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ABSTRACT

The purpose of this project was to determine what the availability of educational data in the state department of education is and what strategies can be applied to improve state data systems and make the best use of them in making national and state educational decisions. The project involved two major activities: the design and implementation of a survey to determine the extent and consistency of data collected by the states as well as the frequency and source of data collection and a study of results of the survey in order to make recommendations for improved data gathering and utilization. Results indicated the available data in state data banks would not be useful in determining training needs of teachers or teacher competency. There was little correlation between kinds of data collected and problems related to science teachers and teaching. Some of the recommendations made were for the upgrading of state data banks to collect information which will be useful in making educational policy decisions. A survey form which could be used to collect data on science teachers employed in the 50 states is also included in the project report. (Author/BR)

DATA UTILIZATION:
a key to improved science education

This publication is the report of a project conducted by the Council of State Science Supervisors, Inc., under a grant from the National Science Foundation.

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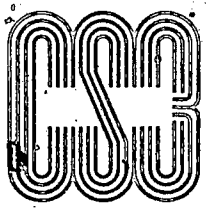

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DATA UTILIZATION:
a key to improved science education

The Council of State Science Supervisors / 1974

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Preface

The Council of State Science Supervisors has, since its initiation in 1963, cooperated with the National Science Foundation, Division of Pre-College Education in Science, in a variety of projects. Throughout this association the Council has benefited from Foundation support while contributing the unique knowledge and experience its members bring from their involvement in the state departments of education. This particular project was an outgrowth of many discussions and planning sessions with staff members from the Foundation who recognized the need for better information about the status of science education when making program decisions. This study of the availability and quality of meaningful data from the data banks maintained by the state departments of education was conducted to determine whether these data resources are adequate to meet a minimal need and how they might be improved to be more valuable in giving direction to educational programs. Although science education was the first concern, it was realized from the onset that the data utilization process is applicable to all study areas.

This project could not have been conducted without the cooperation of the individual chief state school officers and the members of their staffs. The Council expresses its appreciation for the assistance they received, especially from those in the data processing divisions who assisted by responding to the survey instrument that was used in each state.

Because of the interdisciplinary nature of the problems associated with data utilization, it was appropriate that the Council of State Social Studies Specialists and the Association of State Supervisors of Mathematics be involved. The representatives of these two organizations of state employees made major contributions to the conference phase of the project, as well as to the planning that preceded the conference. The Council of State Science Supervisors is grateful for this cooperation.

Throughout the various stages of this project a large number of individuals, institutions, and commercial organizations made important contributions. This support was critical to successful completion of the work that was planned. The Council wishes to express its thanks to everyone who gave their assistance. Finally, the Council expresses its thanks to the National Science Foundation for the financial support that made this project possible.

Project Participants

Members of the Council of State Science Supervisors who participated in the project conference:

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Note: State science supervisors and other state department of education personnel who contributed to the project by completing and returning survey instruments are not listed. However, their contribution was very important and greatly appreciated.

Members of the Council of State Social Studies Supervisors who participated in the project conference:

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Introduction

The Council of State Science Supervisors with membership in most of the fifty states and territories of the United States has listed, among other high priority concerns, the problems of inservice and preservice education. In their first efforts to discover the magnitude of the problem in this special area the officers of the Council contacted staff members of the Precollege Education in Science Division of the National Science Foundation for their assistance. As a result, the Council, with financial sponsorship from the National Science Foundation, conducted seven regional conferences throughout the nation early in 1972. Although the conferences were designed to serve several purposes, a major emphasis was brought to bear upon the problems of providing high quality science teachers and science teaching methods in the school systems of the country. A major contribution at these conferences came in the form of position papers prepared by representatives of the state departments of education. In order to get the broadest possible interpretation of existing problems these papers were prepared cooperatively by representatives of the Council of State Science Supervisors, the Council of State Social Studies Specialists and the Association of State Supervisors of Mathematics in their respective states. This first cooperative effort among three similar organizations in three academic areas has continued to the present time.

