professional development opportunities.

Because Title II/Eisenhower funds are flexible and at the same time targeted to a particular segment of the curriculum, they provide local and

state educators with a key discretionary resource that must be used to address the needs they perceive to be important in mathematics and science education. In the hands of capable leaders (and there are many across the country), these resources are quickly applied to some aspect of the national agenda for reforming mathematics and science education. The funds are thus available to be applied to reform goals, and in many instances they are the only funds that can be easily put to these purposes.

The broad coverage of the program means that large numbers of teachers are reached in some way, most of them through low-intensity experiences in inservice workshops and conferences. Participants in these activities come from the great majority of school districts across the nation. Especially where state or local leadership is attuned to key reform ideas, the program resources help to expose teachers to new ways of approaching their teaching tasks. This exposure brings about the awareness building and rejuvenation described earlier in the report.

The multi-component structure of the program--including different sectors (elementary/secondary, higher education) and levels (state, local)--is largely responsible for the program's success in strengthening the "connective tissue" of the reform movement. In doing so, the three components of the program--states, school districts, and institutions of higher education--largely complement and reinforce one another. Their program-supported activities perform different but related functions, and there is little evidence that the program components duplicate or compete with one another.

Often, the program components work in tandem. For example, the surveys show that more than one-fourth of the higher education projects receive some funds from school districts. Study data indicate that these are often local (flow-through) Eisenhower dollars, and thus the district and the higher education agendas supported by these program dollars are closely aligned. There are other examples of alignment of the components, too, such as the frequent use of state Demonstration and Exemplary funds to educate key leaders in the state about priorities that are subsequently supported, as

well, by program funds at the district level--priorities such as more use of manipulatives in elementary mathematics, or a new state science curriculum framework. In fact, as Chapter XI has already suggested, the study's data show that the program is promoting a kind of "vertical integration" of various components of the education system. This integration is very healthy and important if reform is to be effective on a large scale.

All three of these conditions--focused yet flexible use of resources for professional development, broad coverage of large numbers of the nation's teachers, and increased interaction among groups interested in improvement--must occur if reform is to happen, and the program should be credited with helping to put these conditions in place. At the same time, other things beyond the reach of the program must happen if a critical mass of teachers are to make deep and lasting changes in their approach to mathematics and science teaching.

For one thing, something must be done about the many other aspects of the nation's problems in science and mathematics education that the program rarely or never touches, such as the availability of adequate facilities, equipment, or materials; the salary levels of mathematics and science teachers, relative to positions they might fill in the private sector or elsewhere; the requirements for teacher certification; and the restructuring of schools, school programs, and districts to enable teachers to do their best as professionals. These and other matters are equally important to the ultimate improvement of mathematics and science education. When not attended to, they act as barriers or constraints on the quality and impact of teaching in these subject areas, and hence they limit what professional development can accomplish.

Other resources also must be joined with those provided by Title II/ Eisenhower to fully support the professional development activities that are the target of the program. Program funds are spread widely but thinly; they aren't sufficient to maintain an extensive professional development program for a large proportion of a district's mathematics and science teachers across a year. Especially in LEAs or grant-funded projects that have

ambitious plans for improving mathematics and science teaching, educators must search out other resources to realize their goals. Thus, the Title II/ Eisenhower funds are typically combined with other sources of funding--local, state, private, and federal--to make professional development or other activities happen. But because they are flexible, the funds are easy to use in a variety of combinations.

The Net Effect on Professional Development Opportunities

The net effect of the program, in the current context of reform activities, is to stimulate and promote a broad array of professional development opportunities for mathematics and science teachers that would be unlikely to have been there without the program.

Taken together, these opportunities fulfill many of the requirements for sound professional development, as outlined in Chapter X. Across the majority of the activities supported by the program, large numbers of teachers are becoming aware of new developments in their respective fields, are gaining exposure to appropriate pedagogy, and are making contact with other teachers struggling with the same issues. What is more, in a smaller proportion of cases (fewer than half of all districts, although a majority of higher education projects), Title II/Eisenhower-supported activities are designed with sufficient intensity, follow-up, and school support to make transfer to practice likely.

Professional development of this sort is essential to the widespread adoption of reform ideas, but neither the quantity nor the quality of what the program supports can do the whole job. In quantitative terms, the program reaches large numbers of teachers annually, but not for long enough (in most cases) to make profound changes in what they are doing, at least not in the short term. In qualitative terms, the program supports a variety of training experiences that reflect a wide range of expertise and vision among local educators who design and implement professional development. Thus, the requirements for sound professional development are not consistently met in all districts or higher education projects funded by the Title II/Eisenhower

program. Program-supported activities are not typically focused on deeper learning of content, for example. Especially in districts with unfocused improvement agendas, workshops supported by program funds are often short, one-time experiences that bear little relationship to long-term improvement goals. The flexible, decentralized nature of the program permits such an outcome, alongside the higher-quality professional development found in other settings.

The Program and Its Future

The National Study began at the time Title II had just been reauthorized as the Eisenhower program. Now, the results are becoming available a year or two before new reauthorization questions are likely to be raised at the federal level. The study's findings have important implications for reauthorization, or for other changes in the program's operation.

Summarizing across all the findings and analyses presented in the report, the study team has arrived at three broad conclusions:

(1) The three-part strategy that is central to the Eisenhower program (investing in activities by states, districts, and institutions of higher education) is an important source of the program's strength, and should be continued.

(2) Careful consideration should be given to allocating the program's resources somewhat differently among the components.

(3) A variety of additional leadership activities at the federal, state, and local levels would help to improve the program.

Each of these ideas is further elaborated below.

Maintain the Three-Component Strategy

The components of the program serve somewhat different but complementary functions. The district funds are the most likely to be closely aligned with an overall local strategy for education improvement (such as the adoption of a new curriculum). The higher education projects support substantially

longer, more intensive projects that are badly needed if teachers are to change classroom practices significantly in the ways that many groups believe is needed. State leadership activities help translate the growing number and variety of state mandates (that tell schools and districts what they "should" do) into actions that have a reasonable chance of success.

All three kinds of investments in time and energy are necessary to support change in classroom practices. The three-component strategy provides support for a wide range of activities, based in various institutions.

Change the Balance of Funding to the Three Components

Although it makes good sense to divide the Eisenhower funds among the three components, the balance of funding among the three is not optimal. In fact, the changes made during the recent reauthorization run nearly counter to the directions suggested by the study's data.

The Eisenhower version of the program greatly increased the percentage of funding (and the amounts) that have gone to LEAs as flow-through funds, slightly reduced the percentage available to IHEs through grants (although the actual amount remained nearly the same because of an overall funding increase from 1988-89 to 1989-90), and substantially reduced the amounts and percentage of funding for state agencies of elementary and secondary education (SEAs). (The changes can be seen in Table 76, showing the funding by component for each year of the program.)

These changes may have been supported by attractive rhetoric (e.g., keep the funds closest to the child) and were certainly politically palatable (providing more funds for 15,000 districts as opposed to 50 state agencies or 3,000 institutions of higher education). But the net effect is to short-change the parts of the program providing the greatest subject-area leadership and most intensive experiences for teachers, while increasing funds for the most diffuse parts of the program. More specifically:

Table 76

THE AMOUNT OF TITLE II/EISENHOWER FUNDS ALLOCATED TO PROGRAM COMPONENTS OVER TIME

Program Year	Amounts of Funding Received by State Agencies[a] (thousands of dollars) State Demonstration Grants, etc.[d]	Flow-Through to LEAs	Higher Education Grants, etc.	Total
Under original version of the law				
Year 1 (1985-86)	18,361	42,844	26,231	87,436
Year 2 (1986-87)	7,985	18,632	11,407	38,024
Year 3 (1987-88)	14,836	34,618	21,195	70,649
Year 4 (1988-89)	22,195	51,789	31,707	105,691
Under reauthorized version of the law[b]				
Year 5 (1989-90)	9,530	85,770	31,766	127,066
Year 6 (1990-91)[c]	9,411	84,700	31,370	125,481
Year 7 (1991-92)[c]	14,991	134,914	49,968	199,874

[a]Table based on all 50 states and District of Columbia.

[b]The Hawkins-Stafford Educational Amendments of 1988 reauthorized Title II of EESA as the Dwight D. Eisenhower Mathematics and Science Education Improvement Act.

[c]Estimate based on federal budget information available as of January 8, 1991.

[d]This column includes funds used for state administration and technical assistance.

Source: Federal budget documents, using legislated percentages to generate each column's figures.

- The component of the program (LEA flow-through funding) offering the lowest-intensity training and the widest variety in quality of offerings now receives the lion's share of the resources--nearly two-thirds of all Eisenhower program funds. The district funds are very important--but the return on investment appears to be more mixed than in the other components of the program.

- The component of the program (state agency set-asides) with the greatest potential to assist states in providing subject-specific leadership was greatly curtailed. What is more, the agency with the greatest curricular expertise and knowledge of elementary and secondary systems--the SEA--took the greatest cut. In light of what has been learned about many SEAs' activities during the first four years of the program, the logic of this change seems flawed.

- Finally, the component (higher education projects) that, on average, provides the longest, most intensive experiences for teachers received a slight decrease in funding under the reauthorization.

The thrust of the analysis points to reversing the priorities or, at the least, altering them in subsequent allocation formulas so that a better balance is struck between leadership (especially state leadership), intensive training (mostly through IHE projects), and generally nonintensive discretionary resources put at the disposal of LEAs. The study data do not point to any precise formula; a variety of allocation percentages would achieve the desired result, but capping the LEAs' share at roughly 50% of the overall amount of funds and splitting the remainder at 30% for IHE grants and 20% for state-initiated leadership activities represents one possible change.

Strengthen Leadership Activities at the Federal, State, and Local Levels

As currently authorized, the program is relatively simple to administer, and requirements are not considered burdensome. This simplicity in the law was motivated in part by a desire to encourage state and local flexibility in the use of program funds. The National Study confirms that this effect has been achieved, and that it is a strength of the program. Additional leadership and direction need not involve extensive regulation or requirements under law; much can be done by exhortation and by dissemination of information and suggestions.

One change in the law that the study team would recommend, however, is to permit a wider range of nonprofit institutions (e.g., museums, professional associations) to compete directly for grants under the "higher education" component of the program. Because many of these institutions are increasingly expert in matters of teacher training, it seems unnecessary to exclude them as potential grant recipients.

Additional recommendations for leadership activities are shown in Table 77. The rationale behind strengthening leadership activities has been suggested numerous times in this report: while the Title II/Eisenhower statutes include various provisions that serve to focus funds on areas of greatest need, no statute alone can substitute for good judgment exercised by program administrators at every level--federal, state, and local. The active movement to reform science and mathematics education is resulting in an increase in leadership capacity in many agencies and institutions, but clearly there is still a need for more focused, active leadership activity. Several of the recommendations in Table 77 are discussed in the paragraphs below, to illustrate the types of activities that the study team believes would be most useful, based on findings from the National Study.

A number of federal agencies, notably including ED and NSF, support dozens and dozens of inservice teacher education projects in science and mathematics each year (besides those that are the subject of this report). By and large there has been no coordinated federal effort to inform state science and mathematics supervisors (or other state officials) what activities are taking place, or will take place, within their state. This means that it is much more difficult for the states to (a) disseminate information to teachers about planned activities within the state, (b) help coordinate efforts across agencies, or (c) develop statewide plans for future teacher inservice activities.

Disseminating information to state officials is no panacea guaranteeing better planning, but if the federal government does not provide such information--which may cover millions of dollars of training annually in large states--it is difficult to see how states can be expected to develop

Table 77

RECOMMENDATIONS FOR LEADERSHIP ACTIVITIES
TO IMPROVE THE EISENHOWER PROGRAM

FEDERAL

1. ED should continue to support such leadership activities as national conferences of state coordinators, a national steering committee for the program, and publication of exemplary projects.

2. ED should clarify its nonregulatory guidance so all states understand what they can do--e.g., whether materials, supplies, and equipment can be purchased as part of teacher training. (Note that the study found that "greater regulatory clarity" was desired by many SEAs and SAHEs.)

3. ED should encourage states to ask or require that LEAs focus more of their funds on longer-duration training.

4. ED should encourage state agencies to use some of their funds to provide leadership activities for preservice education. Even if only a few low-cost activities are supported (such as state conferences for IHEs engaged in preservice education), such efforts can be important.

5. ED should continue to work on and improve guidelines for collecting uniform data from states and localities about activities supported by the program--but should focus on a relatively small core of basic data.

6. Federal agencies (including ED and NSF) should strengthen efforts to disseminate information about teacher education (both preservice and inservice) in science and mathematics to such key state leaders as science and mathematics supervisors.

7. ED should compile and disseminate descriptions of exemplary uses of Eisenhower flow-through funds that address the needs of groups historically underrepresented in mathematics and science programs.

STATE

1. SEAs should encourage LEAs to target funds more than in the past (i.e., to spend more dollars per teacher who participates), even at the cost of serving fewer teachers.

2. SAHEs should consider targeting at least a portion of higher education funds through their grant announcement (as some states now do). Focusing on underrepresented groups, or on particular grades or subjects, is a significant way to implement state priorities.

(Continued)

Table 77 (Continued)

3. SEAs, in cooperation with SAHEs, should play a stronger role in annually disseminating information to LEAs (and ultimately to teachers) about a wide variety of teacher training opportunities available in the state, notably during the summer. Agencies could also use this information (gathered from NSF, private foundations, and other sources) to help develop long-term state plans for staff development in science and mathematics.

4. State agencies should consider using a portion of the program funds to support leadership activities (such as state conferences) to improve preservice teacher education in mathematics and science.

LOCAL

1. LEAs should focus at least some program funds each year on "high-intensity" training (e.g., graduate credit courses, inservice training lasting five days or more) and accept the implication that fewer teachers will be served.

2. LEAs should aim to have a "strong agenda" for improving science and mathematics. This means being clear about priorities and developing a multi-year plan to implement them. (There are difficult problems to confront in this process, such as what to do about underqualified teachers who are reluctant to volunteer for professional development activities.)

3. LEAs should play an active role in distributing information to teachers each year about the availability of summer workshops and other training opportunities. Teachers sometimes complain of announcements being "lost" at the district or the building level.

comprehensive plans for inservice teacher training. As just one example, it might make far more sense for districts (or even individual schools) to receive one or two mailings each year describing opportunities for science and mathematics inservice workshops in the state (whether sponsored by NASA, Energy, ED, NSF, or the state itself), instead of having individual teachers piece together information from numerous, sometimes obscure sources. Currently, it would be difficult for state officials to compile the information needed to develop such mailings.

Turning to another recommendation, earlier chapters of this report have highlighted the fact that preservice teacher education receives only a small amount of attention under the Title II/Eisenhower program. One rationale for this situation is that there is too little money available under the program for inservice education, let alone trying to address the problems of preservice education, as well. Although this rationale makes some sense, leadership activities aimed at preservice teacher education need not consume a large share of the program's budget, and could be very useful in communicating state priorities or coordinating state efforts. A high degree of collaboration (both in planning and in budgeting) might be necessary for the SEA and the SAHE within a state to jointly sponsor conferences or other types of leadership activity aimed at preservice teacher education, but nonetheless such efforts are badly needed (see, for example, Goodlad, 1990). It seems worthwhile for a growing number of states to experiment with using Eisenhower funds as one source for addressing teacher education issues within the state.

As another example of leadership that would strengthen the program, Table 77 includes the suggestions that LEAs focus at least some program funds each year on high-intensity training (e.g., graduate credit courses or inservice courses lasting five days or longer). For many LEAs, this would represent a change from practices in 1988-89, when, for example, fewer than half of medium-sized districts provided inservice activities lasting more than six hours. (See Chapter IV for details.) Such a change requires leadership, because there is a natural tendency to spread the small amount of available funds to the largest number of teachers possible, and because concentrating the funds assumes that a thoughtful, focused agenda has been

adopted by the LEA, based on the needs assessment and other considerations. The fact that the 1991-92 appropriation for LEA flow-through funds is more than two-and-one-half times as large as the 1988-89 appropriation means that LEAs will find it much easier to fund at least some high-intensity training.

A final example of leadership that is needed relates to district uses of Eisenhower funds aimed at meeting the needs of groups historically underrepresented in mathematics and science education programs. The study did not find extensive knowledge at the LEA level of specific teacher-training activities that would help meet the needs of minorities, females, the handicapped and other groups underrepresented in mathematics in science. It would be useful for ED to compile descriptions of exemplary programs of this type, specifically supported by Eisenhower funds, and disseminate these widely.

What Should Not or Cannot Be Changed

It is tempting to seek changes that will tighten the requirements of the program. Some new requirements may be needed, but on the whole the study found the current structure of the program to be working effectively. Furthermore, some types of requirements--such as the three highlighted below--can be counterproductive.

Do Not Strengthen the Evaluation Requirements Under the Program--The study affirms a widespread impression that evaluation under Title II/ Eisenhower is generally weak, and descriptive reporting is inconsistent (or simply missing) across states and localities. It is tempting to put stricter evaluation requirements into the law--for example, requirements that LEAs submit better annual evaluation data to state agencies. Evidence from the study suggests that this would be an exercise in futility. Other than having workshop participants systematically filling out end-of-session forms, which tell relatively little about many important impacts of the program, there is no convenient or widely understood way of assessing the enormously varied range of activities supported, nor of getting at the subtle and complex effects of professional development on classroom and student outcomes, not to mention the various forms of institutional impact. Users of the funds tend

to view evaluation and reporting as a necessary (to the extent it is required) but counterproductive use of their time. Given the complexity of the evaluation tasks, combined with the small scale of the activities that are typically supported, more elaborate and formal evaluation seems unjustified and is likely to produce little of value to state agencies or to the federal government.

Do Not Broaden the Range of Targeted Subject Areas Beyond Mathematics and Science--In the earlier version of the Title II program, foreign languages and computer education were also included, although relatively few of the program's resources went to these subject areas. It is always a possibility that the program will become a more broadly focused staff development initiative (in fact, this proposal was among the Department of Education's recommendations several years ago). However, the study findings suggest that one of the most powerful features of the current program structure is the fact that it targets resources exclusively on mathematics and science education. By retaining this focus, the program guarantees that these subject areas receive attention, and that they are not treated in a trade-off relationship with all other areas of the curriculum in competition for staff development resources. Given the importance attached to these subject areas in current thinking across the nation, that targeting seems important to maintain.

Do Not Impose More Elaborate Planning Requirements--Perhaps most tempting of all, federal and state education agencies might insist on more detailed planning for the use of the funds than is currently the case, especially for LEAs. After all, the evidence is plain that many districts do not have focused improvement plans in place, and as a consequence, are less able to put Eisenhower funds to good use. The study's findings give little hope that more stringent planning requirements would change districts' behavior much. Even with recent increases in funding, the Eisenhower program is perceived as too small to warrant an elaborate planning process in its own right. The districts with focused improvement agendas have generally developed their plans with a larger frame of reference in mind than the use of Eisenhower funds per se. The best hope for encouraging more districts to

do the same is to maximize the spread of reform ideas through the variety of leadership activities described above. Imposing elaborate planning requirements governing a small amount of money that partially funds improvement activities will most likely lead local administrators to resist or ignore them, or to comply in a pro forma manner.

The Fundamental Trade-off in the Design of the Program

In the final analysis, the federal government should recognize the trade-off between top-down control of the program and initiative from below. The Title II/Eisenhower program appears to have struck a good balance between the two. As a consequence, the federal government should accept the mixed quality of LEA-sponsored professional development and the generally low intensity of training that characterizes much of what is supported by the program. But these facts are more than offset by the benefits of wide-scale awareness building, teacher rejuvenation, increased subject-area leadership, and the strengthening of connections among those who wish to improve mathematics and science education. Over time, these changes will provide the basis for new visions of mathematics and science education to be integrated into practice on a large scale.

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Appendix A

TITLE II/EISENHOWER LEGISLATION

for Science and Engineering Education. For fiscal year 1986, funds to carry out this title shall be available from amounts authorized by section 102(a)(8) of the National Science Foundation Authorization Act for fiscal year 1986.

(20 U.S.C. 3920) Enacted Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

PROHIBITION AGAINST THE FEDERAL CONTROL OF EDUCATION

SEC. 111. The provisions of section 432 of the General Education Provisions Act, relating to prohibition against Federal control of education, shall apply to each program and award authorized by this title.

(20 U.S.C. 3921) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1269; reenacted Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

PARTICIPATION OF TEACHERS FROM PRIVATE SCHOOLS

SEC. 112. The Foundation shall, after consultation with appropriate private school representatives, make provision for the benefit of teachers in private elementary and secondary schools in the programs authorized by this title, in order to assure equitable participation of such teachers.

(20 U.S.C. 3922) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1269; reenacted Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

TITLE II—EDUCATION FOR ECONOMIC SECURITY

STATEMENT OF PURPOSE

SEC. 201. It is the purpose of this title to make financial assistance available to State and local educational agencies, and to institutions of higher education, to improve the skills of teachers and instruction in mathematics, science, computer learning, and foreign languages, and to increase the access of all students to such instruction, and thereby contribute to strengthening the economic security of the United States.

(20 U.S.C. 3961) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1273.

DEFINITION

SEC. 202. As used in this title, the term "junior or community college" means an institution of higher education—

(1) that admits as regular students individuals who are beyond the age of compulsory school attendance in the State in which the institution is located and who have the ability to benefit from the training offered by the institution;

(2) that does not provide an educational program for which it awards a bachelor's degree (or an equivalent degree); and

(3) that—

(A) provides an educational program of not less than two years that is acceptable for full credit toward such a degree, or

(B) offers a two-year program designed to prepare a student to work as a technician or at the semiprofessional level in engineering, scientific, or other technological fields

requiring the understanding and application of basic engineering, scientific, or mathematical principles of knowledge.

(20 U.S.C. 3962) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1274.

PROGRAM AUTHORIZED

SEC. 203. (a) The Secretary is authorized to make grants to States and to make discretionary grants, in accordance with the provisions of this title, for strengthening the skills of teachers and instruction in mathematics, science, computer learning, and foreign languages.

(b) There are authorized to be appropriated $350,000,000 for the fiscal year 1984, $400,000,000 for the fiscal year 1985, and $350,000,000 for each of the fiscal years 1986, 1987, and 1988 to carry out the provisions of this title.

(20 U.S.C. 3963) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1274; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

ALLOTMENT TO STATES

SEC. 204. (a)(1) From 90 per centum of the amount appropriated to carry out this title for each fiscal year, the Secretary shall allot to each State an amount which bears the same ratio to such 90 per centum as the number of children aged five to seventeen, inclusive, in the State bears to the number of such children in all States, except that no State shall receive less than one-half of 1 per centum of the amount available under this subsection in any fiscal year.

(2)(A) The Secretary shall reserve 9 per centum of such amount to carry out section 212, relating to discretionary grants of national significance.

(B) The Secretary shall reserve the remaining 1 per centum to carry out the provisions of subsection (c).

(3) For the purpose of this subsection, the term "State" does not include Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, or the Trust Territory of the Pacific Islands.

(4) The number of children aged five to seventeen, inclusive, in the State and in all States shall be determined by the Secretary on the basis of the most recent satisfactory data available to him.

(b) The amount of any State's allotment under subsection (a) for any fiscal year to carry out this title which the Secretary determines will not be required for that fiscal year to carry out this title shall be available for reallotment from time to time, on such dates during that year as the Secretary may fix, to other States in proportion to the original allotments to those States under subsection (a) for that year but with such proportionate amount for any of those other States being reduced to the extent it exceeds the sum the Secretary estimates that State needs and will be able to use for that year; and the total of those reductions shall be similarly reallotted among the States whose proportionate amounts were not so reduced. Any amounts reallotted to a State under this subsection during a year shall be deemed a part of its allotment under subsection (a) for that year.

(c)(1) From the amount reserved for each fiscal year under subsection (a)(2)(B), the Secretary shall allot—

(A) not less than one-half of that amount to whatever agency the Secretary determines appropriate for programs authorized by this title for children in elementary and secondary schools operated for Indian children by the Department of the Interior; and

(B) the remainder of that amount among Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, and the Trust Territory of the Pacific Islands according to their respective needs for assistance under this title.

(2) The Secretary shall make payments under paragraph (1)(A) on whatever terms the Secretary determines will best carry out the purpose of this title.

(20 U.S.C. 3964) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1274; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

IN-STATE APPORTIONMENT

SEC. 205. (a) For each of the fiscal years 1984, 1985, 1986, 1987, and 1988; 70 per centum of each State's allotment under section 204 of this title shall be used for elementary and secondary education programs in accordance with section 206.

(b) For each of the fiscal years 1984, 1985, 1986, 1987, and 1988; 30 per centum of each State's allotment under section 204 of this title shall be used for higher education programs in accordance with section 207.

(20 U.S.C. 3965) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1275; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 897.

ELEMENTARY AND SECONDARY EDUCATION PROGRAMS

SEC. 206. (a) The amount apportioned under section 205(a) from each State's allotment under this title shall be used by the State educational agency to strengthen elementary and secondary education programs in accordance with the provisions of this section.

(b)(1) Not less than 70 per centum of the amount available under this section shall be distributed to local educational agencies within the State. Each local educational agency shall use funds distributed under this paragraph for—

(A) the expansion and improvement of training, inservice training, and retraining of teachers and other appropriate school personnel in the fields of mathematics and science, including vocational education teachers who use mathematics and science in the courses of study the teachers teach; or

(B) if the local educational agency determines that the agency has met its need for training, inservice training, and retraining under subparagraph (A), subject to the provisions of section 210(c), such training, inservice training, and retraining in the fields of computer learning and foreign languages, and the acquisition of instructional materials and equipment related to mathematics and science instruction.

Such training and instruction may be carried out through agreements with public agencies, private industry, institutions of higher education, and nonprofit organizations, including museums, libraries, educational television stations, professional science, mathematics and engineering associations, and other appropriate institutions. A local educational agency may carry out the activities authorized by this paragraph with one or more other local educational agencies within the State, or with the State educational agency, or both. Each local educational agency shall assure that programs of training, inservice training and retraining will take into account the need for greater access to and participation in mathematics, science, and computer learning programs and careers of students from historically underrepresented groups, including females, minorities, individuals with limited-English proficiency, the handicapped, and migrants.

(2)(A) The State educational agency shall distribute 50 per centum of the funds available under this subsection to local educational agencies according to the relative enrollments in public and private nonprofit schools within the school district of such agencies. Such relative enrollments may be calculated, at the option of the State educational agency, on the basis of the total number of children enrolled in public schools and (i) private nonprofit schools, or (ii) private nonprofit schools desiring that their children and teachers participate in programs or projects assisted under this title. Nothing in the preceding sentence shall diminish the responsibility of local educational agencies to contact, on an annual basis, appropriate officials from private nonprofit schools within their school districts in order to determine whether such schools desire that their children and teachers participate in programs or projects assisted under this title.

(B) The State educational agency shall distribute 50 per centum of the funds available under this subsection based on the relative number of children aged five to seventeen who—

(i) are from families below the poverty level as determined under section 111(c)(2)(A) of the Elementary and Secondary Education Act of 1965; and

(ii) are from families above the poverty level as determined under section 111(c)(2)(B) of the Elementary and Secondary Education Act of 1965;

in the public schools of the local educational agencies within the State.

(3) The State educational agency shall renew payments to local educational agencies under this subsection based upon the criteria set forth in paragraph (2) of this subsection and a determination by the State educational agency that the local educational agency is implementing the program assisted under this title so that a substantial number of teachers in the public and private schools in the school district of such agency are served and several grade levels of instruction in such schools are involved in the program.

(c)(1) If a local educational agency is spending funds under subsection (b)(1)(B), not to exceed 30 per centum of the funds available to the local educational agency under subsection (b) may be used for the purchase of computer and computer-related instructional equipment.

(2) If a local educational agency is spending funds under subsection (b)(1)(B), not to exceed 15 per centum of the funds available to the local educational agency under subsection (b) may be used to strengthen instruction in foreign languages.

(d) Not less than 20 per centum of the amount available under this section shall be used by the State educational agency—

(1) demonstration and exemplary programs for teacher training and retraining and inservice upgrading of teacher skills in the fields of mathematics and science, foreign language instruction, and computer learning,

(2) demonstration and exemplary programs for instructional equipment and materials in such fields and necessary technical assistance,

(3) demonstration and exemplary programs for special projects for historically underrepresented and underserved populations and for gifted and talented students, and

(4) the dissemination of information to all local educational agencies within the State relating to the exemplary programs in the fields of mathematics, science, foreign languages, and computer learning.

In providing financial assistance for such demonstration and exemplary programs, the State educational agency shall reserve not less than 20 per centum of the amount available under this subsection for special projects in mathematics and science, foreign languages, and computer education to historically underrepresented and underserved populations of students, including females, minorities, handicapped individuals, individuals with limited-English proficiency, and migrant students, and to programs for gifted and talented students. The programs for gifted and talented students may include assistance to magnet schools for such students.

(e) Not less than 5 per centum of the amount available under this section may be used by the State educational agency to provide technical assistance to local educational agencies, institutions of higher education, and nonprofit organizations, including museums, libraries, and educational television stations, in the conduct of programs specified under subsection (b).

(f) Not to exceed 5 per centum of the amount available under this section may be used by the State educational agency for—

(1) the State assessment required by section 208 of this title; and

(2) the costs of administration and evaluation of the program assisted under this title.

(20 U.S.C. 3966) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1275, amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 898

HIGHER EDUCATION PROGRAMS

SEC. 207. (a) The amount apportioned under section 205(b) from each State's allotment under this title shall be used by the State agency for higher education for higher education programs in accordance with the provisions of this section.

(b)(1)(A) Not less than 75 per centum of the amount available for this section shall be used by the State agency for higher education for grants to institutions of higher education in accordance with the provisions of this subsection.

(B) The State agency for higher education shall make funds available on a competitive basis to institutions of higher education in the State which apply for payments under this section. The State agency for higher education shall make every effort to ensure

equitable participation of private and public institutions of higher education.

(2) The amount available under this subsection shall be used for—

(A) establishing traineeship programs for new teachers who will specialize in teaching mathematics and science at the secondary school level;

(B) retraining of secondary school teachers who specialize in disciplines other than the teaching of mathematics, science, foreign languages, or computer learning to specialize in the teaching of mathematics, science, foreign languages, or computer learning, including the provision of stipends for participation in institutes authorized under title I; and

(C) inservice training for elementary, secondary, and vocational school teachers and training for other appropriate school personnel to improve their teaching skills in the fields of mathematics, science, foreign languages, and computer learning, including stipends for participation in institutes authorized under title I.

Each institution of higher education receiving a grant under this subsection shall assure that programs of training, retraining, and inservice training will take into account the need for greater access to and participation in mathematics, science, foreign languages, and computer learning and careers of students from historically underrepresented and underserved groups, including females, minorities, individuals with limited-English proficiency, the handicapped, migrants, and the gifted and talented.

(3) No institution of higher education may receive assistance under paragraphs (2)(B) and (C) of this subsection unless the institution enters into an agreement with a local educational agency, or consortium of such agencies, to provide inservice training and retraining for the elementary and secondary school teachers in the public and private schools of the school district of each such agency.

(c)(1) Not less than 20 per centum of the amount available under this section shall be used by the State agency for higher education for cooperative programs among institutions of higher education, local educational agencies, State educational agencies, private industry, and nonprofit organizations, including museums, libraries, educational television stations, and professional mathematics, science, and engineering societies and associations for the development and dissemination of projects designed to improve student understanding and performance in science, mathematics, computer learning and critical foreign languages. In carrying out this subsection, the State agency for higher education shall give special consideration to programs involving consortial arrangements which include local educational agencies.

(2) For the purpose of paragraph (1) of this subsection, critical foreign languages include foreign languages designated by the Secretary pursuant to section 211(d).

(d) Not to exceed 5 per centum of the amount available under this section may be used by the State agency for higher education for—

(1) the State assessment required by section 208 of this title; and

(2) the costs of administration and evaluation of the program assisted under this title incurred by the State higher education agency.

(20 U.S.C. 3967) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1277; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 899.

STATE ASSESSMENT OF MATHEMATICS, SCIENCE, FOREIGN LANGUAGES, AND COMPUTER LEARNING

SEC. 208. (a) Each State which desires to receive grants under this title shall prepare not later than nine months following the date for which funds under this title become available, a preliminary assessment of the status of mathematics, science, foreign language, and computer learning within the State. Such preliminary assessment shall be made available to all local educational agencies within the State to assist the local educational agencies to carry out the requirements of section 210(b). A final version of such assessment shall be submitted to the Secretary not later than the end of the first year for which funds under this title are made available. Each preliminary assessment shall be prepared after an examination of the local assessments submitted under section 210. Each such assessment shall include a description and a five-year projection of—

(1) the availability of qualified mathematics, science, foreign language, and computer learning teachers at the secondary and postsecondary education levels within the State;

(2) the qualifications of teachers in mathematics, science, foreign languages, and computer learning at the secondary and postsecondary education levels, and the qualifications of teachers at the elementary level to teach mathematics, science, foreign languages, and computer learning;

(3) the State standards for teacher certification, including any special exceptions currently made, for teachers of mathematics, science, foreign languages, and computer learning;

(4) the availability of adequate curricula, instructional materials and equipment, in mathematics, science, foreign languages, and computer learning; and

(5) the degree of access to instruction in mathematics, science, foreign languages, and computer learning of historically underrepresented and underserved individuals and of the gifted and talented.

(b) Each such assessment shall also describe the programs, initiatives, and resources committed or projected to be undertaken within the State to—

(1) improve teacher recruitment and retention;

(2) improve teacher qualifications and skills in the fields of mathematics, science, foreign languages, and computer and computer learning;

(3) improve curricula in mathematics, science, foreign languages, and computer learning including instructional materials and equipment; and

(4) improve access for historically underrepresented and underserved populations, and for the gifted and talented, to instruction in mathematics, science, foreign languages, and computer learning

(c)(1) Each State assessment shall be developed in consultation with the Governor, the State legislature, State Board of Education, local educational agencies within the State, and representatives of—

(A) vocational secondary schools and area vocational education schools,

(B) public and private institutions of higher education,

(C) teacher organizations,

(D) private industry,

(E) other nonprofit organizations, including libraries, museums, and educational television stations, and professional scientific and mathematics associations, and

(F) private elementary and secondary schools,

within the State.

(2) Each State assessment shall be submitted jointly by the State educational agency and the State agency for higher education.

(d) The Secretary shall prepare and submit to the Congress a summary report of the final version of the assessments submitted by States under subsection (a) as soon as practicable after the receipt of such assessments.

(20 U.S.C. 3968) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1278; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 899.

STATE APPLICATION

SEC. 209. (a) Each State which desires to receive grants under this title shall file an application with the Secretary at such time, in such manner, and containing or accompanied by such information as the Secretary may reasonably require.

(b) Each such application shall—

(1) designate the State educational agency for the purpose of programs described in section 206, and the State agency for higher education for programs described in section 207 as the agency or agencies responsible for the administration and supervision of the programs described in sections 206 and 207, as the case may be;

(2) describe the programs for which assistance is sought under the application;

(3) provide assurances that payments will be distributed by the State in accordance with the provisions of sections 206 and 207, as the case may be;

(4) provide procedures—

(A) for submitting applications for programs described in sections 206 and 207 for distribution of payments under this title within the State, and

(B) for approval of applications by the appropriate State agency, including appropriate procedures to assure that the appropriate State agency will not disapprove an application without notice and opportunity for a hearing;

(5) provide assurances that—

(A) the State will prepare and submit the assessment required under section 208;

(B) in the second year for which funds are available under this title, the State will use funds for purposes con-

sistent with the findings of the State assessment under section 208;

(C) for programs described in section 206, the provisions of sections 210 and 211 will be carried out; and

(D) to the extent feasible, evaluations of the program assisted under this title will be performed;

(6) provide assurances that Federal funds made available under this title for any fiscal year will be so used as to supplement, and to the extent practicable, to increase the level of funds that would, in the absence of such Federal funds, be available from non-Federal sources for the purposes described in sections 206 and 207, and in no case supplant such funds from non-Federal sources; and

(7) provide such fiscal control and accounting procedures as may be necessary (A) to ensure proper accounting of Federal funds paid to the applicant under this title, and (B) to ensure the verification of the programs assisted under the application.

(c) The Secretary shall expeditiously approve any State plan that meets the requirements of this section.

(20 U.S.C. 3969) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1279; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 899.

LOCAL EDUCATIONAL AGENCY ASSESSMENT

SEC. 210. (a) Each local educational agency which desires to receive a payment from the State educational agency pursuant to section 206 shall provide to the State educational agency an assessment of the local educational agency's need for assistance in—

(1) teacher training, retraining, and inservice training and the training of appropriate school personnel in the areas of mathematics, science, foreign languages, and computer learning, including a description of the availability and qualifications of teachers in the areas of mathematics, science, foreign language, and computer learning, including the qualifications of teachers at the elementary level to teach in such areas;

(2) improving instructional materials and equipment related to mathematics and science education; and

(3) improving the access to instruction in mathemactics,[1] science, foreign languages, and computer learning of historically underserved and underrepresented individuals and of the gifted and talented, and an assessment of the current degree of access to such instruction of such individuals.

(b) Such assessment shall also describe the types of services to be provided pursuant to the program assisted under section 206, a description of how the services assisted will meet the program needs of the local educational agency, and in the second year for which funds under this title are made available, a description of how the services assisted will address unmet needs described under section 208.

(c) If a local educational agency determines, pursuant to section 206(b)(1), that the agency has met its teacher training, retraining, and inservice training needs in mathematics and science and desires to expend all or a portion of its funds on other activities pre-

[1] Probably should be "mathematics,".

scribed in section 206(b)(1)(B), the local educational agency may request the State educational agency to waive such training requirements. If the State educational agency determines that the local educational agency has met such teacher training needs, the State educational agency shall grant the waiver.

(20 U.S.C. 3970) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1280; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 900.

PARTICIPATION OF CHILDREN AND TEACHERS FROM PRIVATE SCHOOLS

SEC. 211. (a) To the extent consistent with the number of children in the State or in the school district of each local educational agency who are enrolled in private nonprofit elementary and secondary schools, such State or agency shall, after consultation with appropriate private school representatives, make provision for including services and arrangements for the benefit of such children as will assure the equitable participation of such children in the purposes and benefits of this title.

(b) To the extent consistent with the number of children in the State or in the school district of a local educational agency who are enrolled in private nonprofit elementary and secondary schools, such State, State educational agency, or State agency for higher education shall, after consultation with appropriate private school representatives, make provision, for the benefit of such teachers in such schools, for such inservice and teacher training and retraining as will assure equitable participation of such teachers in the purposes and benefits of this title.

(c) If by reason of any provision of law a State or local educational agency is prohibited from providing for the participation of children or teachers from private nonprofit schools as required by subsections (a) and (b), or if the Secretary determines that a State or local educational agency has substantially failed or is unwilling to provide for such participation on an equitable basis, the Secretary shall waive such requirements and shall arrange for the provision of services to such children or teachers which shall be subject to the requirements of this section. Such waivers shall be subject to consultation, withholding, notice, and judicial review requirements in accordance with sections[1] 557(b) (3) and (4) of the Education Consolidation and Improvement Act of 1981.

(20 U.S.C. 3971) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1281; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 900

SECRETARY'S DISCRETIONARY FUND FOR PROGRAMS OF NATIONAL SIGNIFICANCE

SEC. 212. (a) From the amount reserved by the Secretary under section 204(a)(2)(A), the Secretary is authorized to carry out directly, or through grants, cooperative agreements, or contracts, projects which are authorized by this section.

(b)(1) From 75 per centum of the amount available under this section in each fiscal year, the Secretary shall make grants to and enter into cooperative agreements with State and local educational agencies, institutions of higher education, and private nonprofit or-

[1] Probably should be "section".

ganizations, including museums, libraries, educational television stations, and professional science, mathematics, and engineering societies and associations for programs of national significance in mathematics and science instruction, computer learning, and foreign language instruction in critical languages. The Secretary shall give special consideration to provide assistance to local educational agencies, or consortia thereof, to establish or improve magnet schools for gifted and talented students. In awarding of grants and cooperative agreements the Secretary shall give special consideration to local educational agencies, institutions of higher education, and private nonprofit organizations, including museums, libraries, educational television stations, and professional science, mathematics, and engineering societies and associations providing special services to historically underserved and underrepresented populations in the fields of mathematics and science.

(2) The Secretary, from the amount available under paragraph (1) for each fiscal year, shall reserve not to exceed $3,000,000 in each such year for the Director of the National Institute of Education for the purpose of conducting evaluation and research activities. Such evaluation and research activities shall include—

(A) a policy analysis of alternative methods to improve instruction in mathematics and science;

(B) an annual evaluation of the programs assisted under this title; and

(C) research on improving teacher training, retraining, inservice training, and retention, as well as the development of curriculum and materials in the fields of mathematics and science.

One-half of the funds reserved under this paragraph shall be used for the research activities described in clause (C).

(c) From 25 per centum of the amount available in each fiscal year, the Secretary shall make grants to institutions of higher education for the improvement and expansion of instruction in critical foreign languages.

(d) In determining which languages are critical to national security, economic, and scientific needs, the Secretary shall consult with the Secretary of State, the Secretary of Defense, the Secretary of Health and Human Services, and the Director of the National Science Foundation. The Secretary shall publish in the Federal Register a list of critical foreign languages.

(20 U.S.C. 3972) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1281; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 900.

PAYMENTS

SEC. 213. (a) From the amounts appropriated under section 203(b), the Secretary shall pay, in accordance with the provisions of this title, the costs of the programs and activities described in the application approved under section 209, and the costs of programs of national significance under section 212.

(b) Payments under this title shall be made as soon after approval of the application as practicable.

(20 U.S.C. 3973) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1282; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 900.

TITLE III—NATIONAL SCIENCE FOUNDATION PROGRAM FOR PARTNERSHIPS IN EDUCATION FOR MATHEMATICS, SCIENCE, AND ENGINEERING

SHORT TITLE

SEC. 301. This title may be cited as the "Partnerships in Education for Mathematics, Science, and Engineering Act".

(20 U.S.C. 3981, note) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1283

STATEMENT OF PURPOSE

SEC. 302. It is the purpose of this title to supplement State and local resources to—

(1) improve the quality of instruction in the fields of mathematics, science, and engineering in the State;

(2) furnish additional resources and support for research, student scholarships, and faculty exchange programs in the fields of mathematics, science, and engineering; and

(3) encourage partnerships in education between the business community, institutions of higher education, and elementary and secondary schools in the community.

(20 U.S.C. 3981) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1283

DEFINITIONS

SEC. 303. As used in this title—

(1) the term "applicant" means with respect to activities described in section 305(a) an institution of higher education and the other participants described in paragraph (3) of section 305(a), and with respect to activities described in section 305(b) a local educational agency and the other participants described in paragraph (3) of section 305(b);

(2) the term "equipment" includes machinery, utilities, and built-in equipment and any necessary enclosures or structures to house them, and includes all other items necessary for the functioning of a particular facility as a facility for the provision of educational services, including items such as instructional equipment and necessary furniture, printed, published, and audio-visual instructional materials, and books, periodicals, documents, and other related materials; and meaning given that term by section 1201(a) of the Higher Education Act of 1965;

(3) the term "State agency for higher education" means the State board of higher education or other agency or officer primarily responsible for the State supervision of higher education, or if there is no such officer or agency, an officer or agency designated by the Governor or by State law.

(20 U.S.C. 3982) Enacted August 11, 1984, P.L. 98-377, 98 Stat. 1283; amended Nov. 22, 1985, P.L. 99-159, 99 Stat. 900.

20 USC 2974.

"SEC. 1574. FEDERAL ADMINISTRATION.

"(a) TECHNICAL ASSISTANCE.—The Secretary, upon request, shall provide technical assistance to State and local educational agencies under this chapter, particularly with respect to implementation of the programs and activities under subpart 4.

Regulations.

"(b) RULEMAKING.—The Secretary shall issue regulations under this chapter only to the extent that such regulations are necessary to ensure that there is compliance with the specific requirements and assurances required by this chapter.

"(c) AVAILABILITY OF APPROPRIATIONS.—Notwithstanding any other provision of law, unless expressly in limitation of this subsection, funds appropriated in any fiscal year to carry out activities under this chapter shall become available for obligation on July 1 of such fiscal year and shall remain available for obligation until the end of the subsequent fiscal year.

"(d) SPECIAL RULE.—The provisions of sections 1433 and 1434 shall apply to the programs authorized by this chapter.

20 USC 2975.

"SEC. 1575. APPLICATION OF GENERAL EDUCATION PROVISIONS ACT.

"(a) GENERAL RULE.—Except as otherwise specifically provided by this section, the General Education Provisions Act shall apply to the programs authorized by this chapter.

"(b) APPLICABILITY.—The following provisions of the General Education Provisions Act shall be superseded by the specified provisions of this chapter with respect to the programs authorized by this chapter:

20 USC 1221e-3.

"(1) Section 408(a)(1) of the General Education Provisions Act is superseded by section 1574(b) of this chapter.

20 USC 1231c.

"(2) Section 426(a) of such Act is superseded by section 1574(a) of this chapter.

20 USC 1231d.

"(3) Section 427 of such Act is superseded by section 1534(a)(5) of this chapter.

20 USC 1231g.

"(4) Section 430 of such Act is superseded by sections 1522 and 1533 of this chapter.

"(c) SPECIAL RULE.—Sections 434, 435, and 436 of the General Education Provisions Act, except to the extent that such sections relate to fiscal control and fund accounting procedures, may not apply to the programs authorized by this chapter and shall not be construed to authorize the Secretary to require any reports or take any actions not specifically authorized by this chapter.

20 USC 2976.

"SEC. 1576. TRANSITION PROVISIONS.

Grants. Contracts.

"(a) REGULATIONS.—All orders, determinations, rules, regulations, permits, grants, and contracts, which have been issued under chapters 2 and 3 of the Education Consolidation and Improvement Act of 1981 (as in effect on the date before the effective date of the Augustus F. Hawkins-Robert T. Stafford Elementary and Secondary School Improvement Amendments of 1988), or which are issued under such Act on or before the effective date of this Act shall continue in effect until modified or revoked by the Secretary, by a court of competent jurisdiction, or by operation of law other than this Act.

"(b) EFFECT ON PENDING PROCEEDINGS.—The provisions of this chapter shall not affect administrative or judicial proceedings pending on the effective date of this Act under chapters 2 and 3 of the Education Consolidation and Improvement Act of 1981.

"(c) TRANSITION.—With respect to the period beginning July 1, 1988, and ending June 30, 1989, no recipient of funds under this Act or chapter 2 of the Education Consolidation and Improvement Act of 1981 shall be held to have expended such funds in violation of the requirements of this Act or of such Act if such funds are expended in accordance with this Act or such Act.

Effective date. Termination date.

"TITLE II—CRITICAL SKILLS IMPROVEMENT

"PART A—DWIGHT D. EISENHOWER MATHEMATICS AND SCIENCE EDUCATION ACT

Dwight D Eisenhower Mathematics and Science Education Act. 20 USC 2981.

"SEC. 2001. SHORT TITLE.

"This part may be cited as the 'Dwight D. Eisenhower Mathematics and Science Education Act'.

20 USC 2982.

"SEC. 2002. STATEMENT OF PURPOSE.

"The purpose of this part is to strengthen the economic competitiveness and national security of the United States by improving the skills of teachers and the quality of instruction in mathematics and science in the Nation's public and private elementary and secondary schools through assistance to State educational agencies, local educational agencies, and institutions of higher education.

20 USC 2983

"SEC. 2003. PROGRAM AUTHORIZED.

"(a) GRANTS.—The Secretary is authorized to make grants to States and discretionary grants in accordance with the provisions of this part for strengthening the skills of teachers and improving instruction in mathematics and science.

"(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated for the purposes of this part, $250,000,000 for fiscal year 1989 and such sums as may be necessary for each of the 4 succeeding fiscal years.

20 USC 2984.

"SEC. 2004. ALLOCATION OF FUNDS.

"(a) IN GENERAL.—(1) From the amount appropriated under section 2003(b) for any fiscal year, the Secretary shall reserve—

Territories. U.S

"(A) not more than ½ of 1 percent for allocation among Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, and the Trust Territory of the Pacific Islands according to their respective needs for assistance under this part;

Indians

"(B) ½ of 1 percent for programs for Indian students served by schools funded by the Secretary of the Interior consistent with the purposes of this part; and

"(C) 4 percent for section 2012.

"(2) The remainder of the amount so appropriated (after meeting the requirements of paragraph (1)) shall be allocated among the States (treating the District of Columbia and Puerto Rico as States) as follows—

"(A) ½ of such remainder shall be allocated among the States by allocating to each State an amount which bears the same ratio to such ½ of such remainder as the number of children aged 5 to 17, inclusive, in the State bears to the number of such children in all States; and

"(B) ¼ of such remainder shall be allocated among the States according to each State's share of allocations under chapter 1 of the Education Consolidation and Improvement Act of 1981 or part A of chapter 1 of title I of this Act, whichever program was effective for the previous fiscal year,

except that no State shall receive less than ½ of 1 percent of the amount available under this subsection in any fiscal year or less than the amount allotted to such State for fiscal year 1988 under title II of the Education for Economic Security Act.

"(3) For the purposes of this subsection, the term 'State' does not include Guam, American Samoa, the Virgin Islands, the Northern Mariana Islands, or the Trust Territory of the Pacific Islands.

"(4) The number of children aged 5 to 17, inclusive, in the State and in all States shall be determined by the Secretary on the basis of the most recent satisfactory data available to the Secretary.

"(5) The Secretary shall make payments under paragraph (1)(B) on whatever terms the Secretary determines will best carry out the purposes of this part.

"(b) REALLOTMENT OF UNUSED FUNDS.—The amount of any State's allotment under subsection (a) for any fiscal year to carry out this part which the Secretary determines will not be required for that fiscal year to carry out this part shall be available for reallotment from time to time, on such dates during that year as the Secretary may determine, to other States in proportion to the original allotments to those States under subsection (a) for that year but with such proportionate amount for any of those other States being reduced to the extent it exceeds the sum the Secretary estimates that State needs and will be able to use for that year; and the total of those reductions shall be similarly reallotted among the States whose proportionate amounts were not so reduced. Any amounts reallotted to a State under this subsection during a year shall be deemed a part of its allotment under subsection (a) for that year.

20 USC 2985.

"SEC. 2005. IN-STATE APPORTIONMENT.

"(a) ELEMENTARY AND SECONDARY EDUCATION PROGRAMS.—(1) For each fiscal year, an amount equal to 75 percent of each State's allotment under section 2004 shall be used for elementary and secondary education programs in accordance with section 2006, for demonstration and exemplary programs under section 2006(c) and for technical assistance under section 2006(d).

"(2) Not less than 90 percent of such amount shall be distributed as follows:

"(A) The State educational agency shall distribute 50 percent of the funds available under this subsection to local educational agencies according to the relative enrollments in public and private nonprofit schools within the school districts of such agencies. Such relative enrollments may be calculated, at the option of the State educational agency, on the basis of the total number of children enrolled in public schools, and—

"(i) private nonprofit schools, or

"(ii) private nonprofit schools desiring that their children and teachers participate in programs or projects assisted under this part.

Nothing in the preceding sentence shall diminish the responsibility of local educational agencies to contact, on an annual basis, appropriate officials from private nonprofit schools within their school districts in order to determine whether such schools desire that their children and teachers participate in programs or projects assisted under this part.

Disadvantaged persons

"(B) The State educational agency shall distribute 50 percent of the funds available under this subsection based on the relative number of children aged 5 to 17 who—

"(i) are from families below the poverty level as determined under section 1005(c)(2)(A) of this Act; and

"(ii) are from families above the poverty level as determined under section 1005(c)(2)(B) of this Act;

in the schools of the local educational agencies within the State.

"(b) HIGHER EDUCATION PROGRAMS.—For each fiscal year, 25 percent of each State's allotment under section 2004 shall be used for higher education programs in accordance with section 2007.

"SEC. 2006. ELEMENTARY AND SECONDARY EDUCATION PROGRAMS.

Disadvantaged persons. Women. Minorities. Handicapped persons. 20 USC 2986.

"(a) IN GENERAL.—The amount apportioned under section 2005(a)(2) from each State's allotment under this part shall be used by the State educational agency to strengthen elementary and secondary education programs in accordance with the provisions of this section.