The position papers presented by the states revealed a commonality in problems encountered throughout the country, but several characteristics of the position papers were noted that reduced the credibility of arguments presented. Among these were:

- *Most of the papers presented were subjective and contained little or no valid data for making decisions about teacher education.*
- *The writers of the position papers were unable to identify the educational needs of students.*
- *There was little evidence that the states were, at that time, capable of assessing student progress or of establishing criteria for accountability within the schools.*
- *Those writing the position papers were genuinely interested in improving teacher education but lacked adequate information for making necessary decisions.*

Overall it became apparent that the specialists in science, social studies and mathematics in the state departments of education did not have the kinds of data available that would make it possible for them to justify the apparent high expenditures of funds necessary to establish new strategies for inservice and preservice education. As a result, a follow-up study was initiated to determine what data are available within the state data systems and what steps will be necessary to improve and supplement those systems to the point where accurate, reliable information will have maximum use in making national and state educational decisions. This report indicates the procedures followed in that study and the recommendations and findings that have resulted from it.

The major activities of the study were planned and conducted by the Council of State Science Supervisors in cooperation with the Council of State Social Studies Specialists and the Association of State Supervisors of Mathematics. Financial Assistance was provided by the National Science Foundation through a grant to the Council of State Science Supervisors, Incorporated.

A Summary of Project Observations and Recommendations

The need for sound reason in making educational decisions has become increasingly apparent in a period of history where public scrutiny of the schools is at its highest. Taxpayers, minority groups, economic interests and academic fadists are exerting new influences on educational decision making.

To react positively to societal pressures it has become more important than ever that educators go beyond intuition and professional expertise in supporting continuing programs and in designing new ones. They need to have the most objective rationale possible to support change, and that rationale must in turn be based upon objective data utilization.

For these reasons the Council of State Science Supervisors in cooperation with the Council of State Social Studies Supervisors and the Association of State Supervisors of Mathematics, and with the financial support of the National Science Foundation, undertook the task of determining what the availability of educational data in the state departments of education is and what strategies can be applied to improve state data systems and make the best use of them.

The project involved two major activities: (1) the design and implementation of a survey study to determine the extent and consistency of data collected by the states as well as the frequency and source of data collection, and (2) a conference held at Las Vegas, Nevada, attended by state supervisors for the purpose of studying the results of the survey and making recommendations for improved data gathering and utilization. The results of the project may be stated in two categories: observations and recommendations.

Observations

The survey of state departments of education provided observations that describe the nature of the educational data collected by the states.

- *There is little consistency in the kinds of data items collected by the departments of education in the various states.*
- *The frequency of collection and the sources of educational data are highly varied among the states.*
- *The data most consistently collected are related primarily to identification and easily quantified characteristics of teachers.*
- *Data that reflect value judgements are practically never collected.*
- *There is a lack of consistency in computer treatment and coding of the data that are collected in most states.*
- *Most data items are neither collected nor stored in such a way that they could be retrieved to answer national, or even regional, questions.*
- *The sources of data and the frequency of collection are very diverse. Greatest consistency is found in data from annual reports to state departments of education.*
- *In spite of limitations, the state departments of education are, collectively, an extensive source for education data and have the potential for being much better.*

During the conference a study of data utilization procedures produced observations that are significant in judging the value of state data systems.

- *There is considerable difference between using existing data banks to develop a rationale to support decision making and actually attempting to answer research questions using existing data.*
- *As they exist the state data banks cannot be effectively used in doing basic research.*
- *Diverse sources of data and varied frequency of collection limits the use of state data in making regional or national decisions.*
- *Generalized surveys within states can be used successfully to collect data for later use in making decisions, establishing policies and generating researchable questions.*
- *Usefulness of state data systems is dependent upon the methods of collection. In particular, collection of data related to special subject areas requires full knowledge of the unique features of such areas.*
- *Usefulness of state data banks is dependent upon uniformity among states in the procedures used to collect and process data and in the kinds of data items collected.*
- *When a need for educational information is identified, the data available from the state departments of education, no matter how limited, are useful in making educational decisions.*

Recommendations

It was assumed at the conference that the limitations of the existing state data banks is not innate in the systems of the state departments of education. Hence, recommendations were presented with the hope that in the future useful data could be easily retrieved to meet certain kinds of educational needs.

- *The state departments of education should cooperate to produce uniform data collection and data processing procedures.*
- *Most probable uses of data should be identified to avoid collection of trivia and to improve chances that needed data will be available.*
- *Chief state school officers should make a commitment to collecting the data that are identified as needed.*
- *Subject area specialists should be consulted in modification of state data systems so that the data collected will be useful in improving instruction within subject areas.*
- *In most states steps should be taken to improve communications between subject area specialists and data processing specialists.*
- *Procedures should be established to promote utilization of state collected educational data by other agencies. Such agencies should include federal, state and local governmental agencies, universities, private foundations and professional associations that are involved in making decisions that affect education.*
- *Data utilization practices should be encouraged that promote positive change to meet educational change rather than for derogatory or negative purposes.*
- *In particular, data that relate the characteristics of teacher supply and demand should be collected and made available by the states for regional and national studies.*
- *The National Science Foundation and the United States Office of Education should provide financial assistance to states in order to collect and process data that could support existing programs in the sciences or give direction to new ones.*
- *Agencies funding educational programs should make use of existing state data in establishing programs and making grants. Specifically, the National Science Foundation, Division of Pre-College Education in Science, should use data from the state systems to establish the need that exists for programs that will be undertaken by the Education Materials and Instruction Development Section and the Instructional Improvement Implementation Section.*

More specific and detailed observations and recommendations are given within the body of the report along with a description of the procedures that were used to accomplish the objectives that were established for the total project. In reading this report, it is

important to realize that it is a progress report on a project that is intended to continue through several phases. It cannot be considered completed until improved data collection and utilization has actually become part of the procedures used in the states to improve education in the sciences. The Council of State Science Supervisors and colleagues in mathematics and social studies in state departments of education are obligated to continue efforts to improve this aspect of the services they provide. In this effort, it is hoped that other groups such as the U. S. Office of Education, the Council of Chief State School Officers, the Association for Educational Data Systems and other specialized groups of educators involved in state departments of education will become involved.

Planning for Data Utilization

The departments of education of the states and territories of the United States form a unique network for providing educational services as well as for collecting educational information that can be used in making decisions on a broad scale. However, because of the diversity of given functions within these departments it is sometimes difficult to find commonalities among them that will make interdepartmental projects feasible. Data collection is a function that is given different priorities depending upon the nature of educational policies that have been adopted by the states. In addition, geographical size and location, total and localized population, and organizational structure of school systems within states, are among factors that enhance, or limit, data collection abilities of the state departments. From previous experience with preservice and inservice teacher education problems, the members of the Council of State Science Supervisors recognized the value of systematic collection and use of data that describe characteristics of science teachers and science teaching practices. However, it rapidly became known that any effort to develop a national assessment of such teacher-based characteristics would be hampered by the limitations and incompatibilities of the existing data systems. If the unique network of state departments of education is to function in providing data to national studies, the differences in the collection and use of teacher data among the states must be identified. The problems believed to exist initially were:

- *Easily available data are neither consistent enough nor extensive enough to describe the attributes of the existing teaching population in science, social science and mathematics in the states.*
- *Student needs have not been identified and, therefore, existing data do not relate teacher characteristics to the ability of teachers to meet student needs.*
- *Instruments and methods do not exist for assessing student achievement in existing programs.*
- *There is a lack in uniformity of objectives of science education that could be used to structure assessment of students.*
- *Data that could be used to determine the characteristics of the teacher supply and demand at the state and national levels are not available.*
- *Data that could be used to assess quality of teaching practices are not readily available nor has quality teaching been defined.*

If more effective and more appropriate programs for inservice and preservice education of teachers are to be designed on the basis of knowledge about the existing teaching staff, these limitations must be removed or alleviated. It was assumed that correcting these limitations through a national effort would have implications for local and state programs in teacher education as well as national programs such as those that have been undertaken by the National Science Foundation. Assumptions were also made concerning the role of the states in improving teacher data collection and utilization. These assumptions were specifically stated as:

- *There is a need for more and better information from the states in order to:*
  - *Describe the nature of the teaching population in science, social science and mathematics in the states.*
  - *Assess student progress in existing programs.*
  - *Assess teacher supply in science, social science and mathematics.*
  - *Assess the quality of teaching occurring in existing classes of science, social science and mathematics.*
- *There is a need for a better description of the educational needs of today's youth.*
- *State departments of education and their respective subject specialists have a major contribution to make in the collection and analysis of educational data.*
- *State subject specialists will need specialized training in data collection and analysis if meaningful data is to be collected in the states.*
- *New sources of funding and strategies of implementation will be needed to initiate comprehensive state data collection and analysis systems which will be useful in determining the preservice and inservice needs of the nation's teachers.*

In response to these assumptions plans were made to take the first steps necessary to meet the needs that were recognized. The immediate objectives established were:

- *To describe the nature of the data available in state data banks on science teachers employed in the states.*
- *To describe the information available concerning the parameters of science teacher supply in the states.*
- *To describe ways of using data in improving science education in the states.*
- *To describe the elements needed for the creation of the data-collecting and sharing network embracing all states.*
- *To describe the elements currently available for constructing a comprehensive supply and demand picture of the current science teacher market.*
- *To provide a learning experience for participants in data-based policy formulation.*
- *To familiarize state science supervisors with new directions for education programs of the National Science Foundation.*
- *To provide opportunities for state science supervisors to react and respond to National Science Foundation educational program changes.*

Project Accomplishments, Observations and Recommendations

The established project objectives were such that some could best be accomplished through the work of small planning groups, mail surveys and telephone contacts. Other objectives could only be accomplished by having representatives of the states meet in concert to discuss the value and feasibility of collecting data through state departments of education to answer questions relative to the characteristics of science teachers and science teaching.

The procedures used to accomplish each of the project objectives are described separately along with interpretations and recommendations for future action.

Describing the Nature of the Data Available in State Data Banks on Science Teachers Employed in the States

An initial task in determining the feasibility of using data collected from the states to answer critical educational questions was to describe the nature of existing data. Realizing that data collected prior to identification of the question to be answered has limited value, it was also realized that nearly all state departments of education have developed systematic data banks using annual reports, teacher certification records, federal program reports and other periodic sources of teacher information, to renew and update their data collections and that these data can provide background information for making educational decisions. There was no known effort to investigate the compatibility of the various state systems in terms of collection, coding, categorizing, and other procedures that would affect the use of data in application to national or regional problems related to inservice science teachers. Similarly, the degree of consistency used in identification of specific items of data to be collected was not known.

In order to describe the existing data, the project planning committee developed a survey instrument that was used in each of the states plus the District of Columbia and the Canal Zone. Data items related to the characteristics of science teachers were put into seven categories: personal, teaching assignment, teaching experience, certification, college preparation, salary, and miscellaneous. These categories were established after contacting a sample of state consultants to determine the range of data they had available to them. For each category the final item "other" was added to give an indication of the completeness of the data. There is a noticeable lack of items related to teacher understanding of science and competence in teaching which is due to the observation that states make very little effort to establish evaluative criteria that could be applied to teachers in the public schools.

An important item of information related to usefulness of the state data is the condition in which they are stored and the ease of retrieving them. For this reason, each state was asked to indicate whether or not each item was contained in a computerized system. This made three possible responses available: data collected by state and in computer, data collected by state but not in computer, and data not collected by state. The actual survey instrument that was used is included in the appendices. The tabulated data relative to teacher information (items A through G on the survey instrument) are included on the following four pages.