"(b) LOCAL EDUCATIONAL AGENCIES.—(1) Each local educational agency shall use funds distributed under this part for—

"(A) the expansion and improvement of preservice training, inservice training, and retraining of teachers and other appropriate school personnel in the fields of mathematics and science, including vocational education teachers who use mathematics and science in the courses of study they teach;

"(B) recruitment or retraining of minority teachers to become mathematics and science teachers;

"(C) training in and instructional use of computers, video, and other telecommunications technologies as part of a mathematics and science program (which may include the purchase of computers or other telecommunications equipment in schools with an enrollment of 50 percent or more of students from low-income families after all other training needs have been met);

"(D) integrating higher order analytical and problem-solving skills into the mathematics and science curriculum; or

"(E) providing funds for grants projects for individual teachers within the local educational agency to undertake projects to improve their teaching ability or to improve the instructional materials used in their classrooms in mathematics and science.

Contracts

"(2) Such training and instruction may be carried out through agreements with public agencies, private industry, institutions of higher education, and nonprofit organizations, including museums, libraries, educational television stations, professional science, mathematics and engineering associations, and other appropriate institutions. Agreements for funds available under section 2004(a)(1)(B) may be made with institutions of higher education receiving funds under the Tribally Controlled Community College Assistance Act of 1978. A local educational agency may carry out the activities authorized by this paragraph with one or more other local educational agencies within the State, or with the State educational agency, or both. Each local educational agency shall assure that programs of training, inservice training and retraining will take into account the need for greater access to and participation in mathematics and science programs and careers of students from historically underrepresented groups, including females, minorities,

individuals with limited-English proficiency, the handicapped, migrants, and, especially, gifted and talented children from within such groups.

"(3) A local educational agency for any fiscal year may apply for funds as part of a consortium with other local educational agencies, institutions of higher education, or an intermediate educational unit for the conduct of local programs. The State educational agency may assist in the formation of consortia between local educational agencies, institutions of higher education, or intermediate educational units to provide services for the teachers and students in such local educational agency at the request of such local educational agency.

"(4) Not more than 5 percent of funds available to the local educational agency for the purpose of this section for any fiscal year may be used for local administration.

"(c) DEMONSTRATION AND EXEMPLARY PROGRAMS.—Not less than 5 percent of the amount available under this section shall be used by the State educational agency for—

"(1) demonstration and exemplary programs for teacher training and retraining and inservice upgrading of teacher skills in the fields of mathematics and science;

"(2) demonstration and exemplary programs for instructional equipment and materials in such fields and necessary technical assistance;

"(3) demonstration and exemplary programs for special projects for historically underrepresented and underserved populations and for gifted and talented students; or

"(4) the dissemination of information to all local educational agencies within the State relating to the exemplary programs in the fields of mathematics and science.

In providing financial assistance for such demonstration and exemplary programs, the State educational agency shall give special consideration to special projects in mathematics and science to historically underrepresented and underserved populations of students, including females, minorities, handicapped individuals, individuals with limited-English proficiency, and migrant students, and to programs for gifted and talented students. The programs for gifted and talented students may include assistance to magnet schools for such students.

"(d) TECHNICAL ASSISTANCE AND ADMINISTRATIVE COSTS.—Not more than 5 percent of the amount available under this section may be used by the State educational agency—

"(1) to provide technical assistance to local educational agencies, institutions of higher education, and nonprofit organizations, including museums, libraries, and educational television stations, in the conduct of programs specified in subsection (b); and

"(2) for the costs of administration and assessment of programs assisted under this part.

20 USC 2987.

"SEC. 2007. HIGHER EDUCATION PROGRAMS.

"(a) IN GENERAL.—(1) Except as provided in paragraph (2), the amount apportioned under section 2005(b) from each State's allotment under this part shall be used by the State agency for higher education for education programs in accordance with the provisions of this section.

"(2) Funds available under section 2004(a)(1)(B) and reserved under section 2005(b) shall be used, in accordance with the provisions of this section, to support programs conducted within institutions of higher education funded through the Bureau of Indian Affairs.

"(b) GRANTS TO INSTITUTIONS OF HIGHER EDUCATION.—(1)(A) Not less than 95 percent of the amount available for this section shall be used by the State agency for higher education for grants to institutions of higher education in accordance with the provisions of this subsection.

"(B) The State agency for higher education shall make funds available on a competitive basis to institutions of higher education in the State which apply for payments under this section and which demonstrate involvement of local educational agencies. The State agency for higher education shall make every effort to ensure equitable participation of private and public institutions of higher education.

Disadvantaged persons. Women. Minorities. Handicapped persons.

"(2) The amount available under this subsection shall be used for—

"(A) establishing traineeship programs for new teachers who will specialize in teaching mathematics and science at the secondary school level;

"(B) retraining of secondary school teachers who specialize in disciplines other than the teaching of mathematics or science to specialize in the teaching of mathematics or science, including the provision of stipends for participation in institutes authorized under title I of the Education for Economic Security Act or any other program of the National Science Foundation; and

"(C) inservice training for elementary, secondary, and vocational school teachers and training for other appropriate school personnel to improve their teaching skills in the fields of mathematics and science, including stipends for participation in institutes authorized under title I of the Education for Economic Security Act, or any other program of the National Science Foundation.

Each institution of higher education receiving a grant under this subsection shall assure that programs of training, retraining, and inservice training will take into account the need for greater access to and participation in mathematics and science and careers by students from historically underrepresented and underserved groups, including females, minorities, individuals with limited-English proficiency, the handicapped, migrants, and the gifted and talented, and will ensure cooperative agreements or cooperative arrangements with local educational agencies.

"(3) No institution of higher education may receive assistance under paragraphs (2)(B) and (2)(C) of this subsection unless the institution enters into an agreement with a local educational agency, or consortium of such agencies, to provide inservice training and retraining for the elementary and secondary school teachers in the public and private schools of the school district of each such agency.

"(c) COOPERATIVE PROGRAMS.—The State agency for higher education may use funds described in subsection (b)(1)(A) for cooperative programs among institutions of higher education, local educational agencies, State educational agencies, private industry, and nonprofit organizations, including museums, libraries, educational television stations, and professional matehmatics, science, and engineering societies and associations for the development and dissemination of

projects designed to improve student understanding and performance in science and mathematics.

"(d) ASSESSMENT AND ADMINISTRATIVE COSTS.—Not to exceed 5 percent of the amount available under this section may be used by the State agency for higher education for—

"(1) the State assessment required by section 2008(c); and

"(2) the costs incurred by such agency for administration and evaluation of programs assisted under this part.

Disadvantaged persons.
Women.
Minorities.
Handicapped persons.
20 USC 2988.

"SEC. 2008. STATE APPLICATION.

"(a) APPLICATION.—Each State which desires to receive a grant under this part shall file an application with the Secretary which covers a period of 3 fiscal years. Such application shall be filed at such time, in such manner, and containing or accompanied by such information as the Secretary may reasonably require.

"(b) CONTENTS OF APPLICATION.—Each such application shall—

"(1) designate the State educational agency for the purpose of programs described in section 2006, and the State agency for higher education for the purpose of programs described in section 2007 as the agency or agencies responsible for the administration and supervision of the programs described in section 2006 or 2007, as the case may be;

"(2) provide assurances that—

"(A) payments will be distributed by the State in accordance with the provisions of this title;

"(B) for programs described in section 2006, the provisions of section 2010 will be carried out;

"(C) the State will provide such fiscal control and funds accounting as the Secretary may require;

"(D) funds provided under this part will supplement, not supplant, State and local funds made available for activities authorized under this part;

"(E) during the 3-year period of the plan, the State will evaluate its standards for teacher preparation, licensing, certification, and endorsement for elementary and secondary mathematics and science;

"(F) the State will take into account the needs for greater access to and participation in mathematics and science by students and teachers from historically underrepresented groups including females, minorities, individuals with limited-English proficiency, the economically disadvantaged, and the handicapped;

"(G) that the needs of teachers and students in areas with high concentrations of low-income students and sparsely populated areas will be considered in the distribution of funds reserved for State use; and

"(H) that the programs conducted with State funds will be assessed annually (including statistics on the number of students and teachers involved in these programs) and that the data from such assessments, as well as a summary of the local assessments required under section 2009(b)(6), will be submitted to the Secretary;

"(3) if appropriate, provide a description of how funds paid under this part will be coordinated with State and local funds and other Federal resources, particularly with respect to any program available from the National Science Foundation or the Department of Energy, or both; and

"(4) describe procedures—

"(A) for submitting applications for programs described in sections 2006 and 2007 for distribution of payments under this part within the State, and

"(B) for approval of applications by the appropriate State agency, including appropriate procedures to assure that such agency will not disapprove an application without notice and opportunity for a hearing.

"(c) INFORMATIONAL REQUIREMENTS.—Each State application shall also contain the following:

"(1) A projection of the supply and demand for teachers within the State in all the mathematics and science subject areas at the elementary and secondary levels, including a consideration of the impact of changing State graduation requirements and other State reforms upon such supply.

"(2) An assessment of the current elementary and secondary curriculum needs within the State in mathematics and science.

"(d) DESCRIPTION OF ASSISTED ACTIVITIES.—Each application shall also contain the following descriptions:

"(1) How the programs under this Act will meet the teacher training and curriculum needs projected under subsections (c)(1) and (c)(2).

"(2) The specific activities that will be undertaken that involve institutions of higher education.

"(3) The specific activities that will be supported with funds reserved for State use and how those activities relate to the State's needs in mathematics and science.

"(4) The specific activities the State will support to improve access of historically underrepresented groups in mathematics and science education.

"(e) APPROVAL.—The Secretary shall expeditiously approve any State application that meets the requirements of this section.

20 USC 2989.

"SEC. 2009. LOCAL APPLICATION.

"(a) APPLICATION.—A local educational agency that desires to receive a grant under this part shall submit an application which covers a 3-year period (singly or in conjunction with other local educational agencies, institutions of higher education, or an intermediate educational unit).

"(b) CONTENTS OF APPLICATION.—A local educational agency application shall—

"(1) provide a summary assessment of—

"(A) the needs of its current teachers in mathematics and science and whether a shortage of such qualified teachers exists or will exist within 5 years after the date of the application;

"(B) the current levels of mathematics and science student achievement in the local educational agency; and

"(C) the curricular needs of the local educational agency in mathematics and science;

"(2) describe how the local educational agency plans to use funds received under this part to meet the needs described in paragraph (1)(A);

"(3) if applicable, describe how funds under this part will be coordinated with State and local and other Federal resources, especially with respect to any programs available from the

National Science Foundation, or the Department of Energy, or both;

"(4) if applicable, describe how the programs will use other resources of the community and involve public agencies, private industry, institutions of higher education, public and private nonprofit organizations (including, museums, libraries, educational television stations, professional science, mathematics, and engineering associations), and other appropriate institutions;

Disadvantaged persons. Women. Minorities. Handicapped persons.

"(5) assure that programs will take into account the need for greater access to and participation in mathematics and science programs by students from historically underrepresented groups, including females, minorities, individuals with limited-English proficiency, the economically disadvantaged, and the handicapped; and

"(6) assure that the programs will be assessed, that progress made will be reported in terms of numbers of teachers and students affected, and that the results will be submitted to the State educational agency in the time and manner required.

"(c) RENEWAL OF PAYMENTS.—The State educational agency shall renew payments to local educational agencies under this section based upon a determination by the State educational agency that the local educational agency is making adequate progress toward the goals of this part. The State educational agency will not disapprove an application without notice and opportunity for a hearing.

20 USC 2990.

"SEC. 2010. PARTICIPATION OF CHILDREN AND TEACHERS FROM PRIVATE SCHOOLS.

"(a) PARTICIPATION OF PRIVATE SCHOOL STUDENTS.—To the extent consistent with the number of children in the State or in the school district of each local educational agency who are enrolled in private nonprofit elementary and secondary schools, such State or agency shall, after consultation with appropriate private school representatives, make provision for including services and arrangements for the benefit of such children as will assure the equitable participation of such children in the purposes and benefits of this part.

"(b) PARTICIPATION OF PRIVATE SCHOOL TEACHERS.—To the extent consistent with the number of children in the State or in the school district of a local educational agency who are enrolled in private nonprofit elementary and secondary schools, such State, or agency or institution of higher education shall, after consultation with appropriate private school representatives, make provision, for the benefit of such teachers in such schools, for such inservice and teacher training and retraining as will assure equitable participation of such teachers in the purposes and benefits of this part.

"(c) WAIVER.—If by reason of any provision of law a State or local educational agency or institution of higher education is prohibited from providing for the participation of children or teachers from private nonprofit schools as required by subsections (a) and (b), or if the Secretary determines that a State or local educational agency has substantially failed or is unwilling to provide for such participation on an equitable basis, the Secretary shall waive such requirements and shall arrange for the provision of services to such children or teachers, subject to the requirements of this section. Such waivers shall be subject to consultation, withholding, notice, and judicial review requirements in accordance with section 1017 of this Act.

"SEC. 2011. FEDERAL ADMINISTRATION.

20 USC 2991.

"(a) TECHNICAL ASSISTANCE AND EVALUATION PROCEDURES.—The Secretary shall provide technical assistance and, in consultation with State and local representatives, shall develop procedures for State and local evaluations of the programs under this part.

"(b) SUMMARY.—The Secretary shall submit to the Congress every 2 years a summary of the State evaluations of programs under this part.

"(c) MODEL REPORTING STANDARDS.—In conjunction with State and local educational agencies and organizations of mathematics and science educators, the Secretary shall develop model reporting standards to encourage comparability of data required under sections 2008 and 2009.

"SEC. 2012. NATIONAL PROGRAMS.

Grants. Contracts. 20 USC 2992.

"(a) AMOUNT AVAILABLE.—From 4 percent of amounts appropriated under section 2003(b), the Secretary shall make grants or enter into cooperative agreements in accordance with this section.

"(b) ELIGIBLE GRANTEES.—The Secretary shall make grants to and enter into cooperative agreements with State and local educational agencies, institutions of higher education, and public and private nonprofit organizations (including museums, libraries, educational television producers, distributors, and stations, and professional science, mathematics, and engineering societies and associations) for programs of national significance in mathematics and science instruction. The Secretary shall give special consideration in providing such assistance to local educational agencies (or consortia thereof), institutions of higher education, and public and private nonprofit organizations, providing special services to historically underserved and underrepresented populations (and especially gifted and talented children from within such populations) in the fields of mathematics and science.

"(c) PROGRAMS FOR TRAINING AND RETRAINING TEACHERS.—In awarding grants and cooperative agreements, the Secretary shall also give special consideration to programs of such institutions and organizations (such as museums) which train and retrain teachers in methods of scientific inquiry and provide materials which aid the education of students. In awarding grants and cooperative agreements, the Secretary shall give preference to developed and currently operating programs which are disseminated throughout the region in which such an institution or organization is located.

"(d) DISSEMINATION OF INFORMATION.—The Secretary shall disseminate information concerning grants and cooperative agreements under this section to State and local educational agencies and institutions of higher education. Such dissemination of information shall include examples of exemplary national programs in mathematics and science instruction and necessary technical assistance for the establishment of similar programs.

"SEC. 2013. DEFINITIONS.

20 USC 2993.

"As used in this part:

"(1) The term 'institution of higher education' has the meaning given that term in section 1201(a) of the Higher Education Act of 1965.

"(2) The term 'State agency for higher education' means the State board of higher education or other agency or officer primarily responsible for the State supervision of higher education, or, if there is no such officer or agency, an officer or agency designated for the purpose of this title by the Governor or by State law.

"PART B—FOREIGN LANGUAGES ASSISTANCE

Foreign Language Assistance Act of 1988.

"SEC. 2101. SHORT TITLE.

20 USC 3001.

"This part may be cited as the 'Foreign Language Assistance Act of 1988'.

20 USC 3002.

"SEC. 2102. FINDINGS.

"The Congress finds that the economic and security interests of this Nation require significant improvement in the quantity and quality of foreign language instruction offered in the Nation's elementary and secondary schools, and Federal funds should be made available to assist the purpose of this part.

20 USC 3003

"SEC. 2103. PROGRAM AUTHORIZED.

Grants.

"(a) GENERAL AUTHORITY.—The Secretary shall make grants to State educational agencies whose applications are approved under subsection (b) to pay the Federal share of the cost of model programs, designed and perated by local educational agencies, providing for the commencement or improvement and expansion of foreign language study for students.

"(b) APPLICATION.—Any State educational agency desiring to receive a grant under this part shall submit an application therefor to the Secretary at such time, in such form, and containing such information and assurances as the Secretary may require. No application may be approved by the Secretary unless the application—

"(1) contains a description of model programs which—

"(A) are designed by local educational agencies,

"(B) represent a variety of alternative and innovative approaches to foreign language instruction, and

"(C) are selected on a competitive basis by the State educational agency;

"(2) provides assurances that all children aged 5 through 17 who reside within the school district of the local educational agency shall be eligible to participate in any model program funded under this section (without regard to whether such children attend schools operated by such agency);

"(3) provides assurances that the State will pay the non-Federal share of the activities for which assistance is sought from non-Federal sources; and

"(4) provides that the local educational agency will provide standard evaluations of the proficiency of participants at appropriate intervals in the program which are reliable and valid, and provide such evaluations to the State educational agency.

"(c) FEDERAL SHARE.—(1) The Federal share for each fiscal year shall be 50 percent.

"(2) The Secretary may waive the requirement of paragraph (1) for any local educational agency which the Secretary determines does not have adequate resources to pay the non-Federal share of the cost of the project.

"(d) PARTICIPATION OF PRIVATE SCHOOLS.—(1) To the extent consistent with the number of children in the State or in the school district of each local educational agency who are enrolled in private elementary and secondary schools, such State or agency shall, after consultation with appropriate private school representatives, make provision for including special educational services and arrangements (such as dual enrollment, educational radio and television, and mobile educational services and equipment) in which such children can participate and which meet the requirements of this section. Expenditures for educational services and arrangements pursuant to this subsection for children in private schools shall be equal (taking into account the number of children to be served and the needs of such children) to expenditures for children enrolled in the public schools of the State or local educational agency.

"(2) If by reason of any provision of law a State or local educational agency is prohibited from providing for the participation of children from private schools as required by paragraph (1), or if the Secretary determines that a State or local educational agency has substantially failed or is unwilling to provide for such participation on an equitable basis, the Secretary shall waive such requirements and shall arrange for the provision of services to such children which shall be subject to the requirements of this subsection. Such waivers shall be subject to consultation, withholding, notice, and judicial review requirements in accordance with paragraphs (3) and (4) of section 1017(b) of this Act.

"SEC. 2104. ALLOTMENTS.

20 USC 3004

Territories, U.S.

"(a) GENERAL RULE.—(1) From the sums appropriated to carry out this part in any fiscal year, the Secretary shall reserve 1 percent for payments to Guam, American Samoa, the Virgin Islands, the Trust Territory of the Pacific Islands, and the Commonwealth of the Northern Mariana Islands, to be allotted in accordance with their respective needs.

"(2) From the remainder of such sums the Secretary shall allot to each State an amount which bears the same ratio to the amount of such remainder as the school age population of the State bears to the school age population of all States, except that no State shall receive less than an amount equal to one-half of 1 percent of such remainder.

"(b) AVAILABILITY OF FUNDS.—The allotment of a State under subsection (a) shall be made available to the State for 2 additional years after the first fiscal year during which the State receives its allotment under this section if the Secretary determines that the funds made available to the State during the first such year were used in the manner required under the State's approved application.

"SEC. 2105. DEFINITIONS.

20 USC 3005

"(a) GENERAL RULE.—For the purpose of this part:

"(1) The term 'foreign language instruction' means instruction in critical foreign languages as defined by the Secretary.

"(2) The term 'institution of higher education' has the meaning given that term in section 1201(a) of the Higher Education Act of 1965.

"(3) The term 'State agency for higher education' means the State board of higher education or other agency or officer primarily responsible for the State supervision of higher education, or, if there is no such officer or agency, an officer or

Appendix B

SURVEY INSTRUMENTS

National Study of the EESA Title II Program

SURVEY OF TITLE II COORDINATORS-- STATE EDUCATION AGENCY (SEA) FOR ELEMENTARY AND SECONDARY EDUCATION

In this survey we are interested in your State's experiences with Title II of the Education for Economic Security Act (EESA), the federal program primarily aimed at improving science and mathematics education in grades K-12. We also have a few questions about the newly reauthorized version of the law, the Dwight D. Eisenhower Mathematics and Science Education Act, which will soon take effect.

Unless other instructions are provided, for each question please circle all responses that apply or enter the appropriate numeric information.

[1/1-10]

A. TITLE II STAFFING

A1. For which school years of the program were you (or will you be) Title II coordinator for the state education agency (SEA) for elementary and secondary education? (PLEASE CIRCLE ALL THAT APPLY)

1 1985-86 (Year 1)

2 1986-87 (Year 2)

3 1987-88 (Year 3)

4 1988-89 (Year 4)

5 1989-90 (Year 5) [1/11-15]

A2. How many employees in the SEA are assigned Title II responsibilities full time and part time? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Full time responsibilities _____

b. Part time responsibilities _____ [1/16-19]

A3. In addition to Title II, what other areas of responsibility (a) do you and other SEA staff assigned to Title II now have and (b) what did you have before the Title II program? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	(a) Now	(b) Before Title II
None	0	0
Science education	1	1
Mathematics education	2	2
Foreign language education	3	3
Computer education*	4	4
General staff development	5	5
Administration of funds from the federal block grant (Chapter 2 of ECIA)	6	6
Other (PLEASE SPECIFY) _____	7	7

[1/20-33]

* "Computer education" = instruction in use of computers for curricular areas and purposes other than math and science education.

B. STATE NEEDS AND STRATEGY FOR MATHEMATICS/SCIENCE IMPROVEMENT

B1. How were the required state needs assessments carried out in 1985-86 and 1988-89? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	1985-86	1988-89
We used data already available, including data from local education agency (LEA) applications	1	1
We conducted a survey or study of LEAs	2	2
We conducted a survey or study of institutions of higher education (IHEs)	3	3
Don't know	8	8

[1/34-39]

B2. Based on the state needs assessments, what subject areas in elementary/secondary education critically needed improvement in 1985-86? What about in 1988-89? (INDICATE UP TO THREE AREAS THAT NEEDED CRITICAL IMPROVEMENT AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "MOST NEEDED.")

	1985-86	1988-89
Elementary school science	____	____
Elementary school mathematics	____	____
Middle/junior high school science	____	____
Middle/junior high school mathematics	____	____
High school science	____	____
High school mathematics	____	____
Foreign languages (all grade levels)	____	____
Computer education* (all grade levels)	____	____

[1/40-45]

B3. **What changes are needed to improve elementary and secondary mathematics/ science education in your state?** (INDICATE UP TO THREE AREAS THAT NEEDED IMPROVEMENT AND RANK THEM BY ASSIGNING a "1," "2," OR "3," WITH "1" = "MOST NEEDED.")

Improved access/services for female and minority students ____

Better K-12 curricula ____

More collaboration between colleges/universities and local districts ____

Better professional development for current teachers ____

Active recruitment of qualified new teachers ____

Better methods of assessing student learning ____

Revised certification requirements for teachers ____

Other (PLEASE SPECIFY) _____ ____

[1/46-48]

B4. **Characterize your agency's current strategy for deploying Title II funds to address state needs in mathematics and science education.** (PLEASE CIRCLE ONE NUMBER)

1 A proactive strategy with focused priorities and guidelines

2 A mixed strategy that combines support for state-determined priorities with openness to field-initiated ideas

3 An open strategy that provides little guidance and seeks a diversity of ideas from the field

4 Other (PLEASE EXPLAIN) _____

_____

_____

[1/49]

B5. **How useful to the SEA were the state's assessment(s) of needs in math/ science education?** (PLEASE CIRCLE ALL THAT APPLY)

1 Were of little or no use to us

2 Helped us formulate state policies for use of Title II funds

3 Helped us establish guidelines for Demonstration and Exemplary projects

4 Other (PLEASE SPECIFY) _____

_____

[1/50-53]

C. TITLE II FORMULA FUNDS FOR LOCAL SCHOOL DISTRICTS

C1. How many districts in your state received Title II formula funding each year (1) directly through an annual formula grant* or (2) indirectly through another entity (e.g., intermediate unit or supervisory union) acting on the district's behalf? (PLEASE GIVE YOUR BEST ESTIMATE)

	(1) Direct Funding	(2) Indirect Funding
a. 1985-86 (Year 1)	_____	_____
b. 1986-87 (Year 2)	_____	_____
c. 1987-88 (Year 3)	_____	_____
d. 1988-89 (Year 4)	_____	_____

[1/54-85]
[Dup 2/1-10]

C2. How many districts each year (1) requested full or partial waivers to use Title II funds for purposes other than teacher retraining and inservice training, and (2) received these waivers? (PLEASE GIVE YOUR BEST ESTIMATE)

	(1) Number Requested	(2) Number Granted
a. 1985-86 (Year 1)	_____	_____
b. 1986-87 (Year 2)	_____	_____
c. 1987-88 (Year 3)	_____	_____
d. 1988-89 (Year 4)	_____	_____

[2/11-42]

C3. For school year 1988-89 (Year 4) only, what percentage of the Title II funds for LEAs were used for services to private school teachers or students? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[2/43-45]

C4. On September 30, 1989, what percentage of your agency's elementary/secondary Title II 1988-89 (Year 4) funds still remained unallocated or uncommitted to particular projects? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[2/46-48]

* Formula grant = Annual allocation of Title II "flow-through" funding from state to school districts.

D. DEMONSTRATION AND EXEMPLARY PROJECTS

D1. How many Demonstration and Exemplary (D&E) projects received Title II funding (under EESA, section 206(d)) each year? What was the total amount of Title II money received each year? (PLEASE GIVE YOUR BEST ESTIMATE)

	Number of D&E Projects	Total Amount of D&E Money Received	
a. 1985-86 (Year 1)	_____	$_____	
b. 1986-87 (Year 2)	_____	$_____	
c. 1987-88 (Year 3)	_____	$_____	[2/49-81] [Dup 3/1-10]
d. 1988-89 (Year 4)	_____	$_____	[3/11-21]

D2. Was a competitive process used during 1988-89 to make awards for some or all D&E projects?