Legend:

1 = Data Collected by State and in Computer
2 = Data Collected by State but not in Computer
3 = Data Not Collected by State
• = Data Needing Further Clarification

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA
A. Personal																												
1. Teacher Name	1	2	1	1	2	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	3	1	1	
2. Social Security Number	1	2	1	1	2	1	2	1	2	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	3	1	1	
3. Sex	1	2	1	1	2	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	1	
4. Race	1	3	1	3	2	1	3	1	2	1	3	3	3	2	3	3	3	3	1	1	3	1	3	1	3	3	2	3
5. Date of Birth	1	2	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	2	1	1	
6. Place of Birth	3	2	3	3	2	3	2	2	2	2	1	2	3	3	1	2	3	3	2	1	3	2	2	3	3	3	3	3
7. Home Address	1	2	2	1	3	3	2	2	1	1	1	1	2	3	1	2	1	3	1	2	3	2	2	3	3	3	2	3
8. Marital Status	2	2	1	3	3	1	2	2	1	2	1	3	1	3	1	2	2	3	1	2	3	2	2	3	1	3	3	3
9. Citizenship	3	2	2	3	3	3	2	2	1	1	1	2	2	3	1	2	3	3	3	2	3	2	2	1	3	2	2	2
10. Other													1															
B. Teaching Assignment																												
1. Name of School	1	2	1	2	3	1	2	1	1	1	1	1	3	1	1	1	1	2	1	1	1	1	1	1	1	2	1	1
2. Address of School	2	2	1	2	3	1	2	1	1	1	1	1	3	1	1	1	1	2	1	1	1	1	1	1	1	2	1	1
3. Name of School District	2	2	1	2	3	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1
4. Name of Courses Taught	1	3	1	2	3	1	3	1	1	2	2	1	1	1	1	1	2	1	1	1	1	1	2	1	2	1	1	
5. Name of Courses Assigned Each Period	3	3	3	2	3	3	3	2	1	2	2	1	3	3	1	1	1	2	3	1	3	3	3	2	1	2	3	1
6. Name of Text(s) Used in Each Course	3	3	3	3	3	3	3	2	3	3	2	2	3	2	3	3	3	3	3	3	3	3	3	2	3	3	1	3
7. No. of Pupils Per Course	2	3	3	2	3	3	3	2	1	2	2	1	3	3	3	1	1	2	1	1	1	3	1	1	1	2	1	3
8. Duration of Course (weeks or month)	3	3	3	2	3	3	3	2	1	2	2	2	3	2	3	3	1	2	1	3	1	3	1	1	1	3	1	3
9. No. of Minutes Per Week Each Course Meets	3	3	3	2	3	3	3	2	1	3	2	2	3	2	3	3	2	1	2	1	3	1	3	1	1	1	2	3	3
10. Credit Per Course	2	3	3	2	3	3	3	2	3	2	2	2	3	2	3	3	2	1	2	3	2	1	3	3	1	1	3	1	3
11. Grade Level of Course	2	3	3	2	3	3	3	2	2	2	2	1	3	1	1	2	1	3	1	2	1	3	1	3	1	1	2	1	3
12. Assignments Other Than Science Teaching	2	3	1	2	3	3	3	2	2	2	2	2	1	1	1	1	1	2	1	1	3	1	1	1	1	2	1	3
13. Other			1																	1			1					
C. Teaching Experience																												
1. Total Years Teach. Exper.	1	2	1	1	3	1	3	1	2	1	2	1	1	1	1	1	1	2	1	1	2	1	3	1	1	3	1	1
2. Years of Teaching Exper. in State	2	2	1	1	3	1	3	1	1	1	1	1	1	3	1	3	3	2	2	1	2	3	1	1	3	3	1	1
3. New to State	2	2	1	2	3	1	3	1	1	3	2	1	3	1	1	1	1	2	1	1	2	2	2	1	1	3	2	1
4. New to District	2	3	1	2	3	1	3	1	1	1	2	1	1	1	1	1	1	3	1	1	2	2	1	1	1	3	2	3
5. Previous Years Place of Employment	2	3	3	3	3	1	3	1	2	3	2	1	3	3	3	1	3	3	1	2	2	3	1	3	1	3	3	1
6. Years Teaching Present Course(s)	3	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3
7. Other													1		1					1								

INFORMATION ON CHARACTERISTICS OF SCIENCE TEACHERS

	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE	% of States Collecting Data Using Computer Storage (1)	% of States Collecting Data but not Using Computer (2)	% of States not Collecting Data (3)	Total Number of States in Each Category 1/2/3
A. Personal																												
1.	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	87	10	4	45/5/2
2.	1	1	1	1	1	1	3	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	2	83	10	8	43/5/4
3.	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	87	12	2	45/6/1
4.	3	1	3	1	1	3	3	1	3	3	3	1	3	1	1	3	3	1	3	3	3	3	1	3	35	8	58	18/4/30
5.	1	1	2	1	1	1	3	2	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	79	17	4	41/9/2
6.	1	3	2	2	3	3	3	2	2	3	1	1	3	3	3	3	3	2	2	3	2	3	2	2	12	38	50	6/20/26
7.	1	3	2	2	2	3	3	2	2	3	1	1	3	3	3	1	1	2	2	1	2	1	1	2	33	37	31	17/19/16
8.	1	3	1	1	3	1	3	2	3	1	1	1	3	3	3	1	1	1	3	3	2	1	1	2	38	25	37	20/13/19
9.	1	3	2	2	3	3	3	2	2	3	1	3	3	2	2	3	3	2	2	2	1	1	2	2	17	46	37	9/24/19
10.	1																	2										
B. Teaching Assignment																												
1.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	85	12	4	44/6/2
2.	1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	77	19	4	40/10/2
3.	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	2	3		81	13	6	42/7/3
4.	1	1	1	1	3	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2		77	15	8	40/8/4
5.	1	3	1	1	3	1	3	2	3	3	3	1	2	2	1	1	3	1	3	1	2	1	1	2	37	23	40	19/12/21
6.	3	3	3	3	3	3	3	2	3	3	2	3	3	2	3	3	3	2	3	2	3	3	2	2	2	23	75	1/12/39
7.	1	1	1	1	3	1	1	1	3	1	3	1	2	2	1	1	1	1	1	1	2	1	1	1	56	19	25	29/10/13
8.	1	1	3	1	3	1	3	2	3	3	3	1	2	2	2	3	1	1	1	1	3	1	1	2	37	23	40	19/12/21
9.	1	1	2	1	3	1	3	2	3	3	2	1	2	2	2	3	1	3	1	1	3	3	2	2	29	31	40	15/16/21
10.	3	1	2	1	3	1	3	2	3	3	3	1	2	2	2	3	3	1	2	3	3	3	1	1	23	31	46	12/16/24
11.	1	1	2	1	3	1	1	2	3	3	2	1	2	2	1	1	1	1	1	3	3	1	2	1	42	29	29	22/15/15
12.	1	3	1	1	3	1	1	1	1	1	3	1	2	2	1	1	1	1	1	1	3	1	1	1	60	21	19	31/11/10
13.	1	1			1													1		1				1				
C. Teaching Experience																												
1.	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2			79	13	8	41/7/4
2.	1	1	1	1	3	1	1	1	1	1	1	1	1	2	2	3	3	1	1	1	3	1	1	2	62	15	23	32/8/12
3.	3	1	1	2	3	1	1	1	1	1	1	1	1	3	2	1	3	1	1	1	3	1	1	2	58	23	19	30/12/10
4.	3	1	1	1	1	1	1	1	1	1	3	1	1	3	3	1	1	2	1	3	3	1	2	3	60	15	25	31/8/13
5.	3	3	2	3	3	1	1	2	3	3	2	2	3	3	2	3	3	3	2	2	2	1	2	2	21	29	50	11/15/26
6.	3	3	3	1	3	3	3	1	3	3	1	3	3	3	2	3	3	3	3	3	3	2	2	2	8	11	81	4/6/42
7.	1	1			1													1										

Legend:

1 = Data Collected by State and in Computer
2 = Data Collected by State but not in Computer
3 = Data Not Collected by State
· = Data Needing Further Clarification