0 No

1 Yes [3/22]

D3. How many Demonstration and Exemplary (D&E) projects awarded for the 1988-89 school year (including the summer of 1989) were mainly located in each of the following kinds of institutions? (PLEASE COUNT EACH PROJECT ONLY ONCE)

Primary Location	Number of Projects
a. LEA	_____
b. Two-year college	_____
c. Four-year college (undergraduate program only)	_____
d. University (undergraduate and graduate programs)	_____
e. Not-for-profit institution (e.g., museums, public TV stations)	_____
f. No single primary location (e.g., collaborative projects involving two or more types of institutions)	_____
g. State agency	_____
h. Other: _____	_____
Total 1988-89 D&E Projects	_____

[3/23-50]

D4. Of the 1988-89 (Year 4) funds reserved for D&E projects, what percentage was allocated to each of the following disciplines? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Sciences _____%

b. Mathematics _____%

c. Foreign languages _____%

d. Computer education _____%

Total 100% [3/51-62]

D5. Did any of your state's 1988-89 D&E projects focus on the sciences?

0 No

Yes -- On which disciplines have they mainly focused? (PLEASE CIRCLE ALL THAT APPLY)

1 Biology/life sciences

2 Physical sciences

3 Earth science/astronomy

4 "General" science

5 Other (PLEASE SPECIFY) _____

[3/63-67]

D6. Did any 1988-89 D&E projects focus on mathematics?

0 No

Yes -- On which content/skill areas have they mainly focused? (PLEASE CIRCLE ALL THAT APPLY)

1 Arithmetic, computation skills

2 Arithmetic, problem-solving

3 Geometry

4 Probability, statistics, data analysis

5 Algebra

6 Advanced mathematics (e.g., calculus)

7 Other (PLEASE SPECIFY) _____

[3/68-74]
[Disp 4/1-10]

D7. What percentage of 1988-89 (Year 4) D&E funds were used for each of the four purposes, listed below, specified by the EESA law. (PLEASE GIVE YOUR BEST ESTIMATE)

a. Teacher training and retraining, including inservice _____%

b. Instructional equipment and materials, including curriculum development and necessary technical assistance _____%

c. Special projects for underserved populations _____%

d. Disseminating information about exemplary programs _____%

Total 100%

[4/11-22]

D8. Were any subject areas/levels identified as priorities for your state's use of D&E project funds in 1988-89?

No (CIRCLE "0") 0

Yes (INDICATE UP TO THREE PRIORITY AREAS/LEVELS AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "HIGHEST PRIORITY.")

Elementary school science ____
Elementary school mathematics ____
Middle/junior high school science ____
Middle/junior high school mathematics ____
High school science ____
High school mathematics ____
Foreign languages (all grade levels) ____
Computer education (all grade levels) ____

[4/23-25]

D9. Please indicate up to three activities that were an important focus of D&E projects funded in 1988-89, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Inservice teacher education ____
Pre-service teacher education ____
Retraining ____
Nontraditional routes to certification ____
Curriculum development ____
Direct services to elementary/secondary students ____
Equipment and materials improvement ____
Conferences; other dissemination activities ____

[4/26-28]

D10. **Does your agency's use of D&E funds give special priority to serving groups of students traditionally underrepresented in mathematics and science--such as female, racial/ethnic minority, and handicapped students?**

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 D&E grants are targeted to direct services for these students

2 D&E grants support professional development for teachers primarily serving these students

3 D&E grants support projects designed to attract and prepare female and minority teachers

4 Information is disseminated to individuals who might develop projects serving these groups

5 Other (PLEASE SPECIFY) _____

[4/29-33]

D11. **What percentage of D&E projects have been funded through Title II for more than a single year, either through grants in successive years or project periods lasting more than 12 months?** (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[4/34-36]

Please record any other comments that will help us understand D&E 206(d) projects in your state in the space provided at the end of the questionnaire.

E. ADMINISTRATION OF TITLE II

E1. **Which individuals in the SEA (other than yourself) are actively involved in making decisions about Title II funds?** (PLEASE CIRCLE ALL THAT APPLY)

1 The chief state school officer or superintendent

2 State mathematics supervisor

3 State science supervisor

4 State staff development personnel

5 State coordinators for teacher certification

6 Other (PLEASE SPECIFY) _____

[4/37-42]

E2. In what ways (if any) do the SEA and state agency for higher education (SAHE) coordinate or jointly plan Title II-related activities? (PLEASE CIRCLE ALL THAT APPLY)

0 There is little or no coordination of the activities

1 We share results (e.g., lists of awards, needs assessment findings)

2 There is some joint planning for the use of Title II funds

3 We pool funds for certain competitions or projects

4 We work closely together on the required needs assessments

5 Other (PLEASE SPECIFY) _____

[4/43-47]

E3. Has your agency had problems with the fiscal management of its Title II program?

0 No

Yes, the agency... (PLEASE CIRCLE ALL THAT APPLY)

1 Is not adequately reimbursed for administrative costs

2 Does not know its annual allocation early enough to plan adequately

3 Does not get funds in time for expenditures

4 Other (PLEASE SPECIFY) _____

[4/48-51]

E4. Does your agency conduct or require evaluations of Title II-funded activities?

0 No

Yes, we... (PLEASE CIRCLE ALL THAT APPLY)

1 Gather informal feedback on Title II funded activities

2 Collect statistics describing local activities supported by Title II

3 Conduct site visits to LEAs

4 Conduct formal evaluations of D&E projects

5 Require districts to evaluate the effectiveness of their Title II-supported activities

6 Carry out other forms of evaluation (PLEASE SPECIFY)

_____

[4/52-57]

E5. **What types of technical assistance has your agency provided in the past four years using Title II support?** (PLEASE CIRCLE ALL THAT APPLY)

"The agency has..."

1 Provided information on how to apply for funds

2 Given other advice to those wishing to apply for funds

3 Disseminated information concerning projects already supported by Title II

4 Advised LEAs on how to conduct needs assessments

5 Supplied information about regulations and requirements

6 Assisted LEAs in carrying out projects

7 Assisted LEAs in monitoring or evaluating their own programs

8 Other (PLEASE SPECIFY) _____

[4/58-65]

E6. **Which aspects of your state's management of the Title II program has the federal Title II program office influenced over the past several years?** (PLEASE CIRCLE ALL THAT APPLY)

"The federal Title II program office has influenced..."

1 Little, beyond the law and the regulations

2 The conduct of the needs assessment

3 Our identification of "exemplary" programs

4 Our approach to technical assistance

5 Priorities for demonstration projects

6 Other (PLEASE SPECIFY) _____

[4/66-71]

F. THE OVERALL IMPACTS OF TITLE II FUNDS

F1. In carrying out the Title II program, has the SEA established new or stronger ties with any groups?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 The state agency for higher education

2 Science and mathematics education professional associations

3 The Governor's office

4 Private sector firms or groups interested in science or mathematics education

5 The state legislature

6 Representatives of the relevant disciplinary communities (sciences, mathematics, etc.)

[4/72-77]
[Dup 5/1-10]

F2. What impact has Title II had on the amount of interaction between your SEA and the following groups? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Interactions with..."	...Have Decreased	...Have Not Changed	...Have Increased	Don't Know
a. LEAs	1	2	3	8
b. Private schools	1	2	3	8
c. Colleges/universities	1	2	3	8
d. Nonprofit educational institutions (e.g., science museums)	1	2	3	8

[5/11-14]

F3. Has Title II changed the SEA's capacity to provide leadership or technical assistance in the state? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

	Has Decreased	No Change	Has Increased	Don't Know
a. State leadership in math/ science education	1	2	3	8
b. Technical assistance	1	2	3	8

[5/15-16]

F4. **Please indicate the three most significant strengths of the Title II program and rank them by assigning a "1," "2," and "3," with "1" = "most significant."**

Flexible support for district initiatives ____

The emphasis on science and mathematics education ____

The focus on the professional development of teachers ____

Requirement that some funds support LEAs directly ____

The needs assessment requirements for states and districts ____

Support for the state-level efforts to improve science and math education ____

Other (PLEASE SPECIFY) _____ ____

[5/17-19]

F5. **Please indicate the three changes, aside from changes in overall funding, that would most improve the Title II program and rank them by assigning a "1," "2," and "3," with "1" = "would most improve."**

Less paperwork ____

Fewer state-level set-asides ____

Greater regulatory clarity at the federal level ____

Increased stability in funding from year to year ____

A greater proportion of funding reserved for state-initiated activities ____

A broader range of academic disciplines covered by the legislation ____

Other (PLEASE SPECIFY) _____ ____

[5/20-22]

F6. **How burdensome are the federal reporting requirements for Title II?** (PLEASE CIRCLE ONE NUMBER)

1 Minimal and not burdensome

2 Burdensome, but consistent with the size and benefit of the program

3 Burdensome, out of proportion to the benefit of the program

[5/23]

F7. Please indicate your level of agreement or disagreement with the following statements about the impact of Title II. (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"As a result of Title II funding..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
a. The amount of professional development has increased	1	2	3	4	8
b. The quality of professional development has improved	1	2	3	4	8
c. More LEAs try to shape and plan staff development	1	2	3	4	8
d. LEAs (and others) have leveraged other funds using Title II	1	2	3	4	8

[5/24-27]

Please record any other comments that will help us understand the impact of the Title II program in your state in the space provided on the last page.

G. TITLE II FUNDS IN RELATION TO OTHER RESOURCES

G1. What percentage of the total funding for all D&E projects in 1988-89 (Year 4) came from sources other than Title II? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[5/28-30]

G2. Of the total 1988-89 funding used by the SEA specifically for improvement of science, mathematics, or computer education, what percentage was contributed by each source? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Regular SEA budget (if any) for math/science improvement _____%

b. In-kind contributions (e.g., staff salaries, space, supplies) _____%

c. EESA Title II elementary/secondary funds (state set-aside only) _____%

d. ECIA Chapter 2 (state set-aside only) _____%

e. National Science Foundation funds _____%

f. Specially earmarked state funds _____%

g. Corporate or foundation gifts _____%

h. Other (PLEASE SPECIFY) _____ _____%

Total 100%

[5/31-54]

G3. Please give the <u>total</u> amount of state-administered and state-contributed funding (including Title II elementary/secondary funds) allocated each year for the improvement of science and mathematics education. (PLEASE GIVE YOUR <u>BEST</u> ESTIMATE)

a. 1985-86 (Year 1) $_____

b. 1986-87 (Year 2) $_____

c. 1987-88 (Year 3) $_____ [5/55-78] [Dup 6/1-10]

d. 1988-89 (Year 4) $_____ [6/11-18]

H. ADDITIONAL COMMENTS (OPTIONAL)

H1. Comments on Demonstration & Exemplary 206(d) projects in your state:

[6/19]

H2. Comments on the impact of the Title II program in your state:

[6/20]

THANK YOU FOR YOUR COOPERATION

Please use the enclosed postage-paid envelope to return this questionnaire to:

Dr. Michael Knapp
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

If available, please attach a list of your state's Demonstration and/or Exemplary project awards for 1988-89 (Year 4 of Title II)

[6/21]

National Study of the EESA Title II Program

SURVEY OF TITLE II COORDINATORS-- STATE AGENCY FOR HIGHER EDUCATION (SAHE)

In this survey we are interested in your State's experiences with Title II of the Education for Economic Security Act (EESA), the federal program which is primarily aimed at improving science and mathematics education in grades K-12. We are also interested in the newly reauthorized version of the law, the Dwight D. Eisenhower Mathematics and Science Education Act, which will shortly take effect.

Unless other instructions are provided, for each question please circle all responses that apply or enter the appropriate numeric information..

[1/1-10]

A. TITLE II STAFFING

A1. For which school years of the program were you (or will you be) Title II state higher education coordinator? (PLEASE CIRCLE ALL THAT APPLY)

1 1985-86 (Year 1)

2 1986-87 (Year 2)

3 1987-88 (Year 3)

4 1988-89 (Year 4)

5 1989-90 (Year 5)

[1/11-15]

A2. How many employees in the State Agency for Higher Education (SAHE) are assigned Title II responsibilities full time and part time? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Full time responsibilities _____

b. Part time responsibilities _____

[1/16-19]

A3. In addition to Title II, what other areas of responsibility (a) do you and the others assigned to the Title II higher education program now have and (b) what did you have before the Title II program? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	(a) Now	(b) Before Title II
None	0	0
Title II elementary/secondary education component	1	1
Program review	2	2
Grants administration	3	3
Special project coordination4	4	
Program management	5	5
Teacher education	6	6
Other (PLEASE SPECIFY) _____	7	7

[1/20-33]

A4. Before you became Title II coordinator, did you administer any of the following? (PLEASE CIRCLE ALL THAT APPLY)

1 A federally funded grants program

2 A state funded grants program

3 Other type of grants program

4 No prior grants administration experience

[1/34-37]

B. STATE NEEDS AND STRATEGY FOR MATHEMATICS/SCIENCE EDUCATION IMPROVEMENT

B1. Did the SAHE assist in data collection for the required Title II state needs assessments conducted in 1985-86 or 1988-89?

0 No

Yes, the SAHE... (PLEASE CIRCLE ALL THAT APPLY)

1 Surveyed institutions of higher education (IHEs)

2 Helped the SEA develop a survey for the local school districts

3 Helped synthesize and analyze IHE/LEA responses

4 Other (PLEASE SPECIFY) _____

[1/38-41]

B2. How useful to the SAHE were the state's assessment(s) of needs in math/science education? (PLEASE CIRCLE ALL THAT APPLY)

The state's assessments...

1 Were of little or no use to us

2 Helped us formulate state policies for use of Title II funds

3 Helped us establish guidelines for RFPs

4 Hindered rather than helped our relationship with IHEs

5 Other (PLEASE SPECIFY) _____

[1/42-46]

B3. Based on the state needs assessments, what subject areas in elementary/secondary education critically needed improvement in 1985-86? What about in 1988-89? (INDICATE UP TO THREE AREAS THAT NEEDED CRITICAL IMPROVEMENT AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "MOST NEEDED.")

	1985-86	1988-89
Elementary school science	____	____
Elementary school mathematics	____	____
Middle/junior high school science	____	____
Middle/junior high school mathematics	____	____
High school science	____	____
High school mathematics	____	____
Foreign languages (all grade levels)	____	____
Computer education* (all grade levels)	____	____

[1/47-52]

* "Computer education" = instruction in use of computers for curricular areas and purposes other than math and science education.

B4. **What changes are most needed to improve elementary and secondary mathematics/science education in your state?** (INDICATE UP TO THREE AREAS THAT NEEDED IMPROVEMENT AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "MOST NEEDED.")

More collaboration between colleges/universities and school districts ____

More collaboration between the SEA and SAHE ____

Better K-12 curricula ____

Better professional development for current teachers ____

Revised certification requirements for teachers ____

Active recruitment of new, well-qualified teachers ____

Better methods of assessing student learning ____

Improved access/services for female/minority students ____

Other (PLEASE SPECIFY) _____ ____

[1/53-55]

B5. **Characterize your agency's current strategy for deploying Title II funds to address state needs in mathematics and science education.** (PLEASE CIRCLE ONE NUMBER)

1 A proactive strategy with focused priorities and guidelines

2 A mixed strategy that combines support for state-determined priorities with openness to field-initiated ideas

3 An open strategy that provides little guidance and seeks a diversity of ideas from the field

4 Other (PLEASE EXPLAIN) _____

_____

_____

_____

[1/56]

C. FLOW OF TITLE II FUNDS THROUGH COMPETITIVE AND COOPERATIVE GRANTS

C1. How many competitive and cooperative awards were made each year from Title II funds under EESA Section 207 (higher education)? (PLEASE GIVE YOUR BEST ESTIMATE)

	207(b) Competitive Grant Awards	207(c) Cooperative Project Awards
a. 1985-86 (Year 1)	_____	_____
b. 1986-87 (Year 2)	_____	_____
c. 1987-88 (Year 3)	_____	_____
d. 1988-89 (Year 4)	_____	_____

[1/57-72]
[Dup 2/1-10]

C2. For each type of institution listed below, indicate the number of 207(b) competitive grant applications and 207(c) cooperative project applications submitted for the past school year only (1988-89). (PLEASE GIVE YOUR BEST ESTIMATE)

	207(b) Competitive Grant Application	207(c) Cooperative Project Applications
a. Two-year colleges	_____	_____
b. Public 4-year colleges*	_____	_____
c. Private 4-year colleges*	_____	_____
d. Public universities*	_____	_____
e. Private universities*	_____	_____
f. Other nonprofit institutions	_____	_____
g. Other (PLEASE SPECIFY)		
_____	_____	_____

[2/11-38]

C3. What percentage of Title II higher education projects have received multi-year funding from the state, either through grants in successive years or original project periods lasting more than 12 months? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[2/39-41]

C4. On September 30, 1989, what percentage of your agency's 1988-89 (Year 4) higher education funds still remained unobligated to particular projects or pending awards? (PLEASE GIVE YOUR BEST ESTIMATE)

[2/42-44]

_____%

* "4-year colleges" = Undergraduate and master's-level programs only
"Universities" = Doctoral degree granting institutions

D. COMPETITIVE GRANTS TO IHEs (FUNDED UNDER TITLE II, SECTION 207b)

D1. Has the SAHE developed guidelines for preparation of a Title II competitive grant application?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Procedural guidelines

2 Substantive guidelines

[2/45-46]

D2. How has the SAHE assisted IHEs in shaping or developing project proposals? (PLEASE CIRCLE ALL THAT APPLY)

1 Through ad hoc consultation

2 Through guidelines in an RFP

3 Through a two-stage (preliminary and final) proposal process

4 Other (PLEASE SPECIFY) _____

[2/47-50]

D3. Of the 1988-89 (Year 4) funds for 207(b) competitive grants, what percentage has been allocated to each of the following disciplines? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Sciences _____%

b. Mathematics _____%

c. Foreign languages _____%

d. Computer education _____%

Total 100%

[2/51-62]

D4. What types of activities are mainly supported by your 1988-89 207(b) competitive grant funds? (PLEASE CIRCLE ALL THAT APPLY)

1 Inservice teacher training

2 Preservice teacher training

3 Retraining of teachers certified in other disciplines

4 Special certification program(s) for individuals holding a non-education degree

5 Other (PLEASE SPECIFY) _____

[2/63-67]

D5. Since the Title II program began, how many <u>different</u> institutions of higher education (IHEs) in your state have received one or more competitive grants? (PLEASE GIVE YOUR <u>BEST</u> ESTIMATE)

[2/68-70]

_____

D6. Does your agency's use of 207(b) competitive grant funds give special priority to serving groups of students traditionally under-represented in mathematics and science, such as female, racial/ethnic minority, or handicapped students?

0 No

Yes... (PLEASE CIRCLE <u>ALL</u> THAT APPLY)

1 Grant(s) are targeted specifically to direct services for these students

2 Grant(s) support professional development for teachers primarily serving these students

3 Grant(s) support projects designed to attract and prepare female or minority teachers

4 Information is disseminated to individuals who might develop projects serving these groups

5 Other (PLEASE SPECIFY) _____

[2/71-75]

Please record any other comments that will help us understand the competitive 207(b) grants to IHEs in your state in the space provided at the end of the questionnaire.

E. COOPERATIVE PROJECTS (FUNDED UNDER TITLE II, SECTION 207c)

E1. How have your 207(c) cooperative projects been awarded? (PLEASE CIRCLE <u>ONE</u> NUMBER)

1 Through a competitive process

2 By invitation from the SAHE

3 Other (PLEASE SPECIFY) _____

_____

[2/76]
[Dup 3/1-10]

E2. Of the 1988-89 (Year 4) funds for 207(c) grants, what percentage has been allocated to each of the following disciplines? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Sciences _____%

b. Mathematics _____%

c. Foreign languages _____%

d. Computer education _____%

[3/11-22]

E3. Of the 207(c) cooperative grants funded with 1988-89 (Year 4) Title II money, how many projects provide direct services (e.g., summer internships, enrichment programs) to elementary or secondary students? (PLEASE GIVE YOUR BEST ESTIMATE)

[3/23-25]

_____

E4. Across all 207(c) projects, how many students are involved? (PLEASE GIVE YOUR BEST ESTIMATE)

[3/26-30]

_____

E5. What types of organizations in your state have been involved in cooperative projects funded by Title II? (PLEASE CIRCLE ALL THAT APPLY)

1 Local school districts

2 Institutions of higher education (IHEs)

3 Private business and industry

4 Museums and other private, nonprofit institutions

5 Professional societies or associations

6 Other (PLEASE SPECIFY) _____

[3/31-36]

E6. What types of activities have your Title II cooperative project grants mainly supported? (PLEASE CIRCLE ALL THAT APPLY)

1 Inservice teacher education

2 Preservice teacher education

3 Retraining

4 Nontraditional routes to certification

5 Curriculum development

6 Direct services to elementary/secondary students

7 Conferences; other dissemination activities

8 Other (PLEASE SPECIFY) _____

[3/37-44]

E7. Does your agency's use of 207(c) cooperative grant funds give special priority to serving groups of students traditionally underrepresented in mathematics and science, such as female, racial/ethnic minority, or handicapped students?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Grant(s) are targeted specifically to serve these students

2 Grant(s) support professional development for teachers primarily serving these students

3 Grant(s) support projects designed to attract and prepare female or minority teachers

4 Information is disseminated to individuals who might develop projects serving these groups

5 Other (PLEASE SPECIFY) _____

[3/45-49]

E8. Please indicate the three main benefits of Title II cooperative projects and rank them by assigning a "1," "2," and "3," with "1" = "most beneficial."

Allowed the SAHE to encourage innovative ideas _____

Provided a way to target a particular concern or priority _____

Involved more and different partners _____

Allowed more state-level use of federal discretionary funds _____

Made it easier to fund large projects _____

Other (PLEASE SPECIFY) _____

_____ _____

[3/50-52]

Please record any other comments that will help us understand the cooperative 207(c) projects/process in your state in the space provided at the end of the questionnaire.

F. ADMINISTRATION OF TITLE II

F1. Which organizations or groups are actively involved in making decisions about Title II funds? (PLEASE CIRCLE ALL THAT APPLY)

1 Other SAHE administrators

2 Professional associations

3 IHEs or their associations

4 University faculty or other providers of inservice programs

5 Teacher certification boards

6 Other (PLEASE SPECIFY) _____

[3/53-58]

F2. In what ways (if any) do the SAHE and the state agency for elementary/ secondary education (SEA) coordinate or jointly plan Title II-related activities? (PLEASE CIRCLE ALL THAT APPLY)

0 There is little or no coordination of the activities

1 We share results (e.g., lists of awards, needs assessment findings)

2 There is some joint planning for use of Title II funds

3 We pool funds for certain competitions or projects (or both)

4 We work together very closely on the required needs assessment

5 Other (PLEASE SPECIFY) _____

[3/59-63]

F3. Has your agency had problems with the fiscal management of its Title II program?

0 No

Yes, the agency... (PLEASE CIRCLE ALL THAT APPLY)

1 Is not adequately reimbursed for administrative costs

2 Does not know its annual allocation early enough to plan adequately

3 Does not get funds in time for expenditures

4 Other (PLEASE SPECIFY) _____

[3/64-67]

F4. **Does your agency conduct or require evaluations of its Title II-funded projects?**

0 No

Yes, we... (PLEASE CIRCLE ALL THAT APPLY)

1 Gather informal feedback on Title II-funded projects

2 Conduct formal evaluations of some Title II-funded projects

3 Conduct formal evaluations of all Title II-funded projects

4 Require projects to evaluate themselves

5 Conduct other forms of evaluation (PLEASE SPECIFY)

_____

[3/68-72]

F5. **In the past four years, what types of technical assistance has your agency provided to IHEs or other institutions that carry out Title II-funded projects?** (PLEASE CIRCLE ALL THAT APPLY)

"The agency has..."

1 Offered little or no technical assistance regarding Title II

2 Provided information on how to apply for a grant

3 Given other advice to those wishing to apply for funds

4 Disseminated information about projects supported previously

5 Supplied information about regulations and requirements

6 Assisted with project implementation

7 Assisted with project evaluation

8 Other (PLEASE SPECIFY) _____

[3/73-80]
[Dup 4/1-10]

F6. **How has the federal Title II program office influenced the state's management of the Title II program during the past four years?** (PLEASE CIRCLE ALL THAT APPLY)

"The federal Title II program office has influenced..."

1 Little, beyond the law and the regulations

2 The conduct of the needs assessment

3 Our identification of "exemplary" projects

4 Our approach to technical assistance

5 The types of competitive 207(b) projects supported

6 The types of cooperative 207(c) projects supported

7 Other (PLEASE SPECIFY) _____

[4/11-17]

G. OVERALL IMPACTS OF TITLE II FUNDS

G1. In carrying out the Title II program, has the SAHE established new or stronger ties with any of the following organizations or groups?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 The state agency for elementary and secondary education

2 Science and mathematics education professional associations

3 The Governor's office

4 Private sector firms or groups interested in science or mathematics education [4/18-24]

5 The state legislature

6 Representatives of the disciplinary communities (sciences, mathematics)

8 Don't know

G2. What impact has Title II had on the amount of interaction between the SAHE and the following groups? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Interactions between the SAHE and"	...Have Decreased	...Have Remained the Same	...Have Increased	Don't Know
a. School districts	1	2	3	8
b. Private schools	1	2	3	8
c. Colleges/universities	1	2	3	8
d. Nonprofit educational institutions (e.g., museums)	1	2	3	8

[4/25-28]

G3. How has Title II changed the SAHE's capacity to provide leadership or technical assistance for improvement in mathematics and science education in the state? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"As a result of the Title II program..."	...Has Decreased	...Has Remained the Same	...Has Increased	Don't Know
a. State leadership in math/science education	1	2	3	8
b. Our capacity for technical assistance	1	2	3	8

[4/29-30]

G4. Please indicate the three changes, aside from changes in overall funding, that would most improve the Title II program and rank them by assigning a "1," "2," and "3," with "1" = "would most improve the program."

Less paperwork _____

Reinstated requirement for cooperative grants _____

Greater regulatory clarity at the federal level _____

Increased stability in funding from year to year _____

A greater proportion of funding reserved for state-initiated activities _____

A broader range of academic disciplines covered by the legislation _____

Other (PLEASE SPECIFY) _____ _____

[4/31-33]

G5. Please indicate the three most significant strengths of the Title II program (other than the additional funding it provides) and rank them by assigning a "1," "2," and "3," with "1" = "most significant."