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA
D. Certification																												
1. Basis on Which Teachers Certification Was Issued	1	2	2	1	2	1	2	1	1	2	1	2	2	1	1	1	1	2	2	1	2	1	1	1	2	2	1	1
2. Type of Certificate Held (eg. life, admin., provisional, etc.)	1	2	2	1	2	1	2	1	1	1	1	2	1	1	1	1	1	2	1	1	2	1	2	1	1	2	1	1
3. Subject Area(s) of Certification (Endorsement)	1	2	2	1	2	1	2	1	1	1	1	2	2	1	1	1	1	2	1	1	2	1	1	1	1	2	1	1
4. Date Certif. was Issued	1	2	2	1	2	1	2	1	1	1	1	2	2	2	1	1	2	2	1	1	2	1	2	1	2	1	1	2
5. Date Certif. was Utilized	1	3	3	1	2	3	3	1	3	1	1	2	2	3	3	3	1	2	1	3	2	3	1	3	1	3	1	3
6. Date Certif. Expires	1	2	2	1	2	1	2	1	1	1	1	2	2	1	1	1	1	2	1	1	2	1	2	1	1	2	1	1
7. Certificate(s) held in Other States	3	3	3	3	2	3	2	1	2	3	2	2	3	2	2	3	3	2	3	2	2	3	2	3	3	3	2	2
8. Other													1															
E. College Preparation																												
1. Total Hours College Credit	2	2	3	2	2	3	2	2	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	1	3	1	2
2. Yr. Last Credit was Earned	2	3	3	2	2	3	2	2	2	2	2	1	3	3	1	1	3	2	1	2	2	2	2	2	3	3	1	3
3. Degree(s) Earned																												
a. Type	1	2	1	1	2	1	2	1	1	2	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	2	1	1
b. Date Earned	1	2	1	2	2	3	2	1	1	2	1	1	2	3	1	1	2	2	1	2	2	1	2	1	1	2	1	2
c. College Name	1	2	1	1	2	3	2	3	2	2	1	2	1	1	1	2	1	2	1	2	2	1	2	1	1	2	1	2
d. College Location	2	3	3	2	2	3	2	3	2	2	1	2	1	2	1	2	3	2	1	2	2	1	2	1	1	3	2	1	1
4. Transcript of Credits	2	2	2	2	2	3	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2
5. No. of Credits Preparation in Major Teaching Area	2	2	3	2	2	3	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	1	3	3	2	2
6. NSF Supported Projects Attended	2	3	3	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3	3	3
7. Other														1						1								
F. Salary																												
1. Salary	1	2	1	2	3	1	2	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	3	1	1	2	1	1
2. Days of Contract	2	2	1	3	3	1	3	3	3	1	1	2	1	1	1	3	1	2	3	3	2	3	3	1	3	3	1	2
3. Full or Part-time Employee	1	2	1	2	3	1	2	1	3	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	2
4. Fringe Benefits	1	3	3	3	3	3	3	1	3	1	1	2	3	3	3	3	3	3	3	3	2	3	3	1	3	3	3	3
5. Extra Pay for Extra Duty	3	3	3	3	3	1	3	1	3	1	2	3	3	3	2	3	1	3	1	3	2	3	3	3	3	3	3	3
6. Percent of Salary Supported by Federal Funds	2	2	3	3	3	3	2	1	3	3	1	2	3	1	3	2	1	3	3	1	3	3	3	3	2	3	3	3
7. Other													1							1								
G. Miscellaneous																												
1. Military Experience	2	3	3	3	3	3	3	1	2	2	1	2	3	3	3	2	3	2	3	2	2	3	2	3	3	3	3	2
2. Non-teaching Job Exper.	2	3	3	3	3	3	3	1	2	2	2	3	3	3	3	2	3	3	1	2	3	3	2	3	3	3	3	3
3. Other																												