The emphasis on science and mathematics education _____

The focus on the professional development of teachers _____

The inclusion of higher education as a partner in improving education in the elementary and secondary schools _____

Support for state-level efforts to improve math/science education _____

Other (PLEASE SPECIFY) _____ _____

[4/34-36]

G6. From your perspective, how has the level of collaboration <u>between the following groups</u> changed as a result of the Title II-supported projects in your state? (PLEASE CIRCLE <u>ONE</u> NUMBER IN <u>EACH</u> ROW)

"The level of collaboration between..."	...Has <u>Decreased</u>	...Has Remained <u>the Same</u>	...Has <u>Increased</u>	Don't <u>Know</u>
a. IHE faculty and district teachers/staff	1	2	3	8
b. Academic and education departments within IHEs	1	2	3	8
c. Other educational institutions (e.g., museums) and IHEs	1	2	3	8

[4/37-39]

G7. **Please indicate your level of agreement or disagreement with the following statements about the impact of Title II projects.** (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"As a result of Title II projects..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
a. More discipline-based IHE faculty (e.g., physics, math) are interested in participating in inservice/preservice activities for teachers	1	2	2	4	8
b. IHE faculty are taking a greater leadership role in the improvement of science/math/computer education in the schools	1	2	3	4	8
c. IHEs have been able to leverage additional funds from other sources in support of improvements in math/science education	1	2	3	4	8
d. IHE faculty have a better understanding of the problems of K-12 math/science education	1	2	3	4	8

[4/40-43]

G8. **How burdensome are the federal reporting requirements for Title II?** (PLEASE CIRCLE ONE NUMBER)

1 Minimal and not burdensome

2 Burdensome, but consistent with the size and benefit of the program

3 Burdensome, out of proportion to the benefit of the program

[4/44]

Please record any other comments that will help us understand the impact of Title II funds in your state in the space provided at the end of the questionnaire.

H. TITLE II FUNDS IN RELATION TO OTHER RESOURCES

H1. **Does your agency administer other funds that are directly targeted at improving mathematics and science education in the elementary and secondary schools?**

0 No (GO TO SECTION I)

1 Yes (ANSWER QUESTIONS H2 AND H3)

[4/45]

H2. Of the total funding used by your agency specifically for improving elementary and secondary mathematics or science education in 1988-89, please give the percentage contributed by each source. (PLEASE GIVE YOUR BEST ESTIMATE)

a. Regular SAHE budget for math/science improvement _____%

b. In-kind contributions (e.g., staff salaries, space, supplies) _____%

c. EESA Title II higher education funds _____%

d. State special projects funds _____%

e. Corporate or foundation funds _____%

f. Other (PLEASE SPECIFY)

_____ _____%

Total 100%

[4/46-63]
[Dup 5/1-10]

H3. Please give the total of all funds (including your Title II higher education funds) available to the SAHE for elementary and secondary mathematics and science education improvement in each of the following years. (PLEASE GIVE YOUR BEST ESTIMATE)

a. 1985-86 (Year 1) $_____

b. 1986-87 (Year 2) $_____

c. 1987-88 (Year 3) $_____

d. 1988-89 (Year 4) $_____

e. 1989-90 (Year 5) $_____

[5/11-50]

I. ADDITIONAL COMMENTS (OPTIONAL)

II. Comments on competitive 207(b) grants to IHEs in your state:

_____

_____

_____

_____

_____

_____

[5/51]

I2. **Comments on the cooperative 207(c) projects/process in your state:**

[5/52]

I3. **Comments on the impact of the Title II program in your state:**

[5/53]

THANK YOU FOR YOUR COOPERATION

Please use the enclosed postage-paid envelope to return this questionnaire to:

Dr. Michael Knapp
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

National Study of the EESA Title II Program

SURVEY OF INSTITUTIONS OF HIGHER EDUCATION (IHEs) AND OTHER INSTITUTIONS WITH TITLE II-SUPPORTED PROJECTS

In this survey we are interested in learning about projects supported by your state agency for higher education with funds from Title II of the Education for Economic Security Act (EESA), the federal program primarily aimed at improving science and mathematics education in grades K-12. These projects include those funded as Title II "competitive grants" or "cooperative projects" in postsecondary education institutions (two-year and four-year colleges, universities, etc.) or other nonprofit institutions or organizations with an educational mission (e.g., science museums, professional societies).

You may have received more than one Title II grant over the last four years; please respond to items with the following project in mind:

ATTACH LABEL HERE

If this is a multiyear project, please respond with the most recent full year of the project (1988-89 school year), or else the whole project, as directed.

Unless other instructions are provided, for each question please circle all responses that apply or enter the appropriate numeric information.

[1/1-10]

A. BACKGROUND OF PROJECT DIRECTOR

A1. What is the title of the project for which you received Title II funding from your state's agency for higher education?

_____

_____

[1/11]

A2. How many months did (will) this project last? (PLEASE GIVE YOUR BEST ESTIMATE)

_____months [1/12-13]

A3. For the duration of the project, what percentage of your time did (will) you spend on this particular Title II-supported project? (PLEASE GIVE YOUR BEST ESTIMATE)

_____% of full-time [1/14-16]

A4. In addition to this project, what other responsibilities (a) do you now have and (b) did you have before receiving a Title II grant? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	(a) Now	(b) Before Title II
Coordination of special programs/projects	1	1
Teaching undergraduate- or graduate-level science, mathematics, or foreign language courses	2	2
University or departmental administration	3	3
Teaching teacher education courses	4	4
Administration related to teacher certification	5	5
Scientific or mathematical research	6	6
Other (PLEASE SPECIFY) _____	7	7

[1/17-30]

A5. What is your job title at this institution? (PLEASE CIRCLE ONE NUMBER)

1 Adjunct professor of _____

2 Instructor of _____

3 Assistant professor of _____

4 Associate or full professor of _____

5 Other (PLEASE SPECIFY) _____

_____

[1/31-33]

B. FOCUS OF TITLE II PROJECT

B1. What were the main purposes of your Title II project? (PLEASE CIRCLE ALL THAT APPLY)

1 Professional development* for practicing teachers

2 Preparation of new teachers

3 Retraining of teachers certified in other disciplines

4 Special certification program for individuals holding a non-education degree

5 Direct services to students

6 Curriculum development

7 Other (PLEASE SPECIFY) _____

[1/34-40]

B2. On what disciplines did your Title II project focus? (PLEASE CIRCLE ALL THAT APPLY)

1 Sciences

2 Mathematics

3 Computer education**

4 Foreign languages

5 Other (PLEASE SPECIFY) _____

[1/41-45]

B3. For which types and levels of teachers was this project designed? (PLEASE CIRCLE ALL THAT APPLY IN EACH ROW)

	Elementary School	Middle/ Junior High School	High School	No Specific Level
a. Certified teachers now in service	1	2	3	4
b. Uncertified teachers now in service	1	2	3	4
c. Undergraduate or graduate preservice teachers	1	2	3	4
d. Teachers working toward graduate degrees	1	2	3	4
e. Other (PLEASE SPECIFY) _____	1	2	3	4

_____

[1/46-65]

* "Professional development" includes all forms of inservice and continuing education, both inside and outside the district, for currently practicing teachers.

** "Computer education" = instruction in use of computers for curricular areas and purposes other than mathematics and science education.

B4. Were any of the project activities specifically designed for teachers working with particular student groups?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Gifted and talented students

2 Minority students

3 Handicapped students

4 Students with limited English proficiency

5 Other (PLEASE SPECIFY) _____

[1/66-70]

B5. Were some or all of the project activities directed towards teachers at particular levels of proficiency or expertise?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 "Lead" or "master" teachers, who will train others

2 Teachers adequately prepared in one area of math or science, needing retraining in another math or science discipline

3 Underprepared teachers currently assigned to math or science

4 Out-of-field or uncertified teachers who will soon be teaching math or science

5 Preservice teachers

6 Other (PLEASE SPECIFY) _____

[1/71-76]

B6. Was the project specifically designed to recruit, prepare, or provide inservice support to teachers or teacher candidates of minority background?

0 No

Yes, the project was designed to... (PLEASE CIRCLE ALL THAT APPLY)

1 Recruit teachers of minority background

2 Provide preservice support to teachers of minority background

3 Provide inservice support to teachers of minority background

[1/77-79]
[Dup 2/1-10]

C. DESCRIPTION OF THE PROJECT

C1. For the twelve-month period following the project award (e.g., 1988-89 school year plus summer of 1989), how many of each of the following types of participants received (or will receive) direct services from the project? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Public school teachers _____

b. Private school teachers _____

c. Teacher candidates _____

d. College/university students _____

e. K-12 students _____

f. Other (PLEASE SPECIFY) _____ _____

Total Number of Participants _____

[2/11-39]

C2. Please give the percentage of women participants and participants of minority background. (PLEASE GIVE YOUR BEST ESTIMATE)

a. Women participants _____%

b. Minority participants _____%

[2/40-45]

C3. How many school districts were involved with this project? (PLEASE GIVE YOUR BEST ESTIMATE)

_____

[2/46-48]

C4. Were all participants (or will they be) involved in project activities for approximately the same number of hours? (PLEASE CIRCLE THE APPROPRIATE NUMBER)

0 No (PLEASE ANSWER QUESTION C5)

1 Yes (PLEASE GO TO QUESTION C6)

[2/49]

C5. What are the minimum and maximum number of hours that individuals may have participated in project activities? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Minimum: _____ hours/participant

[2/50-55]

b. Maximum: _____ hours/participant

C6. Across all participants, what is the average number of hours per participant they were (or will be) involved with the project throughout its duration, including summer activities? (PLEASE GIVE YOUR BEST ESTIMATE)

[2/56-58]

_____

C7. Where did (or will) project activities take place? (PLEASE CIRCLE ALL THAT APPLY)

1 Main campus or building of my institution

2 Satellite campus or building of my institution

3 Local school district building

4 Other (PLEASE SPECIFY) _____

[2/59-62]

C8. What percentage of the project activities took (or will take) place during the following time periods? (PLEASE GIVE YOUR BEST ESTIMATE)

During the school day (8 a.m. - 3 p.m.)	_____%
Late afternoon/evening(s) after school hours	_____%
Weekends during the academic year	_____%
During the summer	_____%
Other (PLEASE SPECIFY) _____	_____%
Total	100%

[2/63-77]

[Dup 3/1-10]

C9. How many of each of the following type of individuals at your institution were (or are) employed on the Title II project? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Faculty or specialists in education	_____
b. Faculty or specialists in mathematics, science, computer science, foreign languages	_____
c. Graduate students	_____
d. Administrators at this institution	_____
e. K-12 teachers or subject specialists	_____
f. Consultants from outside this institution	_____
g. Other (PLEASE SPECIFY) _____	_____
Total Number of Project Participants	_____

[3/11-27]

C10. Do you have follow-up procedures that you use with those who participate in your Title II project?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 We provide follow-up training (e.g., through visits to participants' schools)

2 We evaluate the results of our project with a formal mail or telephone survey

3 We provide informal follow-up support to some individual participants

4 Other (PLEASE SPECIFY) _____

[3/28-31]

C11. Did some or all participants receive college or graduate credit for work done in connection with this project?

0 No [3/32]

1 Yes

D. APPROACH TO MATHEMATICS EDUCATION IMPROVEMENT

D1. Did your project focus on improving mathematics education?

0 No (PLEASE GO TO SECTION E)

1 Yes (PLEASE ANSWER QUESTIONS D2 THROUGH D4) [3/33]

D2. On which content/skill areas in mathematics did your project mainly focus? (PLEASE CIRCLE ALL THAT APPLY)

1 Arithmetic, computation skills

2 Arithmetic, problem-solving

3 Geometry

4 Probability, statistics, data analysis

5 Algebra

6 Advanced mathematics (e.g., calculus)

7 Other (PLEASE SPECIFY) _____

[3/34-40]

D3. Please indicate up to three important goals of your Title II-supported project related to improving mathematics education in the schools, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Develop a corps of mathematics specialists or "lead" teachers _____

Improve or update teachers' subject matter knowledge _____

Strengthen teachers' skills in teaching K-12 mathematics _____

Provide opportunities for teachers to develop mathematics activities or units _____

Introduce a new mathematics curriculum _____

Improve skills of preservice teachers _____

Other (PLEASE SPECIFY)

_____ _____

[3/41-43]

D4. Please indicate up to three specific curricular or instructional strategies in mathematics education that were an important focus of this project, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Increased use of manipulatives _____

Incorporation of calculators into the curriculum _____

Integration of technology (e.g., computers) into the mathematics curriculum _____

Increased emphasis on problem-solving and higher-order thinking skills _____

Introduction of cooperative learning techniques _____

Increased emphasis on applications of mathematics _____

Methods of teaching/reaching minority or disadvantaged populations _____

Other (PLEASE SPECIFY)

_____ _____

[3/44-46]

E. APPROACH TO SCIENCE EDUCATION IMPROVEMENT

E1. Did your project focus on improving science education?

0 No (PLEASE GO TO SECTION F)

1 Yes (PLEASE ANSWER QUESTIONS E2 THROUGH E4) [3/47]

E2. On which scientific disciplines or fields did your project concentrate? (PLEASE CIRCLE ALL THAT APPLY)

1 Physical sciences (chemistry, physics)

2 Biology/life sciences

3 Earth sciences/astronomy

4 "General" science

5 Other (PLEASE SPECIFY) _____

[3/48-52]

E3. Please indicate up to three important goals of your Title II-supported project related to improving science education in the schools, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Develop a corps of science specialists or "lead" teachers _____

Improve or update teachers' knowledge of scientific disciplines _____

Strengthen teachers' pedagogical skills in science _____

Provide opportunities for teachers to develop science activities or units _____

Introduce a new science curriculum _____

Improve skills of preservice teachers _____

Other (PLEASE SPECIFY) _____ _____

[3/53-55]

E4. Please indicate up to three specific curricular or instructional strategies in science education that were an important focus of this project, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Increased use of the laboratory or other hands-on approaches to science education _____

Integration of technology (e.g., computers) into the science curriculum _____

Increased use of demonstrations and concrete examples in the classroom _____

Increased emphasis on problem solving and higher-order thinking skills _____

Introduction of cooperative learning techniques _____

Increased emphasis on the social implications of science and technology _____

Methods of teaching/reaching minority or disadvantaged populations _____

Other (PLEASE SPECIFY) _____ _____

[3/56-58]

F. APPROACH TO IMPROVING FOREIGN LANGUAGES EDUCATION

F1. Did your project focus on improving foreign languages education?

0 No (PLEASE GO TO SECTION G)

1 Yes (PLEASE ANSWER QUESTIONS F2 AND F3)

[3/59]

F2. Please indicate up to three important goals of your Title II-supported project related to improving foreign language education, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Enlarge the pool of foreign language teachers _____

Improve the oral proficiency of foreign language teachers _____

Improve the articulation of foreign language instruction across grades _____

Promote foreign language instruction at the elementary school level _____

Teach a new foreign language to existing foreign language teachers _____

Improve skills of preservice teachers _____

Other (PLEASE SPECIFY)_____ _____

[3/60-62]

F3. Please indicate up to three specific curricular or instructional strategies in foreign language education that were an important focus of this project, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Attention to oral language instruction _____

Use of technology in foreign language instruction _____

A cultural approach to foreign language instruction _____

Use of proficiency-based instruction and assessment techniques _____

A multimedia approach to foreign language instruction _____

Other (PLEASE SPECIFY) _____ _____

[3/63-65]

G. APPROACH TO IMPROVING COMPUTER EDUCATION

G1. Did your project focus on improving computer education (apart from mathematics or science education)?

[3/66]

0 No (PLEASE GO TO SECTION H)

1 Yes (PLEASE ANSWER QUESTION G2)

G2. Apart from mathematics and science instruction, what were the goals of your Title II project related to improving computer education in the schools? (PLEASE CIRCLE ALL THAT APPLY)

"Title II grant funds..."

1 Provided computer hardware or software for courses in areas other than mathematics and science (PLEASE SPECIFY)

_____

2 Provided computer hardware or software for use in many curricular areas (e.g., by setting up a general-purpose computer laboratory)

3 Supported staff development related to computer literacy

4 Other (PLEASE SPECIFY) _____

_____

[3/67-70]

H. ADMINISTRATION OF THE TITLE II-SUPPORTED PROJECT

H1. In what ways (if any) have you involved local school districts in your Title II project? (PLEASE CIRCLE ALL THAT APPLY)

0 None

1 We worked closely with one or two school districts and trained teachers from these districts only

2 We involved a large consortium of school districts and trained one or more teachers from each

3 The training we offered was op n to teachers from any district wishing to participate

4 Other (PLEASE SPECIFY) _____

[3/71-74]

H2. What other organizations were partners in your project? (PLEASE CIRCLE ALL THAT APPLY)

0 None

1 State agency for higher education (SAHE)

2 One or more other higher education institutions

3 Private business and industry

4 Museums and other private, nonprofit institutions

5 Professional societies or associations

6 Other (PLEASE SPECIFY) _____

[3/75-80]
[Dup 4/1-10]

H3. Has the state agency for higher education (SAHE) been involved with your Title II project?

0 No

Yes, the SAHE... (PLEASE CIRCLE ALL THAT APPLY)

1 Encouraged us to apply for the grant

2 Provided technical assistance during proposal development

3 Provided technical assistance during the grant award period

4 Evaluated our project

5 Other (PLEASE SPECIFY) _____

[4/11-15]

H4. In what ways (if at all) do you assess the effectiveness of your Title II-supported project?

0 No assessment is done

The project... (PLEASE CIRCLE ALL THAT APPLY)

1 Solicits participants' testimonials or opinions

2 Observes or otherwise appraises participants' performance

3 Compares student performance (e.g., in participants' classes) before and after project participation

4 Gathers anecdotal evidence

5 Carries out other forms of assessment (PLEASE SPECIFY)

_____

[4/16-20]

H5. What is done with the results of assessments (if any) described above?

0 Not applicable; no assessment is done

The results are... (PLEASE CIRCLE ALL THAT APPLY)

1 Reported back to participants or participating organizations

2 Sent to the state funding agency

3 Used in further project planning

4 Used in other ways (PLEASE SPECIFY)

_____

[4/21-24]

I. RECEIPT OF TITLE II FUNDS

I1. How was your Title II grant awarded? (PLEASE CIRCLE ONE NUMBER)

1 As a competitive grant under Section 207(b) of EESA Title II

2 As a "cooperative project" under Section 207(c) of EESA Title II

8 Don't know [4/25]

I2. **For your project (including extensions beyond this academic year) how much Title II funding (excluding any matching funds you may have provided) were you awarded for each of the following years?** (PLEASE GIVE YOUR BEST ESTIMATE)

a. 1988-89 (including summer 1989) $_____

b. 1989-90 (if additional or follow-up funding has been awarded) $_____

Total Title II funds awarded for the project $_____

[4/26-49]

I3. **If you received Title II funds in earlier years for this or closely related project(s) (e.g., if your current grant is a continuation of earlier work), indicate how much funding was received for each year.** (PLEASE GIVE YOUR BEST ESTIMATE; PUT AN ENTRY ON EACH LINE, EVEN IF "0.")

a. 1985-86 (Year 1 of Title II) $_____

b. 1986-87 (Year 2 of Title II) $_____

c 1987-88 (Year 3 of Title II) $_____

[4/50-73]

I4. **To the best of your knowledge, has your institution directly received other Title II grants unrelated to your project?**

0 No

1 Yes

8 Don't know

[4/74]
[Dup 5/1-10]

I5. **Counting Title II funds only, what was your project budget (1987-88 or 1988-89 award, as specified on the cover of this questionnaire)?** (PLEASE GIVE YOUR BEST ESTIMATE)

a. Salaries and fringe benefits $_____

b. Overhead _____

c. Consultant fees and expenses _____

d. Equipment _____

e. Supplies and materials _____

f. Staff and participant travel _____

g. Participant stipends _____

h. Other (PLEASE SPECIFY) _____ _____

Total Budget (Title II $ only) $_____

[5/11-82]
[Dup 6/1-10]

I6. **Did your project receive additional money or in-kind support from sources other than Title II?**

0 No (PLEASE GO TO SECTION J)

[6/11]

1 Yes (PLEASE ANSWER QUESTIONS I7 AND I8)

I7. **Was your Title II grant an important factor in leveraging funding from other sources (e.g., through matching funds)?** (PLEASE CIRCLE ONE NUMBER)

0 No, of little or no importance

1 Yes, but of minor importance

2 Yes, an important factor

[6/12]

8 Don't know

I8. **What was the total amount of money or estimated value of matching or in-kind support that your project received from the sources listed below?**

a. Budget of my department/institution $_____

b. Other funds from my institution (e.g., research money) _____

c. In-kind support from my institution (estimate) _____

d. Federal funds (other than Title II) _____

e. State funds _____

f. School district funds _____

g. Private sector monies _____

h. Other matching or in-kind support (estimate)

(PLEASE SPECIFY) _____ _____

Total Other Support $_____

[6/13-84]

[Dup 7/1-10]

J. OVERALL IMPACT OF THE TITLE II PROJECT

J1. As a result of this Title II project, how has the level of interaction between your institution and the following groups changed? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

Interactions with...	...Have Decreased	...Have Remained the Same	...Have Increased	Don't Know
a. School districts	1	2	3	8
b. Private schools	1	2	3	8
c. Colleges/universities	1	2	3	8
d. The stage agency for higher education (SAHE)	1	2	3	8
e. Business and industry	1	2	3	8
f. Private nonprofit institutions	1	2	3	8
g. Professional organizations and associations	1	2	3	8

[7/11-17]

J2. Is your institution a college or university?

0 No (PLEASE GO TO QUESTION J4)

1 Yes (PLEASE ANSWER QUESTION J3)

J3. How have attitudes within the institution been affected by the Title II project? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"The project has promoted..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
a. Greater interaction between education and discipline-based departments	1	2	3	4	8
b. Greater faculty interest in the schools' problems with science and mathematics education	1	2	3	4	8
c. Increased commitment by the administration or department(s) to helping the schools	1	2	3	4	8
d. A better understanding among faculty of the problems of K-12 math/science education	1	2	3	4	8
e. Greater faculty interest or understanding of the problems with foreign language education	1	2	3	4	8

[7/18-22]

J4. **Has your Title II-supported project influenced the degree of collaboration between your institution and one or more local school districts (LEAs)?**

0 No

Yes, the Title II-supported project has... (PLEASE CIRCLE ONE NUMBER)

1 Started a new collaborative relationship with one or more local LEAs

2 Strengthened existing collaborative relationships with one or more local LEAs

3 Had other effects on our relationship with LEAs (PLEASE SPECIFY)

_____

_____

[7/23-25]

J5. **In your opinion, how has your Title II-supported project improved education in the schools?** (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"There is now greater emphasis on..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
a. A laboratory or hands-on approach to science	1	2	3	4	8
b. Science at the elementary or junior high school levels	1	2	3	4	8
c. Mathematical applications and problem solving	1	2	3	4	8
d. The use of manipulatives or calculators in mathematics	1	2	3	4	8
e. The integration of technology into science and mathematics education	1	2	3	4	8
f. Oral proficiency in foreign language education	1	2	3	4	8
g. Higher-order thinking skills in math or science education	1	2	3	4	8
h. The involvement of under-represented groups (e.g., minorities, women) in science and mathematics	1	2	3	4	8
i. Other (PLEASE SPECIFY) _____	1	2	3	4	8

[7/26-34]

_____

THANK YOU FOR YOUR COOPERATION

Please use the enclosed postage-paid envelope to return this questionnaire to:

Dr. Michael Knapp
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

Please attach a project abstract or synopsis if one is available.

[7/35]

National Study of the EESA Title II Program

LOCAL EDUCATION AGENCY (LEA) SURVEY

In this survey we are interested in your district's experiences with Title II of the Education for Economic Security Act (EESA), the federal program primarily aimed at improving science and mathematics education in grades K-12. Your district most likely receives an annual allocation of Title II funds to support professional development of teachers, among other uses. Even if your district does not receive Title II funds, we would still appreciate your responses to questions in sections A, B, and M.

Unless other instructions are provided, for each question please circle all responses that apply or enter the appropriate numeric information.

[1/1-10]

A. EDUCATIONAL IMPROVEMENT NEEDS IN YOUR DISTRICT

A1. Of the following subject areas/levels, please indicate the three tha needed the most improvement in your district in (1) the 1988-89 school year and (2) the 1985-86 school year, and ran' them by assigning a "1," " "2," or "3," with "1" = "most needed."

	1988-89	1985-86
Elementary school mathematics	_____	_____
Elementary school science	_____	_____
Middle/junior high mathematics	_____	_____
Middle/junior high science	_____	_____
High school mathematics	_____	_____
High school science	_____	_____
Foreign languages (all grade levels)	_____	_____
Computer education* (all grade levels)	_____	_____

[1/11-16]

A2. For the three areas that you marked in Question A1 for 1988-89, please indicate up to three important changes that were needed.

	Area Ranked #1 Needed:	Area Ranked #2 Needed:	Area Ranked #3 Needed:
Better curricula	1	1	1
More or better equipment/facilities for instruction	2	2	3
Improved preparation or motivation among teachers	3	3	3
A larger supply of qualified teachers	4	4	4
Better methods of assessing student learning	5	5	5
Improved access/services for female students	6	6	6
Improved access/services for minority students	7	7	7
Other (PLEASE SPECIFY) _____	8	8	8

[1/17-25]

* "Computer education" = instruction in us' of computers for curricular areas and purposes other than mathematics and science education.

A3. For the three areas that you marked in Question A1 for 1985-86, please indicate up to three important changes that were needed.

	Area Ranked #1 Needed:	Area Ranked #2 Needed:	Area Ranked #3 Needed:
Better curricula	1	1	1
More or better equipment/ facilities for instruction	2	2	2
Improved preparation or motivation among teachers	3	3	3
A larger supply of qualified teachers	4	4	4
Better methods of assessing student learning	5	5	5
Improved access/services for female students	6	6	6
Improved access/services for minority students	7	7	7
Other (PLEASE SPECIFY) _____	8	8	8

[1/26-34]

A4. Did your district offer inservice training in mathematics, science, foreign languages, or computer education during the 1988-89 school year (including the summer of 1989), whether or not supported by Title II?

No (CIRCLE "0") 0

Yes (INDICATE UP TO THREE SUBJECT AREAS OR GRADE LEVELS IN WHICH THE MOST TRAINING WAS PROVIDED, AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "MOST TRAINING PROVIDED")

Elementary school mathematics _____

Elementary school science _____

Middle/junior high school mathematics _____

Middle/junior high school science _____

High school mathematics _____

High school science _____

Foreign language (all grade levels) _____

Computer education (all grade levels) _____

[1/35-37]

B. RECEIPT OF TITLE II FUNDS

B1. How much did your district receive in Title II EESA formula grants for each year of the Title II program? (PLEASE GIVE YOUR BEST ESTIMATE)

a. 1985-86 (Year 1) $_____

b. 1986-87 (Year 2) $_____

c. 1987-88 (Year 3) $_____

d. 1988-89 (Year 4) $_____

e. 1989-90 (Year 5) (received) $_____

[1/38-77]

B2. If you received no Title II money for one or more of the school years above, indicate the reason(s). (PLEASE CIRCLE ALL THAT APPLY)

1 The amount of money available was too small to bother with.

2 The cost of administration and paperwork outweighed the benefit.

3 The state has not yet approved our application for 1989-90.

4 Our district has received Title II-funded services through a consortium or regional arrangement, which received our formula grant on our behalf.

5 Other reason (PLEASE SPECIFY) _____

[1/78-82]

IF YOU HAVE NEVER RECEIVED TITLE II FORMULA FUNDING OR SERVICES OF ANY KIND, PLEASE GO TO SECTION M.

C. BACKGROUND OF TITLE II COORDINATOR/STAFF

C1. During which school years have you been Title II coordinator for this district? (PLEASE CIRCLE ALL THAT APPLY)

1 1985-86 (Year 1)

2 1986-87 (Year 2)

3 1987-88 (Year 3)

4 1988-89 (Year 4)

5 1989-90 (Year 5)

[Dup 2/1-10]
[2/11-15]

C2. How many employees in the district are assigned Title II responsibilities full time or part time? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Employees full time on Title II _____

b. Employees part time on Title II _____

[2/16-19]

C3. What other responsibilities (a) do you and other staff who are assigned to Title II currently hold and (b) what did you hold before Title II? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	(a) Now	(b) Before Title II
None	0	0
Coordinating or supervising mathematics education	1	1
Coordinating or supervising science education	2	2
Managing other federal or state programs	3	3
Managing district staff development/teacher training	4	4
General administration of curriculum and instruction	5	5
Classroom teaching	6	6
Other (PLEASE SPECIFY) _____	7	7

[2/20-33]

D. PROFESSIONAL DEVELOPMENT ACTIVITIES*

D1. Have you used 1988-89 (Year 4) Title II formula funds to support any kind of professional development* for teachers in your district?

0 No (PLEASE GO TO SECTION E)

1 Yes (PLEASE ANSWER QUESTIONS D2 THROUGH D8)

[2/34]

D2. In your district, how many teachers during 1988-89 (including the summer of 1989) were fully or partly supported with Title II funds to attend the following? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Within-district inservice training _____

b. Out-of-district professional meetings and conferences _____

c. College or university courses _____

d. Other events outside the district (PLEASE SPECIFY)

_____ _____

[2/35-50]

* "Professional development" includes all forms of inservice and continuing education, both inside and outside the district, for currently practicing teachers.

D3. Title II-supported professional development in 1988-89 was mainly aimed at teachers from which subject areas and levels? (PLEASE CIRCLE ALL THAT APPLY IN EACH ROW)

	Elementary School	Middle/ Junior High School	High School	All Levels
a. Mathematics teachers	1	2	3	4
b. Science teachers	1	2	3	4
c. Foreign language teachers	1	2	3	4
d. Computer education teachers	1	2	3	4

[2/51-66]

D4. Were some or all of these Title II-supported professional development activities directed towards teachers at particular levels of proficiency or expertise?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 "Lead" or "master" teachers, who will train others

2 Teachers adequately prepared in one area of math or science, who need retraining in another math or science discipline

3 Underprepared teachers currently assigned to math and science

4 Out-of-field or uncertified teachers

5 Preservice teachers

6 Other _____

[2/67-72]

D5. Were some or all of these professional development activities specifically designed for teachers working with particular student groups?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Gifted and talented students

2 Minority students

3 Handicapped students

4 Students with limited English proficiency

5 Other (PLEASE SPECIFY) _____ _____

[2/73-77]
[Dup 3/1-10]

D6. How many of each of the following types of teachers participated in 1988-89 Title II-supported professional development? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Female teachers _____

b. Minority teachers _____

c. Private school teachers _____

[3/11-22]

D7. Who mainly provided Title II-supported inservice training in your district in 1988-89? (PLEASE CIRCLE ALL THAT APPLY)

1 District teachers

2 District specialists in the subject area

3 Commercial workshop providers (e.g., from publishers)

4 College or university faculty

5 Other outside experts (e.g., museum staff)

6 Consortium or intermediate unit training staff or consultants

7 Other (PLEASE SPECIFY) _____

8 Don't know

[3/23-30]

D8. How many total "contact hours" of credit or noncredit training were provided in Title II-supported inservice training during the 1988-89 school year and summer of 1989? (NOTE: 1 TEACHER FOR 1 HOUR = 1 CONTACT HOUR) (PLEASE GIVE YOUR BEST ESTIMATE)

_____

[3/31-34]

D9. In the first three years of the program, what professional development activities were supported by Title II funds in your district? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

Title II-Supported attendance at ...	Year 1 (1985-86)	Year 2 (1986-87)	Year 3 (1987-88)
No professional development activities	0	0	0
Within-district inservice training	1	1	1
Out-of-district professional meetings and conferences	2	2	2
College or university courses	3	3	3
Other events outside the district	4	4	4

[3/35-46]

D10. In the first three years of the program, Title II-supported professional development was mainly aimed at which subject areas? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	Year 1 (1985-86)	Year 2 (1986-87)	Year 3 (1987-88)
Not applicable; no professional development activities	0	0	0
Mathematics	1	1	1
Sciences	2	2	2
Foreign languages	3	3	3
Computer education	4	4	4

[3/47-58]

E. OTHER EDUCATIONAL IMPROVEMENT ACTIVITIES

E1. Have you used 1988-89 (Year 4) Title II formula funds for anything besides professional development?

0 No (PLEASE GO TO SECTION F)

1 Yes (PLEASE ANSWER QUESTION E2)

[3/59]

E2. In what ways have the funds been used? (PLEASE CIRCLE ALL THAT APPLY)

1 Purchase of computer hardware

2 Purchase of computer software

3 Upgrading mathematics or science curricular materials

4 Other (PLEASE SPECIFY) _____

[3/60-63]

F. APPROACH TO MATHEMATICS EDUCATION IMPROVEMENT

F1. Did any of your district's 1988-89 Title II-supported activities focus on improving mathematics education?

0 No (PLEASE GO TO SECTION G)

1 Yes (PLEASE ANSWER QUESTIONS F2 THROUGH F4)

[3/64]

F2. On which content/skill areas in mathematics did your district's 1988-89 Title II-supported activities mainly focus? (PLEASE CIRCLE ALL THAT APPLY)

1 Arithmetic, computation skills

2 Arithmetic, problem-solving

3 Geometry

4 Probability, statistics, data analysis

5 Algebra

6 Advanced mathematics (e.g., calculus)

7 Other (PLEASE SPECIFY) _____

[3/65-71]

F3. Please indicate up to three important goals of these mathematics education improvement activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Develop a corps of mathematics specialists or "lead" teachers _____

Improve or update teachers' subject matter knowledge _____

Strengthen teachers' skills in teaching K-12 mathematics _____

Provide opportunities for teachers to develop mathematics activities or units _____

Introduce a new mathematics curriculum _____

Improve skills of teacher interns or student teachers _____

Other (PLEASE SPECIFY) _____ _____

[3/72-74]

F4. Please indicate up to three curricular/instructional strategies in mathematics education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Increased use of manipulatives _____

Incorporation of calculators into the curriculum _____

Integration of technology (e.g., computers) into the mathematics curriculum _____

Increased emphasis on problem-solving and higher-order thinking skills _____

Introduction of cooperative learning techniques _____

Increased emphasis on applications of mathematics _____

Methods of teaching/reaching minority or disadvantaged populations _____

Other (PLEASE SPECIFY) _____ _____

[3/75-77]

G. APPROACH TO SCIENCE EDUCATION IMPROVEMENT

G1. Did any of your 1988-89 Title II-supported activities focus on improving science education?

0 No (PLEASE GO TO THE SECTION H)

1 Yes (PLEASE ANSWER QUESTIONS G2 THROUGH G4)

[3/78]
[Dup 4//1-10]

G2. On which scientific disciplines or fields did your 1988-89 Title II-supported activities focus? (PLEASE CIRCLE ALL THAT APPLY)

1 Physical sciences (chemistry, physics)

2 Biology/life sciences

3 Earth sciences/astronomy

4 "General" science

5 Other (PLEASE SPECIFY) _____

[4/11-15]

G3. Please indicate up to three important goals of these science education improvement activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Develop a corps of science specialists or "lead" teachers _____

Improve or update teachers' subject matter knowledge _____

Strengthen teachers' pedagogical skills in science _____

Provide opportunities for teachers to develop science activities or units _____

Introduce a new science curriculum _____

Improve skills of teacher interns or student teachers _____

Other (PLEASE SPECIFY) _____ _____

[4/16-18]

G4. Please indicate up to three curricular/instructional strategies in science education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Increased use of the laboratory or other "hands-on" approaches ____

Integration of technology (e.g., computers) into the science curriculum ____

Increased use of demonstrations and concrete examples in the classroom ____

Increased emphasis on problem solving and higher-order thinking skills ____

Introduction of cooperative learning techniques ____

Increased emphasis on the social implications of science and technology ____

Methods of teaching/reaching minority or disadvantaged populations ____

Other (PLEASE SPECIFY) _____ ____

[4/19-21]

H. APPROACH TO THE IMPROVEMENT OF FOREIGN LANGUAGES EDUCATION

H1. Did any of your 1988-89 Title II-supported activities focus on improving foreign language education?

0 No (PLEASE GO TO SECTION I)

1 Yes (PLEASE ANSWER QUESTIONS H2 AND H3)

[4/22]

H2. Please indicate up to three important goals of your 1988-89 Title II-supported activities aimed at improving foreign language education and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Enlarge the pool of foreign language teachers ____

Improve the oral proficiency of foreign language teachers ____

Improve the articulation of foreign language instruction across grades ____

Promote foreign language instruction at the elementary school level ____

Teach a new language to existing foreign language teachers ____

Improve the skills of teacher interns or student teachers ____

Other (PLEASE SPECIFY)

_____ ____

[4/23-25]

H3. **Please indicate up to three curricular/instructional strategies in foreign language education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Attention to oral language instruction _____

Use of technology in foreign language instruction _____

A cultural approach to foreign language instruction _____

Use of proficiency-based instruction and assessment techniques _____

A multimedia approach to foreign language instruction _____

Other (PLEASE SPECIFY)

_____ _____

[4/26-28]

I. APPROACH TO IMPROVING COMPUTER EDUCATION

I1. **Did any of your 1988-89 Title II-supported activities focus on improving computer education outside of mathematics or science education?**

0 No (PLEASE GO TO SECTION J)

1 Yes (PLEASE ANSWER QUESTION I2)

[4/29]

I2. **What were the goals of your 1988-89 Title II-supported activities aimed at improving computer education in your district?** (PLEASE CIRCLE ALL THAT APPLY)

1 Provide computer hardware or software for courses in areas other than mathematics and science (PLEASE SPECIFY)

_____

2 Provide computer hardware or software for use in many curricular areas (e.g., by setting up a general-purpose computer laboratory)

3 Support staff development related to computer literacy

4 Other (PLEASE SPECIFY) _____

_____

[4/30-33]

J. ADMINISTRATION AND DECISIONMAKING

J1. Please indicate up to three groups that exerted the most influence on your district's planning for the use of 1988-89 (including the summer of 1989) Title II funds, and rank them by assigning a "1," "2," or "3," with "1" = "most influential."

Local mathematics or science coordinators or specialists _____

Top administrators in the district office _____

Regional or intermediate education units _____

Teachers and principals from district schools _____

Private school teachers or administrators _____

Parents and citizens _____

College/university staff _____

State department of education (SEA) staff _____

Other (PLEASE SPECIFY) _____ _____

[4/34-36]

J2. Please indicate up to three factors that had the greatest effect on your district's decisions about the use of Title II formula funds in the 1988-89 school year (including the summer of 1989), and rank them by assigning a "1," "2," or "3," with "1" = "most influential."

Uncertainty about levels of funding from year to year _____

Federal/state regulations, guidelines, or priorities _____

The absolute amount of funds received _____

Established district priorities _____

Availability of appropriate staff to conduct inservice training _____

Other (PLEASE SPECIFY) _____ _____

[4/37-39]

J3. Did the district's Title II program receive assistance from the state's Title II coordinator or staff during the 1988-89 school year (including the summer of 1989)?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Explanation of the law and regulations for Title II (including changes due to reauthorization)

2 Helping us conduct the district's needs assessment

3 Arranging special services for teachers or students

4 Providing information about exemplary projects

5 Helping us monitor or evaluate our use of Title II funds

6 Other (PLEASE SPECIFY) _____

[4/40-45]

J4. Did your district have problems with the fiscal management of its Title II program?

0 No

Yes, our district... (PLEASE CIRCLE ALL THAT APPLY)

1 Was not adequately reimbursed for administrative costs

2 Did not know its annual allocation early enough to plan adequately

3 Did not receive funds in time to pay for some expenditures

4 Other (PLEASE SPECIFY) _____

[4/46-49]

J5. Has your district joined forces with any of the following organizations in carrying out activities supported by Title II funds?

0 No

Yes -- Which ones? (PLEASE CIRCLE ALL THAT APPLY)

1 Other local school districts

2 Institutions of higher education (IHEs)

3 Private business and industry

4 Museums and other private, nonprofit institutions

5 Professional societies or associations

6 Regional or intermediate education units

7 Other (PLEASE SPECIFY) _____

[4/50-56]

J6. In what ways (if at all) do you assess the effectiveness of Title II-supported activities on mathematics and science improvement programs of which they are a part?

0 No assessment is done

The district... (PLEASE CIRCLE ALL THAT APPLY)

1 Solicits teachers' testimonials or opinions

2 Observes or otherwise appraises teachers' performance

3 Compares student performance before and after improvement activities

4 Gathers anecdotal evidence

5 Carries out other forms of assessment (PLEASE SPECIFY)

_____

[4/57-61]

J7. How are the results of the assessments noted above (if any) used?

0 Not applicable; no assessment is done

The results are... (PLEASE CIRCLE ALL THAT APPLY)

1 Reported back to teachers

2 Sent to the state agency

3 Included in subsequent local needs assessments

4 Considered informally in planning

5 Used in other ways (PLEASE SPECIFY)

_____

[4/62-66]

K. USE OF TITLE II FORMULA FUNDS

K1. How did the district divide its 1988-89 (Year 4) Title II formula funds among the following types of activities? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Within-district inservice teacher training (includes stipends, cost of substitute teachers, etc.) _____%

b. Out-of-district professional development for teachers (attending conferences, taking courses, etc.) _____%

c. Curriculum development (if permitted in your state) _____%

d. Purchase of computers and other educational technology or software (if permitted) _____%

e. Administrative costs _____%

g. Other (PLEASE SPECIFY)

_____ _____%

Total: 100%

[4/67-84]
[Dup 5/1-10]

K2. Of the district's 1988-89 (Year 4) Title II formula funds, what percentage has been allocated to each of the following disciplines? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Sciences _____%

b. Mathematics _____%

c. Foreign languages _____%

d. Computer education (if not considered part of science or mathematics) _____%

Total: 100%

[5/11-22]

K3. On September 30, 1989, what percentage of your district's 1988-89 (Year 4) funds still remained unspent? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[5/23-25]

K4. How have you allocated your 1988-89 (Year 4) Title II formula funds among the following? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Salaries and fringe benefits $_____

b. Consultant fees and expenses $_____

c. Equipment (if permitted--e.g., for use in training teachers) $_____

d. Materials and supplies $_____

e. Travel costs, conferences $_____

f. Participant stipends $_____

g. Other (PLEASE SPECIFY)

_____ $_____

Total $_____

[5/26-82]

K5. Of the total funding in 1988-89 for professional development activities that were supported in whole or in part by Title II, what percentage of the funding came from Title II? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[5/83-85]
[Dup 6/1-10]

K6. In the 1988-89 school year, which of the following also contributed resources to activities that received Title II support? (PLEASE CIRCLE ALL THAT APPLY)

1 Regular district budget

2 ECIA Chapter 2 funds

3 National Science Foundation funds

4 Specially earmarked state funds

5 Corporate or foundation gifts

6 Other source (PLEASE SPECIFY) _____

8 Don't know

[6/11-17]

K7. What percentage of the 1988-89 (Year 4) formula allocation was used to support services that directly or indirectly benefitted private school students in your district? (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[6/18-20]

K8. How many private school students reside within your district's boundaries? (PLEASE GIVE YOUR BEST ESTIMATE)

_____ students

[6/21-25]

L. OVERALL IMPACTS OF TITLE II ON YOUR DISTRICT

L1. In your district, how (if at all) have Title II-supported activities contributed to student learning and participation in mathematics, science, and foreign languages education? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

"Title II-supported activities have..."	Mathematics	Sciences	Foreign Languages
Had little observable influence on students	1	1	1
Improved student interest in the discipline(s)	2	2	2
Helped increase enrollments in required or elective courses	3	3	3
Increased participation in extracurricular activities	4	4	4
Improved students' knowledge and skills	5	5	5
Not sure	8	8	8

[6/26-43]

L2. On what kinds of evidence do you base your responses to question L1 above? (PLEASE CIRCLE ALL THAT APPLY)

1 Teachers' testimonials

2 Students' comments (e.g., from interview or questionnaire)

3 Student performance measures

4 Student participation counts

5 Other evidence (PLEASE SPECIFY)

_____

[6/44-48]

L3. In your view, how much has Title II funding affected the following aspects of professional development in your district? (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Title II funding has ..."	Not at All	Some-what	A Fair Amount	A Great Deal
a. Increased the number of teachers served in our district	1	2	3	4
b. Increased the time teachers can spend in professional development activities	1	2	3	4
c. Permitted us to hire better-quality inservice trainers or expert consultants	1	2	3	4
d. Allowed more release time for teachers	1	2	3	4
e. Provided incentives (stipends, sabbatical leave credits, etc.) for teacher participation	1	2	3	4
f. Provided travel to professional development opportunities	1	2	3	4
g. Paid for more equipment and facilities, such as computers and science labs	1	2	3	4
h. Other (PLEASE SPECIFY) _____ _____	1	2	3	4

[6/49-56]

L4. Please indicate your degree of agreement or disagreement with these statements about the contributions of Title II formula funding (across all 4 years of the program) in your district. (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Title II funding has..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Don't Know
a. Helped the district to serve particular student groups (minorities, females, gifted and talented, learning disabled)	1	2	3	4	8
b. Helped clarify priorities for science and mathematics instruction	1	2	3	4	8
c. Helped initiate projects we would otherwise have difficulty funding	1	2	3	4	8
d. Had little impact in this district	1	2	3	4	8
e. Stimulated joint programming with other districts or institutions	1	2	3	4	8
f. Provided the primary source of funding for math/science improvement activities	1	2	3	4	8
g. Helped us leverage other sources of funding (e.g., by using Title II as matching funds)	1	2	3	4	8

[6/57-63]

M. OTHER TITLE II FUNDS AND SERVICES

M1. To what extent has your district become aware of any Title II-supported "Demonstration and/or Exemplary" (D&E) projects funded by the state education agency (SEA)? (PLEASE CIRCLE ALL THAT APPLY)

1 We have little or no knowledge of these projects

2 We were sent an announcement (e.g., RFP) of a competition for Title II awards

3 We received information from the SEA about D&E projects under way

4 We learned about Title II-supported D&E projects from sources other than the SEA

[6/64-67]

M2. How has your district benefitted from the D&E projects supported by Title II? (PLEASE CIRCLE ALL THAT APPLY)

1 We have benefitted minimally, or not at all

2 We have received one or more awards for D&E projects

3 We have received services or assistance from other D&E projects

4 Other (PLEASE SPECIFY) _____

8 Don't know

[6/68-72]

M3. To what extent has your district become aware of any Title II-supported "higher education" projects* funded by your state agency for higher education (SAHE)? (PLEASE CIRCLE ALL THAT APPLY)

1 We have little or no knowledge of these projects

2 We have worked with one or more institutions (e.g., a college) to apply for a "higher education" award

3 We received information from the state about specific "higher education" projects under way

4 We learned about Title II-supported "higher education" projects from sources other than the state

[6/73-76]

* Title II "higher education" projects include those funded by the state as "competitive grants" or "cooperative" projects" and typically involve an institution of higher education (IHE), one or more school districts, and often other institutions in a partnership arrangement.

M4. How has your district benefitted from the "higher education" projects supported by Title II? (PLEASE CIRCLE ALL THAT APPLY)

1 We have benefitted minimally, or not at all

2 Some of our district's teachers participated in a "higher education" project with an institution that received an award

3 This district has been a collaborator in a "higher education" project, with an institution that received an award

4 Other (PLEASE SPECIFY) _____

8 Don't know

[6/77-81]

THANK YOU FOR YOUR COOPERATION

Please use the enclosed postage-paid envelope to return this questionnaire to:

Dr. Michael Knapp
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

National Study of the EESA Title II Program

INTERMEDIATE UNIT/CONSORTIUM SURVEY

In this survey we are interested in your agency's or consortium's experiences with Title II of the Education for Economic Security Act (EESA), the federal program primarily aimed at improving science and mathematics education in grades K-12. The questionnaire contains three types of questions:

- Questions about your agency and what you do with Title II funds;
- Questions about all of the districts that you serve and the total amount of district participation in Title II services;
- Questions about the district named below and the services it has received or would be likely to have received in the last school year (1988-89, including the survey of 1989).

ATTACH LABEL HERE

Please answer the items in this questionnaire as best you can. Any information that you provide will be greatly appreciated. Unless other instructions are provided, for each question please circle all responses that apply or enter the appropriate numeric information.

[ID 1/1-10]

A. ABOUT YOUR AGENCY OR CONSORTIUM

A1. What type of educational agency or consortium are you?

1 Supervisory union

2 Board of cooperative education services (BOCES)

3 Area education agency (AEA)

4 Other intermediate units (e.g., regional educational service centers, county education offices in some states)

5 District that coordinates a consortium of districts

6 Other (PLEASE DESCRIBE)_____ _____

[1/11]

A2. How many school districts (of different enrollment sizes) receive (or can receive) services through your agency or consortium?

District Enrollment Size	Number of Districts
25,000 or more	_____
10,000 - 24,999	_____
2,500 - 9,999	_____
600 - 2,499	_____
Less than 600	_____

[1/12-26]

B. EDUCATIONAL IMPROVEMENT NEEDS IN THE DISTRICTS SERVED BY YOUR AGENCY OR CONSORTIUM

B1. Of the following subject areas/levels, please indicate the three that needed the most improvement in the districts served by your agency or consortium during the 1988-89 school year and rank them by assigning a "1," "2," or "3," with "1" = "most needed."

Elementary school mathematics	_____
Elementary school science	_____
Middle/junior high mathematics	_____
Middle/junior high science	_____
High school mathematics	_____
High school science	_____
Foreign languages (all grade levels)	_____
Computer education* (all grade levels)	_____

[1/27-34]

* "Computer education" = instruction in use of computers for curricular areas and purposes other than mathematics and science education.

B2. For the three areas that you marked in Question B1, please indicate up to three important changes that were needed.

	Area Ranked #1 Needed:	Area Ranked #2 Needed:	Area Ranked #3 Needed:
Better curricula	1	1	1
More or better equipment/facilities for instruction	2	2	3
Improved preparation or motivation among teachers	3	3	3
A larger supply of qualified teachers	4	4	4
Better methods of assessing student learning	5	5	5
Improved access/services for female students	6	6	6
Improved access/services for minority students	7	7	7
Other (PLEASE DESCRIBE) _____	8	8	8

[1/35-43]

B3. Did your agency or consortium offer inservice training in mathematics, sciences, foreign languages, or computer education during the 1988-89 school year (including the summer of 1989), whether or not supported by Title II?

No (CIRCLE "0") 0

Yes (INDICATE UP TO THREE SUBJECT AREAS OR GRADE LEVELS IN WHICH THE MOST TRAINING WAS PROVIDED, AND RANK THEM BY ASSIGNING A "1," "2," OR "3," WITH "1" = "MOST TRAINING PROVIDED")

Elementary school mathematics _____

Elementary school science _____

Middle/junior high school mathematics _____

Middle/junior high school science _____

High school mathematics _____

High school science _____

Foreign language (all grade levels) _____

Computer education (all grade levels) _____

[1/44-52]
[Dup 2/1-10]

C. RECEIPT OF TITLE II FUNDS

C1. How much did your agency or consortium receive in Title II EESA formula grants for each year of the Title II program? (PLEASE GIVE YOUR BEST ESTIMATE)

a. 1985-86 (Year 1) $_____

b. 1986-87 (Year 2) $_____

c. 1987-88 (Year 3) $_____

d. 1988-89 (Year 4) $_____

e. 1989-90 (Year 5) (received) $_____

[2/11-50]

D. BACKGROUND OF TITLE II COORDINATOR/STAFF

D1. During which school years have you been Title II coordinator for this agency or consortium? (PLEASE CIRCLE ALL THAT APPLY)

1 1985-86 (Year 1)

2 1986-87 (Year 2)

3 1987-88 (Year 3)

4 1988-89 (Year 4)

5 1989-90 (Year 5)

[2/51-55]

D2. How many employees in this agency or consortium are assigned Title II responsibilities full time or part time? (PLEASE GIVE YOUR BEST ESTIMATE)

a. Employees full time on Title II _____

b. Employees part time on Title II _____

[2/56-59]

D3. What other responsibilities (a) do you and other staff who are assigned to Title II currently hold and (b) did you hold before Title II? (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

	Now	Before Title II
None	0	0
Coordinating or supervising mathematics education	1	1
Coordinating or supervising science education	2	2
Managing other federal or state programs	3	3
Managing staff development/teacher training	4	4
General administration of curriculum and instruction	5	5
Training teachers	6	6
Other (PLEASE SPECIFY)_____	7	7

[2/60-75]

E. PROFESSIONAL DEVELOPMENT ACTIVITIES*

E1. Have you used 1988-89 Title II formula funds to support any kind of professional development* for teachers?

0 No (PLEASE GO TO SECTION F)

1 Yes (PLEASE ANSWER QUESTIONS E2 THROUGH E4)

[2/76] [Dup 3/1-10]

E2. Title II-supported professional development in 1988-89 was mainly aimed at teachers from which subject areas and levels? (PLEASE CIRCLE ALL THAT APPLY IN EACH ROW)

	Elementary School	Middle/ Junior High School	High School	All Levels
a. Mathematics teachers	1	2	3	4
b. Science teachers	1	2	3	4
c. Foreign language teachers	1	2	3	4
d. Computer education teachers	1	2	3	4

[3/11-26]

E3. Were some or all of these Title II-supported professional development activities directed towards teachers at particular levels of proficiency or expertise?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 "Lead" or "master" teachers, who will train others

2 Adequately prepared teachers needing retraining in their disciplines

3 Underprepared teachers

4 Out-of-field or uncertified teachers

5 Preservice teachers

6 Other (PLEASE SPECIFY)_____

[3/27-33]

E4. Were some or all of these professional development activities specifically designed for teachers working with particular student groups?

0 No

Yes... (PLEASE CIRCLE ALL THAT APPLY)

1 Gifted and talented students

2 Minority students

3 Handicapped students

4 Students with limited English proficiency

5 Other (PLEASE SPECIFY)_____

[3/34-39]

* "Professional development" includes all forms of inservice and continuing education, both inside and outside the district, for currently practicing teachers.

F. OTHER EDUCATIONAL IMPROVEMENT ACTIVITIES

F1. Have you used 1988-89 (Year 4) Title II formula funds for anything besides professional development?

0 No (PLEASE GO TO SECTION G)

1 Yes (PLEASE ANSWER QUESTION F2)

[3/40]

F2. In what ways have the funds been used? (PLEASE CIRCLE ALL THAT APPLY)

1 Purchase of computer hardware

2 Purchase of computer software

3 Upgrading mathematics or science curricular materials

4 Other (PLEASE SPECIFY)_____

[3/41-44]

G. ADMINISTRATION AND DECISIONMAKING

G1. Please indicate up to three groups that exerted the most influence on your agency's or consortium's planning for the use of 1988-89 Title II funds, and rank them by assigning a "1," "2," or "3," with "1" = most influential."

Local mathematics or science coordinators or specialists _____

Top administrators in your agency or consortium _____

Administrators in districts you serve _____

Teachers and principals in districts you serve _____

Private school teachers or administrators _____

Parents and citizens _____

College/university staff _____

State department of education (SEA) staff _____

Other (PLEASE SPECIFY)_____ _____

[3/45-53]

G2. Please indicate up to three factors that had the greatest effect on your agency's or consortium's decisions about the use of Title II formula funds in 1988-89 (including the summer of 1989), and rank them by assigning a "1," "2," or "3," with "1" = "most influential."

Uncertainty about levels of funding from year to year _____

Federal/state regulations or guidelines _____

The absolute amount of funds received _____

Established priorities of districts you serve _____

Availability of appropriate staff to conduct inservice training _____

Other (PLEASE SPECIFY)_____ _____

[3/54-59]

G3. **Did your agency's or consortium's Title II program receive assistance from the state's Title II coordinator or staff during 1988-89 (including the summer of 1989)?**

0 No

Yes... (PLEASE CIRCLE ALL THAT PPLY)

1 Explanation of the law and regulations for Title II

2 Helping us conduct the needs assessment

3 Arranging special services for teachers or students

4 Providing information about exemplary projects

5 Helping us monitor or evaluate our use of Title II funds

6 Other (PLEASE SPECIFY)_____

[3/60-66]

G4. **Did your agency or consortium have problems with the fiscal management of its Title II program?**

0 No

Yes, our agency or consortium... (PLEASE CIRCLE ALL THAT APPLY)

1 Was not adequately reimbursed for administrative costs

2 Did not know its annual allocation early enough to plan adequately

3 Did not receive funds in time to pay for some expenditures

4 Other (PLEASE SPECIFY)_____

[3/67-71]

G5. **Has your agency or consortium joined forces with any of the following organizations in carrying out activities supported by Title II funds?**

0 No

Yes -- Which ones? (PLEASE CIRCLE ALL THAT APPLY)

1 Local school districts

2 Institutions of higher education (IHEs)

3 Private business and industry

4 Museums and other private, nonprofit institutions

5 Professional societies or associations

6 Regional or intermediate education units

7 Other_____

[3/72-79]
[Dup 4/1-10]

G6. **In what ways (if at all) do you assess the effectiveness of Title II-supported activities on mathematics and science improvement programs of which they are a part?** (PLEASE CIRCLE ALL THAT APPLY)

0 No assessment is done

The agency or consortium... (PLEASE CIRCLE ALL THAT APPLY)

1 Solicits teachers' testimonials or opinions

2 Observes or otherwise appraises teachers' performance

3 Compares student performance before and after improvement activities

4 Gathers anecdotal evidence

5 Carries out other forms of assessment (PLEASE SPECIFY)

_____

[4/11-16]

G7. **How are the results of the assessments noted above (if any) used?**

0 Not applicable; no assessment is done

The results are... (PLEASE CIRCLE ALL THAT APPLY)

1 Reported back to teachers

2 Sent to the state agency

3 Included in subsequent local needs assessments

4 Considered informally in planning

5 Used in other ways (PLEASE SPECIFY)

_____

[4/17-22]

H. USE OF TITLE II FORMULA FUNDS

H1. **How did the agency or consortium divide its 1988-89 (Year 4) Title II formula funds among the following types of activities?** (PLEASE GIVE YOUR BEST ESTIMATE)

a. Local inservice teacher training (includes stipends, cost of substitute teachers, etc.) _____%

b. Out-of-area professional development for teachers (attending conferences, taking courses, etc.) _____%

c. Curriculum development (if permitted in your state) _____%

d. Purchase of computers and other educational technology or software (if permitted) _____%

e. Administrative costs _____%

g. Other (PLEASE SPECIFY)

_____ _____%

Total = 100%

[4/23-40]

H2. **Of the district's 1988-89 (Year 4) Title II formula funds, what percentage has been allocated to each of the following disciplines?** (PLEASE GIVE YOUR BEST ESTIMATE)

a. Sciences _____%

b. Mathematics _____%

c. Foreign languages _____%

d. Computer education (if not considered part of science or mathematics) _____%

Total - 100%

[4/41-52]

H3. **On September 30, 1989, what percentage of your agency's or consortium's 1988-89 (Year 4) funds still remained unspent?** (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[4/53-55]
[Dup 5/1-10]

H4. **How have you allocated your 1988-89 (Year 4) Title II formula funds among the following?** (PLEASE GIVE YOUR BEST ESTIMATE)

a. Salaries and fringe benefits $_____

b. Consultant fees and expenses $_____

c. Equipment (if permitted--e.g., for use in training teachers) $_____

d. Materials and supplies $_____

e. Travel costs, conferences $_____

f. Participant stipends $_____

g. Other (PLEASE SPECIFY)_____ $_____

Total - $_____

[5/11-74]

H5. **Of the total funding in 1988-89 for professional development activities that were supported in whole or in part by Title II, what percentage of the funding came from Title II?** (PLEASE GIVE YOUR BEST ESTIMATE)

_____%

[5/75-77]
[Dup 6/1-10]

H6. **In the 1988-89 school year, which of the following also contributed resources to activities that received Title II support?** (PLEASE CIRCLE ALL THAT APPLY)

1 The regular budget of districts served by your agency or consortium

2 ECIA Chapter 2 funds

3 National Science Foundation funds

4 Specially earmarked state funds

5 Corporate or foundation gifts

6 Other source (PLEASE SPECIFY)_____

8 Not sure

[6/11-18]

H7. **Approximately, what percentage of the K-12 students in the districts served by your agency or consortium attend private schools? (PLEASE GIVE YOUR BEST ESTIMATE)**

_____%

[6/19-21]

H8. **Approximately what percentage of the 1988-89 Title II funding received by your agency or consortium was used to support services aimed at private school teachers or students? (PLEASE GIVE YOUR BEST ESTIMATE)**

_____%

[6/22-24]

I. OTHER TITLE II FUNDS AND SERVICES

I1. **To what extent has your agency or consortium become aware of any Title II-supported "Demonstration and/or Exemplary" (D&E) projects funded by the state education agency (SEA)? (PLEASE CIRCLE ALL THAT APPLY)**

1 We have little or no knowledge of these projects

2 We were sent an announcement (e.g., RFP) of a competition for Title II awards

3 We received information from the SEA about D&E projects under way

4 We learned about Title II-supported D&E projects from sources other than the SEA

[6/25-28]

I2. **How have the districts served by your agency or consortium benefitted from the D&E projects supported by Title II? (PLEASE CIRCLE ALL THAT APPLY)**

1 They have benefitted minimally, or not at all

2 They have received one or more awards for D&E projects

3 They have received services or assistance from other D&E projects

4 Other (PLEASE SPECIFY)_____

8 Not sure

[6/29-33]

I3. **To what extent has your agency or consortium become aware of any Title II-supported "higher education" projects* funded by your state agency for higher education (SAHE)? (PLEASE CIRCLE ALL THAT APPLY)**

1 We have little or no knowledge of these projects

2 We have worked with one or more institutions (e.g., a college) to apply for a"higher education" award

3 We received information from the state about specific "higher education" projects under way

4 We learned about Title II-supported "higher education" projects from sources other than the state

[6/34-37]

I4. **How have the districts served by your agency or consortium benefitted from the "higher education" projects supported by Title II?** (PLEASE CIRCLE ALL THAT APPLY)

1 They have benefitted minimally, or not at all

2 Some of the districts' teachers participated in a "higher education" project with an institution that received an award

3 Our agency has been a collaborator in a "higher education" project, with an institution that received an award

4 Other (PLEASE SPECIFY)_____

8 Not sure

[6/38-42]

J. **QUESTIONS ABOUT ALL OF THE DISTRICTS YOU SERVE AND THE DISTRICT NAMED ON THE COVER OF THIS QUESTIONNAIRE**

> **The questions in this section refer to all of the districts served by your agency or consortium and the specific district (that you serve) named on the cover of this questionnaire. PLEASE ANSWER THESE QUESTIONS AS BEST YOU CAN.**

J1. **How many teachers during 1988-89 (including the summer of 1989) were fully or partly supported with Title II funds to attend the following?** (PLEASE GIVE YOUR BEST ESTIMATE)

	Teachers in All of the Districts That You Serve	Teachers in the District Named on the Cover
a. Local inservice training	_____	_____
b. Out-of-area professional meetings and conferences	_____	_____
c. College or university courses	_____	_____
d. Other events not sponsored by your agency or consortium (PLEASE DESCRIBE) _____	_____	_____

[6/43-74]
[Dup 7/1-10]

* Title II "higher education" projects include those funded by the state as "competitive grants" or "cooperative" projects" and typically involve an institution of higher education (IHE), one or more school districts, and often other institutions in a partnership arrangement.

J2. **How many of each of the following types of teachers participated in 1988-89 Title II-supported professional development?** (PLEASE GIVE YOUR BEST ESTIMATE)

	Teachers in All of the Districts You Serve	Teachers in the District Named on the Cover
a. Female teachers	_____	_____
b. Minority teachers	_____	_____
c. Private school teachers	_____	_____

[7/11-34]

J3. **How many total "contact hours" of credit or noncredit training were provided in Title II-supported inservice training during the 1988-89 school year and summer of 1989?** (NOTE: 1 TEACHER FOR 1 HOUR = 1 CONTACT HOUR) (PLEASE GIVE YOUR BEST ESTIMATE)

Contact Hours For Teachers in All of the Districts You Serve	Contact Hours For Teachers in the District Named on the Cover
_____	_____

[7/35-43]

J4. **Approximately how many districts, including the district named on the cover, participated in Title II-funded services during the first three years of the program?** (PLEASE GIVE YOUR BEST ESTIMATE)

Program Year	Total Number of Districts	The District Named on the Cover	
Year 1 (1985-86 SY)	_____	Yes	No
Year 2 (1986-87 SY)	_____	Yes	No
Year 3 (1987-88 SY)	_____	Yes	No

[7/44-52]

J5. **In the first three years of the program, what professional development or other activities were supported by Title II funds for any of the districts receiving services from your agency or consortium?** (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

Title II Supported...	Year 1 (1985-86)	Year 2 (1986-87)	Year 3 (1987-88)
Not applicable; no Title II-supported services	0	0	0
Inservice training offered by agency or consortium	1	1	1
Out-of-area professional development (e.g., conferences, courses at universities)	2	2	2
Curriculum development	3	3	3
Purchase of computers or other educational technology or software	4	4	4
Other services (PLEASE SPECIFY) _____	5	5	5

[7/53-67]

J6. **In the first three years of the program, Title II-supported services were mainly aimed at which subject areas?** (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

Title II Supported	Year 1 (1985-86)	Year 2 (1986-87)	Year 3 (1987-88)
Not applicable; no Title II-supported services	0	0	0
Mathematics	1	1	1
Sciences	2	2	2
Foreign languages	3	3	3
Computer education	4	4	4

[7/68-79]
[Dup 8/1-10]

K. QUESTIONS ABOUT ONE DISTRICT'S PARTICIPATION IN MATHEMATICS EDUCATION IMPROVEMENT

NOTE: The questions in this and remaining sections refer only to the district indicated on the cover of this questionnaire.

K1. Did the district named on the cover participate (or was it likely to have participated) in Title II-supported activities focused on improving mathematics education during 1988-89 (including the summer of 1989)?

0 No (PLEASE GO TO SECTION L)

Yes... (PLEASE ANSWER QUESTIONS K2 THROUGH K4)

1 Did participate

2 Was likely to have participated

8 Not sure

[8/11]

K2. On which content/skill areas in mathematics did the Title II-supported activities in which this district participated mainly focus? (PLEASE CIRCLE ALL THAT APPLY)

1 Arithmetic, computation skills

2 Arithmetic, problem-solving

3 Geometry

4 Probability, statistics, data analysis

5 Algebra

6 Advanced mathematics (e.g. calculus)

7 Other (PLEASE SPECIFY)_____

[8/12-18]

K3. Please indicate up to three important goals of these mathematics education improvement activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."

Develop a corps of mathematics specialists or "lead" teachers _____

Improve or update teachers' subject matter knowledge _____

Strengthen teachers' skills in teaching K-12 mathematics _____

Provide opportunities for teachers to develop mathematics activities or units _____

Introduce a new mathematics curriculum _____

Improve skills of teacher interns or student teachers _____

Other (PLEASE SPECIFY)_____ _____

[8/19-25]

K4. **Please indicate up to three curricular/instructional strategies in mathematics education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Increased use of manipulatives _____

Incorporation of calculators into the curriculum _____

Integration of technology (e.g., computers) into the mathematics curriculum _____

Increased emphasis on problem-solving and higher-order thinking skills _____

Introduction of cooperative learning techniques _____

Increased emphasis on applications of mathematics _____

Methods of teaching/reaching minority or disadvantaged populations _____

Other (PLEASE DESCRIBE)_____ _____

[8/26-33]

L. QUESTIONS ABOUT ONE DISTRICT'S PARTICIPATION IN SCIENCE EDUCATION IMPROVEMENT

L1. **Did the district named on the cover participate (or was it likely to have participated) in Title II-supported activities focused on improving science education? during 1988-89 (including the summer of 1989)**

0 No (PLEASE GO TO SECTION M)

Yes... (PLEASE ANSWER QUESTIONS L2 THROUGH L4)

1 Did participate

2 Was likely to have participated

8 Not sure

[8/34]

L2. **On which scientific disciplines or fields did the 1988-89 Title II-supported activities in which this district participated focus?** (PLEASE CIRCLE ALL THAT APPLY)

1 Physical sciences (chemistry, physics)

2 Biology/life sciences

3 Earth sciences/astronomy

4 "General" science

5 Other (PLEASE SPECIFY)_____

[8/35-39]

L3. **Please indicate up to three important goals of these science education improvement activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Develop a corps of science specialists or "lead" teachers _____

Improve or update teachers' knowledge of scientific disciplines _____

Strengthen teachers' pedagogical skills in science _____

Provide opportunities for teachers to develop science activities or units _____

Introduce a new science curriculum _____

Improve skills of teacher interns or student teachers _____

Other (PLEASE SPECIFY)_____ _____

[8/40-46]

L4. **Please indicate up to three curricular/instructional strategies in science education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Increased use of the laboratory or other "hands-on" approaches _____

Integration of technology into the science curriculum _____

Increased use of demonstrations and concrete examples in the classroom _____

Increased emphasis on problem solving and higher-order thinking skills _____

Introduction of cooperative learning techniques _____

Increased emphasis on the social implications of science and technology _____

Methods of teaching/reaching minority or disadvantaged populations _____

Other (PLEASE SPECIFY)_____ _____

[8/47-54]

M. **QUESTIONS ABOUT <u>ONE</u> DISTRICT'S PARTICIPATION IN FOREIGN LANGUAGES EDUCATION IMPROVEMENT**

M1. **Did the district named on the cover participate (or was it likely to have participated) in Title II-supported activities focused on improving foreign language education during 1988-89 (including the summer of 1989)?**

0 No (PLEASE GO TO SECTION N)

Yes... (PLEASE ANSWER QUESTIONS M2 THROUGH M3)

1 Did participate

2 Was likely to have participated

8 Not sure

[8/55]

M2. **Please indicate up to three important goals of the 1988-89 Title II-supported activities in which this district participated and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Enlarge the pool of foreign language teachers _____

Improve the oral proficiency of foreign language teachers _____

Improve the articulation of foreign language instruction across grades _____

Promote foreign language instruction at the elementary school level _____

Teach a new language to existing foreign language teachers _____

Improve skills of teacher interns or student teachers _____

Other (PLEASE DESCRIBE)

_____ _____

[8/56-62]

M3. **Please indicate up to three curricular/instructional strategies in foreign language education that were an important focus of these activities, and rank them by assigning a "1," "2," or "3," with "1" = "most important."**

Attention to oral language instruction _____

Use of technology in foreign language instruction _____

A cultural approach to foreign language instruction _____

Use of proficiency-based instruction and assessment techniques _____

A multimedia approach to foreign language instruction _____

Other (PLEASE SPECIFY)

_____ _____

[8/63-68]

N. QUESTIONS ABOUT ONE DISTRICT'S PARTICIPATION IN COMPUTER EDUCATION IMPROVEMENT

N1. **Did the district named on the cover participate (or was it likely to have participated) in Title II-supported activities focused on improving computer education (outside of mathematics or science education) during 1988-89, including the summer of 1989?**

0 No (PLEASE GO TO SECTION O)

Yes... (PLEASE ANSWER QUESTIONS N2 THROUGH N3)

1 Did participate

2 Was likely to have participated

8 Not sure

[8/69]

N2. **What were the goals of the 1988-89 Title II-supported activities aimed at improving computer education in the district named on the cover?** (PLEASE CIRCLE ALL THAT APPLY)

1 Provide computer hardware or software for courses in areas other than mathematics and science (PLEASE SPECIFY AREAS)

_____

2 Provide computer hardware or software for use in many curricular areas (e.g., by setting up a general-purpose computer laboratory)

3 Support staff development related to computer literacy

4 Other (PLEASE SPECIFY)_____

_____

[8/70-73]
[Dup 9/1-10]

O. OVERALL IMPACTS OF TITLE II ON ONE DISTRICT

O1. **In the district named on the cover, how (if at all) have Title II-supported activities contributed to student learning and participation in mathematics, science, and foreign languages education?** (PLEASE CIRCLE ALL THAT APPLY IN EACH COLUMN)

"Title II-supported activities have..."	Mathematics	Sciences	Foreign Languages
Had little observable influence on students	1	1	1
Improved student interest in the discipline(s)	2	2	2
Helped increase enrollments in required or elective courses	3	3	3
Increased participation in extracurricular activities	4	4	4
Improved students' knowledge and skills	5	5	5
Not sure	8	8	8

[9/11-28]

O2. **On what kinds of evidence do you base your responses to question O1 above?** (PLEASE CIRCLE ALL THAT APPLY)

1 Teachers' testimonials

2 Students' comments (e.g., from interview or questionnaire)

3 Student performance measures

4 Student participation counts

5 Other evidence (PLEASE SPECIFY)

_____

[9/29-33]

03. **In your view, how much has Title II funding affected or is likely to have affected the following aspects of professional development in the district named on the cover?** (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Title II funding has ..."	Not at All	Some-what	A Fair Amount	A Great Deal
a. Increased the number of teachers served in the district	1	2	3	4
b. Increased the time teachers can spend in professional development activities	1	2	3	4
c. Permitted us to hire better-quality inservice trainers or expert consultants	1	2	3	4
d. Allowed more release time for teachers	1	2	3	4
e. Provided incentives (stipends, sabbatical leave credits, etc.) for teacher participation	1	2	3	4
f. Provided travel to professional development opportunities	1	2	3	4
g. Paid for more equipment and facilities, such as computers and science labs	1	2	3	4
h. Other (PLEASE SPECIFY)_____	1	2	3	4

[9/34-41]

04. **Please indicate your degree of agreement or disagreement with these statements about the contributions of Title II formula funding (across all 4 years of the program) in the district named on the cover.** (PLEASE CIRCLE ONE NUMBER IN EACH ROW)

"Title II funding has..."	Strongly Disagree	Disagree	Agree	Strongly Agree	Not Sure
a. Helped the district to serve particular student groups (minorities, females, gifted and talented, learning disabled)	1	2	3	4	8
b. Helped clarify priorities for science and mathematics instruction	1	2	3	4	8
c. Helped initiate projects the district would otherwise have difficulty funding	1	2	3	4	8
d. Had little impact in this district	1	2	3	4	8
e. Stimulated joint programming with other districts or institutions	1	2	3	4	8
f. Provided the primary source of funding for math/science improvement activities	1	2	3	4	8
g. Helped the district leverage other sources of funding (e.g., by using Title II as matching funds)	1	2	3	4	8

[9/42-48]

THANK YOU FOR YOUR COOPERATION

Please use the enclosed postage-paid envelope to return this questionnaire to:

Michael Knapp
SRI International, Room B-S146
333 Ravenswood Avenue
Menlo Park, CA 94025

Appendix C

STUDY METHODOLOGY

Appendix C

STUDY METHODOLOGY

In this appendix, we provide detail regarding study samples, the precision of estimates based on survey data, and data collection procedures.

Site Visit Samples

The samples of states, LEAs/IUs,* and IHE projects that were visited as part of this project have been summarized in tables presented in the Introduction to this report. Here we detail the criteria used in selecting the site visit samples.

Criteria for Selecting the Intensive Study States

Site visits to LEAs and IHEs took place in seven intensive study states. The following primary and secondary criteria were used in selecting the state sample. Two criteria were given the greatest weight in the sampling process: state population size and state activism in K-12 education.

- Population size. Large population states differ systematically from small ones in a number of characteristics relevant to Title II. For example, large states tend to have larger and more sophisticated state education agencies (SEAs), which often provide more detailed guidelines and more attentive monitoring of federal programs. A related point is that the size of the state's school-age population largely determines the amount of Title II funds going into the state and, hence, the amount available for state administrative activities; this may constrain small states' administrative activities. Large states can also be expected to have more active and complex political environments at the state level, a feature that may make administration of Title II more complex.

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* Intermediate units (IUs) are described on page 145.

For sampling purposes, states were divided into three groups: 18 large states, defined as those that receive more than $2 million under Title II (in FY 1988); 13 small states (plus the District of Columbia), or those receiving the statutory minimum; and 19 midsize states, which are all others.

- State activism in K-12 science and mathematics education reform. States vary considerably in the degree to which they have developed programs, initiatives, and related mandates aimed at improving science and mathematics education in their state. The degree to which state activism varies could have substantial implications for the activity types supported by Title II funds.

Additional factors of secondary interest that were considered in selecting the seven intensive study states include the following:

- Number of districts. States with a small number of districts are likely to benefit from a closer relationship among key Title II participants, such as state program coordinators and local science and mathematics supervisors. In states with hundreds of districts, such relationships have a very different character.

- Approaches to managing Title II. The approaches to managing Title II have varied in significant ways among the states. Several have fostered especially close relationships between the SAHEs and the SEAs, thereby trying to link the expenditures in LEAs and IHEs closely; for example, California combined funds from different statutory set-asides and ran a competition jointly managed by the SEA and the SAHE.

- School-age special needs population. Differences in the state's proportion of school-age children living in poverty can be viewed as a useful proxy for many students underrepresented in science and mathematics, whose needs are a special focus of the Title II program. (This measure does not pertain to female students, also an underrepresented group, who are found in approximately equal proportions across al. states.)

- Fiscal condition and educational finance factors. Fiscal variables that can be expected to affect the implementation of Title II include both patterns of spending on education and general strength of the tax base. These do not necessarily vary together. These two variables, and their relationship to each other, are very important in determining the fiscal environment for Title II. Together, they may help to determine the degree to which Title II funds are considered "critical" by state and local personnel.

- Region. Division of the United States into four regions necessarily creates a coarse set of distinctions among states, but it usefully captures essential political differences, as well as more subtle differences in the organization of schools, the economic conditions under which they operate, and the character of public concerns. The study team adopted the regional classification scheme used by NAEP and by the Department of Commerce: Northeast (11 states and the District of Columbia, Southeast (12 states), Central (12 states), and West/Southwest (15 states).

The seven states that were selected for study varied on all the preceding criteria and, in addition, have used Title II funds in diverse ways that represent a range of approaches to implementing the program, as noted below:

- California--has made significant efforts to improve science and mathematics education and has a very high population of minority students. The SEA and SAHE have cooperated by pooling state Title II funds in a way that is unusual if not unique.

- New York--used Title II funds to establish an elementary science teachers' support network, designed to further state attempts to expand science instruction at this level.

- North Carolina--established an innovative statewide network of IHEs focused on improving science and mathematics education, which plays an important role in its Title II program.

- Arkansas--has a very high percentage of students living in poverty. The Title II coordinators of the two state agencies have cooperated closely in attempts to focus attention on the elementary level.

- Iowa--has used its Title II funds for a very diverse set of projects, including projects linking teachers with working scientists.

- Vermont--used Title II funds to develop a Resource Agent Program that can provide training throughout the state, including its many small districts; the state has also adopted a unique regional approach to using Title II funds.

- Wyoming--has the fewest proportion of students living in poverty of any state (1980 data). The state sets very few requirements in science and mathematics for its LEAs, yet receives disproportionately more funds under Title II due to the statutory minimum grant to states.

Within these states, site visits were made to 18 LEAs, 7 IUs (and briefly to several of the small LEAs served by these IUs), and to 21 IHEs. The sampling criteria for selection are described below:

Criteria for Selecting the LEA Site Visit Sample

One criterion for selection was relatively even distribution across states. To maximize the possibility of linking site visit data with questionnaire responses, sites were chosen within cells defined by two of the stratification criteria used in the LEA survey sample:

- District enrollment. District size is an important determinant of the size of the Title II grant, and the nature of both the district administration of Title II, as well as the activities supported, is likely to vary significantly between larger and smaller LEAs.
- Poverty level. Not only does the nature of the problems faced by LEAs differ depending upon poverty level, but grant size is partially dependent on this criteria, and in addition underserved groups in science and mathematics (likely to be present in larger numbers in poorer districts) are a particular target of the Title II legislation.

Other primary criteria for selection included:

- Participation in an intermediate unit (IU) or consortial arrangement. Approximately one-third of the sites were chosen because the LEA was receiving Title II-funded services through an IU or consortium. In such instances, the IU itself was as much a focus of data collection as participating LEAs.
- Exemplary practices. Districts with practices identified (e.g. by the state) as "exemplary" were of special interest for site visits, to illustrate ways that Title II can be used most effectively.
- Urbanicity. Urban districts and rural districts are likely to face different problems, and adopt different strategies for using these funds, independent of district size.
- Relationship between LEA and nearby IHE(s). Title II has the potential to increase the collaboration between LEAs and IHEs. Selecting sites that vary in the closeness of their relationship under Title II will help to identify whether (and how) the program influences these relationships.

Criteria for Selecting IHE Site Visit Sample

As with the LEAs, IHEs were selected so that they were relatively evenly distributed across the intensive study states. Once again, to ensure a link between site visit and survey data, sites were chosen within cells defined by the principal stratification variables used in the IHE survey sample:

- Grant size. For obvious reasons, the nature of funded activities and the range of impacts is heavily influenced by the size of the award.
- Type of institution. At least one institution from each of the four principal categories of IHEs were included in the sample. (The categories are: research/doctoral; comprehensive; liberal arts; and, two-year colleges.) In addition, the site visit sample included two nonprofit institutions (science museum, professional society) that were recipients of Title II grants.

Other primary criteria for selection included:

- Type of award. A mix of Title II competitive awards and cooperative awards (under Section 207) were included.
- Discipline and level. Biological sciences, physical sciences, mathematics, and computing were represented in the sample, as were the target levels of education (elementary, middle, and high school).
- Relationship between the IHE project and nearby LEAs. As explained above under LEA site selection criteria, varying degrees of closeness between IHE and LEAs can help to illuminate Title II's impact on institutional collaboration.
- Exemplary practices. IHEs with practices identified (e.g. by the state) as "exemplary" were a focus for site visits, to illustrate ways that Title II can be used most effectively.
- Type of project. Training, retraining, and preservice preparation projects were each included in at least one site.

Secondary criteria included: duration of the project (short- versus long-term); type of consortial arrangement (if any), including nature of other institutions involved; characteristics of the project directors, such as whether they were in schools of education or the liberal arts.

Survey Samples

Mail surveys were administered to state agencies (the SEA and SAHE), LEAs (including a subsample of IUs serving smaller LEAs), and the directors of projects located in institutions of higher education (including several nonprofit institutions, which were eligible to receive grants under Title II). The state agency samples need no explanation, as all 51 agencies were included (50 states plus the District of Columbia). The other two mail survey samples are explained below.

LEA/IU Survey Sample

Defining the Universe of LEAs--The focus of the study is on operating LEAs--i.e., those that have teachers, students, administrators, and operating schools. For this reason, we excluded from the universe the much smaller group of LEAs that do not operate schools but pay tuition to other districts for the education of their children. This choice is consistent with other studies conducted by SRI in recent years in which a national sample of LEAs has been selected (e.g., Knapp & Blakely, 1986).

Additionally, various other categories of local and state educational "districts" were excluded from the universe, including:

- Vocational-technical districts (except those that operate as a regular LEA). These types of districts appeal to audiences with special interests beyond regular LEAs. More importantly, these districts often are not comparable to LEAs in enrollment, operating hours, or administrative structure, making comparisons problematic. National estimates that included such districts would be biased in unclear directions.
- Supervisory unions, area educational agencies, interim districts, boards of county education services, or other superordinate or intermediate units. These organizations occur most frequently in extremely rural areas where the individual district-level enrollments are quite small.*

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* Even though these intermediate units (IUs) were excluded from the LEA universe for sampling purposes, they were nonetheless a focus of study wherever the sampled LEAs received program-funded services from an IU rather than manage the program funds directly themselves.

- Public agencies, such as state education agencies (with the exception of the Department of Education in Hawaii, which is the LEA); Bureau of Indian Affairs (BIA) schools; achievement centers and regional resource centers; private agencies, such as homes for delinquent youth; and Texas Independent State School Districts, which primarily are correctional facilities and homes for delinquent youth. We include, however, the "accommodation" school districts in Arizona, which are regular operating LEAs with nontraditional boundaries (e.g., around federal dams and military installations).

- LEAs from Puerto Rico, Guam, and other territories, to reduce the cost and complexity of data collection.

- LEAs with zero enrollment.

As noted above, some LEAs that accept Title II funds are not themselves the grantees. Instead, intermediate units, consortia, or other entities receive funds on behalf of the LEA. The initial LEA sample was subdivided into two subsamples, one not served by IUs or consortia and the other served under such arrangements, based on information given to us in an advanced notification phone call prior to the mailing of the survey instrument.

Stratification Variables and the LEA Sampling Frame--A random sample of 1,600 LEAs was chosen to represent the full range of school districts that receive (or could receive) Title II funding. The sample was drawn within cells of a sampling frame defined by three variables: district size (enrollment), district wealth (Orshansky percentile), and metropolitan status (urban-suburban-rural).

The size of the Title II grant to which any district is entitled depends on overall district enrollment and the number of students eligible for Chapter 1. Therefore, the use of district enrollment and district wealth in selecting the sample ensured that there would be sufficient variation in the sizes of the Title II grants in the sample districts--a key analytic variable.

The districts are divided into three groups on the basis of poverty level (Orshansky percentile, which indicates the percentile ranking of the community served by each school district, on the basis of the proportion of families falling below the federally determined poverty line). Low poverty

districts are defined as those with an Orshansky percentile less than 10; such districts will generally not need to do extensive planning of programs for poor and disadvantaged students. Districts with Orshansky percentiles of 10-19 are defined as the medium poverty range; for such districts, attention to poor and disadvantaged students is likely to be a regular feature of education programs. High-poverty districts, defined as those with Orshansky percentiles of 20 or greater, typically consider effective educational programs for poor and disadvantaged students as one of their most important needs.

Using a data tape based on information from Quality Education Data (QED), we constructed a sampling frame for the LEA survey, which is shown in Table 78. Cutpoints to define size strata are as follows:

- Very large districts (25,000 students or more).
- Large districts (10,000 - 24,999 students).
- Medium districts (2,500 - 9,999).
- Small districts (1 - 2,499).

The latter group was further subdivided by defining "very small" districts as those with fewer than 600 students; this was done because there are so many very small districts and we did not want to overrepresent them in the sample.

Cell Sizes and Weighting--As can be seen in Table 78, cases were allocated to cells disproportionately, to maximize what could be learned from the districts with the largest numbers of students (and correspondingly, the greatest amounts of Title II funding). The fraction of each group selected for the LEA sample thus varied from 100% of the very large districts (of which there are fewer than 200) to approximately 2% of the very small districts (of which there are more than 5,000). The very large districts account for students and Title II funds far in excess of their proportion with the LEA universe, while the reverse is true for the very small districts. LEAs in the sample were distributed to cells so that:

- The distribution of districts among strata and cells reflected the underlying distribution of students (and dollars) as much as possible, consistent with the other two criteria below.

Table 78

LEA SAMPLING FRAME

Enrollment	Low Poverty (0 - 9) Urban	Sub.	Rural	Total LEAs	Medium Poverty (10 - 19) Urban	Sub.	Rural	Total LEAs	High Poverty (>= 20) Urban	Sub.	Rural	Total LEAs	Total
VERY LARGE (cell no.)	(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)		
25,000+ Sample N	10	33	0	43	62	13	1	76	53	4	1	58	177
Pop. N	10	33	0	43	62	13	1	76	53	4	1	58	177
Sampling fraction			(1:	1)			(1:	1)			(1:	1)	(1: 1)
LARGE (cell no.)	(10)	(11)	(12)		(13)	(14)	(15)		(16)	(17)	(18)		
10,000- Sample N	13	74	11	98	31	45	22	98	20	13	18	51	247
24,999 Pop. N	23	147	21	191	61	90	44	195	38	18	34	90	476
Sampling fraction			(1:	1.9)			(1:	2)			(1:	1.8)	(1: 1.9)
MEDIUM (cell no.)	(19)	(20)	(21)		(22)	(23)	(24)		(25)	(26)	(27)		
2,500- Sample N	9	277	61	347	10	93	151	254	12	24	116	152	753
9,999 Pop. N	27	1066	234	1327	40	357	581	978	38	92	447	577	2882
Sampling fraction			(1.	3.8)			(1:	3.9)			(1:	3.8)	(1: 3.8)
SMALL (cell no.)	(28)	(29)	(30)		(31)	(32)	(33)		(34)	(35)	(36)		
600- Sample N	2	71	50	123	3	32	86	121	0	8	48	56	300
2,499 Pop. N	2	1295	904	2201	5	581	1569	2155	0	140	873	1013	5369
Sampling fraction			(1:	17.9)			(1:	17.8)			(1:	18.1)	(1: 17.9)
(cell no.)	(37)	(38)	(39)		(40)	(41)	(42)		(43)	(44)	(45)		
0-599 Sample N	3	10	25	38	2	6	37	45	2	4	34	40	123
Pop. N	6	501	1273	1780	2	303	1838	2143	2	134	1710	1846	5769
Sampling fraction			(1:	46.8)			(1:	47.6)			(1:	46.2)	(1: 46.9)
TOTALS Sample N	37	465	147	649	108	189	297	594	87	53	217	357	1600
Pop. N	68	3042	2432	5542	170	1344	4033	5547	131	388	3065	3584	14673
Sampling fraction			(1:	8.5)			(1:	9.3)			(1:	10)	(1: 9.2)

- Sufficient numbers of districts were retained in each stratum and cell for the major types of analyses we anticipated performing (which take the district as the unit of analysis).
- Potential problems in developing reliable estimates would be avoided as much as possible (e.g., excluding large districts that account for a large proportion of variance on any variable).

Within the three poverty strata, special attention was given to high-poverty districts, which account for slightly fewer than 25% of all districts. The high-poverty districts were oversampled, for two closely related reasons: minorities and others underrepresented in science and mathematics are a special focus of Title II; and the science and mathematics programs in high-poverty districts are likely to have special needs that differ in kind and degree from other districts.

Responses to the LEA survey were weighted by the inverse of the sampling fraction (adjusted for nonresponse), to create estimates for population parameters within each cell.

IHE Project Survey Sample

Defining the Universe of IHE Projects--We defined the sampling universe as all projects awarded by state agencies to institutions of higher education (or other nonprofit institutions) with 1987-88 or 1988-89 Title II funds--that is, during Year 3 and Year 4 of the program. We included two years rather than one because of the likelihood that multi-year grants might be made and that these might not be fully represented in one year's grant cycle. The two years also enabled us to check the frequency of grants made repeatedly to the same project directors. Data to construct the universe were collected directly from state agencies for higher education prior to the selection of the sample.

Stratification Variables and the IHE Project Sampling Frame--Two variables were used to stratify the IHE project sampling frame: size of the grant and the type of institution receiving the grant award. The justification for choosing these two variables was as follows: first, it was important to avoid oversampling small projects, due to their large numbers in the

universe of grant awards, and also to avoid undersampling large ones, which are fewer in number. As in the case of LEAs, we wished to represent in the sample the greatest concentration of Title II dollars possible (consistent with other sampling criteria), and therefore used stratification as a means to ensure that result. Second, we correctly anticipated that grant awards would not be distributed equally among the different types of institutions--relatively few grants were made, for example, to four-year liberal arts colleges or nonprofit institutions that were not IHEs. To compensate for this fact, stratification by institutional type ensured that a sufficient number of projects in such institutions would be included in the analysis.

Based on data received from state agencies for higher education, we constructed a universe of Title II-funded higher education projects as shown in Table 79. The table also indicates the size of the sample within each cell of the stratification grid and the corresponding sampling fractions for each cell.

Cell Sizes and Weighting--As in the LEA sample, cases were allocated to cells within the stratification grid with unequal probability of selection; however, the sampling fractions did not vary greatly across cells (from 1:1 to 1:3.3).

To create estimates of population parameters, responses were weighted in the same way as the LEA survey--by multiplying each case by the inverse of the sampling fraction (adjusted for nonresponse).

Table 79

IHE PROJECT SAMPLING FRAME

Grant Size	Category of Higher Education Institution: Research University	Comprehensive University	Liberal Arts	Two-year	Other IHE	Non-IHE	Totals
< $20K							
(Sample)	(67)	(82)	(16)	(21)	(6)	(30)	(222)
Population	191	242	38	58	8	43	580
Sampling fraction, 1:	2.9	3.0	2.4	2.8	1.3	1.4	2.6
$20-$39,999K							
(Sample)	(59)	(94)	(13)	(31)	(2)	(15)	(214)
Population	167	252	43	84	3	19	568
Sampling fraction, 1:	2.8	2.7	3.3	2.7	1.5	1.3	2.7
>= $40K							
(Sample)	(109)	(91)	(14)	(19)	(7)	(22)	(262)
Population	152	123	20	26	8	32	361
Sampling fraction, 1:	1.4	1.4	1.4	1.4	1.1	1.5	1.4
Totals:	(235)	(267)	(43)	(71)	(15)	(67)	(698)
	510	617	101	168	19	94	1,509
Sampling fraction, 1:	2.2	2.3	2.3	2.4	1.3	1.4	2.2

Response Rates and Responding Samples

Response rates from the four survey samples were high, especially for state surveys and the IHE project survey. The number of returns and the corresponding response rates are summarized in Table 80 below.

Table 80

MAIL SURVEY RESPONSE RATES

Survey Sample	Sample N	Total N of Returns (N used in analysis)[a]	Total Response Rate (% used in analysis)
LEAs/IUs[b]	1,599	1,274 (997)	80% (73%)
IHE projects[c]	698	631 (582)	90% (83%)
State Agencies			
SEAs	51	48 (48)	94% (94%)
SAHEs	51	47 (47)	92% (92%)

[a]A lower percentage of questionnaires were used in analyses, due to the exclusion of late returns and a number of problematic cases.

[b]Figures combine the subsample of LEAs not served by an IU or consortium and the subsample that were served under such arrangements.

[c]Figures combine subsamples of Year 3 and Year 4 projects.

As can be seen in the following two tables (81 and 82), responses to the LEA/IU and IHE questionnaires were distributed fairly evenly across the cells of the sampling frame, thereby minimizing possible response biases.

Table 81

LEA/IU SURVEY--RESPONDING SAMPLE

District Size (Enrollment)	Low Poverty (OP = 0-9)		Medium Poverty (OP = 10-19)		High Poverty (OP >= 20)		Total
	Not Served by IUs/Consortia	Served by IUs/Consortia	Not Served by IUs/Consortia	Served by IUs/Consortia	Not Served by IUs/Consortia	Served by IUs/Consortia	
Very large (25,000+)							
Sample N	33	2	57	0	37	2	131
Pop. N	41	2	76	0	55	3	177
Large (10,000-24,999)							
Sample N	74	1	76	3	39	1	194
Pop. N	188	3	188	7	88	2	476
Medium (2,500-9,999)							
Sample N	209	45	172	27	109	9	571
Pop. N	1,092	35	846	133	533	44	2,882
Small (600-2,499)							
Sample N	59	17	61	21	31	11	200
Pop. N	1,709	492	1,603	552	748	265	5,369
Very small (0-599)							
Sample N	9	7	18	10	13	8	65
Pop. N	1,001	778	1,378	765	1,143	703	5,769
Totals							
Sample N	384	72	384	61	229	31	1,161
Pop. N	4,031	1,510	4,091	1,457	2,567	1,017	14,673

Table 82

IHE PROJECT SURVEY--RESPONDING SAMPLE

Grant Size	Category of Higher Education Institution: Research University	Comprehensive University	Liberal Arts	Two-year	Other IHE	Non-IHE	Totals
< $20K							
(Sample[a])	(56)	(71)	(16)	(15)	(6)	(22)	(186)
Population	191	242	38	58	8	43	580
$20-$39,999K							
(Sample[a])	(52)	(83)	(10)	(24)	(2)	(8)	(179)
Population	167	252	43	84	3	19	568
>= $40K							
(Sample[a])	(96)	(77)	(11)	(15)	(4)	(14)	(217)
Population	152	123	20	26	8	32	361
Totals:	(204)	(231)	(37)	(54)	(12)	(44)	(582)
	510	617	101	168	19	94	1,509

[a]Responding sample, used in analysis (excludes late returns and problematic cases).

Precision of Estimates Based on Survey Samples

Ignoring stratification, the responding samples were sufficiently large to estimate parameters as follows:

- LEA Survey: Overall estimates fall within 2.9 % of true population values, at the .05 level of confidence.
- IHE Survey: Overall estimates fall within 2.5 % of true population values, at the .05 level of confidence.

We note, however, that the actual precision of estimates used in analysis can vary somewhat depending on the precise set of cases included in each analysis.

For some analyses, estimates were made within strata--for example, by size of LEA. Table 81 illustrates the range of error, by including standard error values along with estimated percentages. Confidence intervals around estimated population proportions or means can be calculated with the following statistic:

$$+/- \quad 1.96 \ (SE) \qquad [p < .05]$$

where SE = the standard error for the estimate in question. Thus, the estimates for very large LEAs in the table fall within +/- 3.9% of the estimated value, within +/- 5.9% for large LEAs, within +/- 3.9% for medium-sized LEAs, and so on. Estimates by strata were thus somewhat less precise than those for the population as a whole; nonetheless, they are sufficiently accurate for policy purposes. (We note that, due to the small samples within the very small LEAs, estimates of population parameters for this stratum are less precise than those for other strata.)

Table 83

SIZE OF STANDARD ERROR IN LEA SURVEY: USE OF PROGRAM FUNDS TO SUPPORT LEAD TEACHER TRAINING IN ANY SUBJECT AREA
(Based on Table 44)

LEA Size Category (sample/population size) [a]			Percentage (and Standard Error) of Districts Not Served by IUs, That Used Year 4 Funds to Support Training for Lead Teachers and Specialists	
Very large				
Sample:	n =	127	76	(2)
Population:	N =	172		
Large				
Sample:	n =	189	71	(3)
Population:	N =	464		
Medium				
Sample:	n =	490	55	(2)
Population:	N =	2,471		
Small				
Sample:	n =	151		
Population:	N =	4,060	39	(4)
Very small				
Sample:	n =	40	14	(5)
Population:	N =	3,522		
Total				
Sample:	n =	997	40	(2)
Population:	N =	10,689		

[a]Responding sample, excluding problematic cases and late returns.

Data Collection Procedures

Data were collected on a series of topics that related to (1) program operations at the state and local levels; (2) impacts of the program on the state and local "infrastructure" for science and mathematics education improvement; (3) impacts on the quantity and quality of professional development activities; and (4) impacts on teachers, classrooms, and students. Information related to each set of topics came from background data sources, mail surveys, or state and local site visits, as summarized in Table 82.

Site Visits

The site visit data collection procedures were designed to: (1) elaborate on information collected through the mail surveys; (2) explore study topics that were not amenable to survey data collection (e.g., the process of planning activities that were funded by Title II money); (3) validate survey responses; and (4) explain patterns uncovered in both surveys and site visits, especially with reference to forces and conditions in the local and state context that influenced how the money was spent or what it accomplished (the fact that LEA and IHE sites were "nested" within states in which data were collected at the state level facilitated the achievement of this goal).

Site visits were carried out during the fall and winter of the 1988-89 school year. Two-person teams spent between one and four days on site, depending on the size of the district, IHE, or state agency under study.

Data were collected at both an institutional and individual level--interviews with project directors and institutional administrators elicited information about the operation of the program, decisionmaking, institutional effects, and similar topics. Extended interviews with a selection of teachers (more than 100 in all) who were participating in program-funded training events yielded "professional development profiles," from which the role and effects of Title II-sponsored activities could be inferred.

Table 84

OVERVIEW OF STUDY TOPICS AND DATA SOURCES

Study Topics	Research Questions
A. State-Level Operations (SEA, SAHE)	
1. State Context for Math/Science Education Improvement	12
2. Priorities and Priority-setting Under Title II	1 (1.1, 1.3), 3
3. State-level Activities Supported Under Title II	1 (1.1, 1.3, 1.4)
4. Administration and Evaluation	3
5. The Flow of Title II Funds and Their Relationship to Other Resources	4, 5
6. Institutional Participants and Relationships at the State Level	1 (1.4), 3, 6.2
7. State-level Assessments of the Program	6, 7, 8, 9, 10
B. Local-Level Operations (LEA, IHE)	
1. Local Context for Math/Science Education Improvement	12
2. Local Priorities and Priority-setting Under Title II	1 (1.1, 1.3), 3
3. LEA and IHE Activities Supported Under Title II	1
4. Administration and Evaluation	3
5. Local Funds Allocation and Expenditure in Relationship to Other Resources	4, 5
6. Local Institutional Participants and Relationships	1 (1.4)
7. Local-level Assessments of the Program	6, 7, 8, 9, 10
C. Impacts on the State Infrastructure for Science and Mathematics Education Improvement	
1. Change in State Capacity for Leadership and Technical Assistance	6
2. Development of New Interinstitutional Relationships	6 (6.2)
3. Change in State Priorities for Math/ Science Education Improvement	6
4. Increase in Resources for Math/Science Education Improvement	6 (6.1)

Table 84 (Concluded)

Study Topics	Research Questions
D. Impacts on the Local Infrastructure for Science and Mathematics Education Improvement	
1. Change in the LEA and IHE Capacity for Professional Development and Math/Science Education Improvement	6 (6.1, 6.3)
2. Change in Structure or Direction of Math/Science Education in LEA or IHE	6 (6.4)
E. Impacts on the Quantity and Quality of Professional Development Activities	
1. Change in Quantity of Professional Development Activities	6 (6.3), 7
2. Change in Quality of Professional Development Activities	6 (6.3), 7, 9 (9.2)
2.1 Inservice Teacher Education	
2.2 Preservice Teacher Education	
2.3 Recertification/Retraining	
F. Impacts on Teachers, Classrooms, and Students	
1. Contributions to Individual Teachers' Knowledge, Pedagogical Skills, and Attitudes	8
2. Change in the Direction or Quality of Mathematics/Science Education at School Level	9 (9.2)
2.1 K-12 Mathematics	
2.2 Elementary School Science	
2.3 Secondary School Science	
3. Influences on Science and Mathematics Classrooms	9
4. Influences on Student Outcomes	10

Site visit data were primarily qualitative, although numerical data (e.g., regarding participation, funding, needs assessment findings, workshop evaluations, or test scores) were gathered wherever available and appropriate. Site visitors relied primarily on open-ended interviews and document reviews, guided by a detailed topical guide. Data from these sources were supplemented by some observations of classroom instruction or inspection of materials, whenever it made sense to do so and could be feasibly arranged within the time constraints of the field visits.

The following types of individuals were interviewed in the sites:

- State Agencies: Title II program coordinators; fiscal officers; federal programs directors; directors of staff development; state mathematics and science supervisors and staff; grants management staff; and others such as individuals responsible for reform programs, legislative liaison, and overall curriculum coordination.
- LEAs and IUs: Title II program coordinators, curriculum coordinators (especially in mathematics and science), staff development officers, grants management staff, evaluators, assistant superintendents for curriculum, and others such as computer coordinators, directors of special needs programs, or itinerant specialists. In addition, a small number of teachers participating in program-funded activities were interviewed.
- IHE Projects: Project directors and staff; dean or department chair; subject area faculty involved in the project or knowledgeable about it; adjunct faculty or staff brought in to assist with the Title II-funded project; and others such as graduate students, evaluators, or grants management staff, as appropriate. In addition, a selection of the project participants (past and present) was interviewed.

Mail Surveys

Mail surveys were administered to state agencies, LEAs, and IHE projects in the fall of 1989, but with reference to the the most recent full year of the program (in the case of LEAs, the 1988-89 school year; in the case of IHE projects, either the 1987-88 or 1988-89 academic years, depending on which one the grant applied to). Respondents were as follows:

- State Agencies. The coordinator responsible for administering program funds in the SEA and SAHE filled out the questionnaire (a separate survey instrument was sent to each).

- LEAs/IUs. The designated "Title II Coordinator" filled out the survey, although the person varied from site to site (in some cases, the assistant superintendent for curriculum; in other sites, a special projects coordinator, mathematics or science supervisor, staff development officer, or federal programs administrator). A different version of the LEA questionnaire was created for IU or consortium respondents, who provided information about both the IU and a particular LEA receiving program-funded services from the IU.

- IHE Projects. The project director to whom the grant was awarded filled out the questionnaire (or the designee of this person, as in some cases where another person had assumed direct operational control of the grant).

The survey instruments are contained in Appendix B of this report.

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