	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE	% of States Collecting Data Using Computer Storage (1)	% of States Collecting Data but not Using Computer (2)	% of States not Collecting Data (3)	Total Number of States in Each Category 1/2/3
D. Certification																												
1.	2	2	2	2	1	1	3	1	2	3	1	2	1	2	2	2	1	1	2	1	1	2	1	2	2	50	46	4	26/24/2
2.	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	2	3			75	23	2	39/12/1
3.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	3	1	1	1	2	2		75	23	2	39/12/1
	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	2	2		65	35	0	34/18/0
4.	3	3	3	2	1	1	1	2	3	1	3	2	3	3	2	3	3	3	2	3	3	1	2	3		29	21	50	15/11/26
5.	1	3	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	2	1	1	1	2	3		69	27	4	36/14/2
6.																													
7.	3	2	2	2	2	3	3	2	3	3	3	3	3	3	3	3	3	2	2	3	1	1	2	3		4	40	56	2/21/29
					1																								
8.																													
E. College Preparation																													
	2	1	2	2	2	1	3	2	1	1	1	2	1	1	3	2	1	2	2	2	2	1	2	2		29	62	10	15/32/5
1.	2	3	2	2	3	1	3	2	3	3	2	2	2	3	3	1	1	3	2	2	2	1	2	2		17	50	33	9/26/17
2.																													
3.	1	1	1	1	1	1	1	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2		77	23	0	40/12/0
	1	3	2	2	1	1	1	2	2	1	1	1	3	2	2	1	3	1	1	1	1	1	2	2		50	40	10	26/21/5
	1	3	2	2	1	1	1	2	2	1	1	1	3	1	2	1	3	1	2	1	1	2	2	2		48	42	10	25/22/5
	1	3	2	2	1	1	1	2	2	1	1	2	3	1	2	1	3	2	2	2	2	1	2	2	2	33	50	17	17/26/9
	2	2	2	2	2	1	2	2	2	3	1	2	2	2	3	2	3	2	2	2	2	2	2	2	2	4	85	12	2/44/6
4.																													
5.	2	2	2	2	2	1	2	2	3	3	1	2	2	2	3	2	3	2	2	2	2	2	2	2		12	73	15	6/38/8
6.	2	3	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	3	3	2	2			0	23	77	0/12/40
	1																												
7.																													
F. Salary																													
	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1			83	13	4	43/7/2
1.	1	3	1	3	1	1	2	1	1	3	3	1	1	1	2	1	3	1	1	1	3	1	2	3		46	17	37	24/9/19
2.	1	3	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1		81	13	6	42/7/3
3.	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	2	3	3	1	2	13	10	77	7/5/40
4.	1	3	3	3	2	1	3	3	1	3	3	3	2	3	3	2	3	3	1	3	3	1	1	2		21	1	65	11/7/34
5.																													
6.	3	3	3	3	1	3	3	1	3	3	3	3	3	2	3	3	3	3	3	1	3	2	2	3		15	17	67	8/9/35
	1												2																
7.																													
G. Miscellaneous																													
	3	2	2	2	2	3	2	1	3	3	2	2	3	2	3	3	3	3	2	2	3	1	2	2		8	42	50	4/22/26
1.	1	3	2	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	1	2	2		8	25	67	4/13/35
2.		1																											
3.																													

The data collected in the survey were presented to participants at the Las Vegas Conference where they were carefully considered in group discussions in order to identify patterns that would be important in assessing the value of existing data for answering questions pertinent to science education. The following general and specific observations were recorded during those discussions:

- *The data most readily and most consistently available are related more to identification than to teaching characteristics.*
- *Those data of a highly personal nature, such as race, place of birth, and marital status, are not consistently recorded.*
- *Much of the information that is collected and computerized appears to be primarily related to state financing of school systems and to teacher certification.*
- *The quantitative nature of the data being collected does not reflect competency of teachers or effectiveness of programs.*
- *Data related to the nature of programs such as name of text, number of pupils, duration of course and credit per course are not consistently collected.*
- *The data most collected tend to have greater value at the state level than at the national level.*
- *There is little reciprosity in record keeping among states.*
- *The kinds of data collected consistently have little relevance to the unique aspects of science education.*
- *There are practically no items of data, other than those related to identification and certification, that are collected uniformly in all states.*
- *Approximately 15% of the states do not have a way to correlate teachers names with social security numbers.*
- *There is almost no information kept on military experience and jobs outside of teaching fields.*
- *There are very few data collected that indicate experience teaching specific courses.*

Many other observations of a specific nature are obvious from studying the data matrix. It is especially interesting to compare the percentage figures given in the three columns at the right side of the matrix.

The conference participants came to some conclusions following their discussion of the results of the survey:

- *The available data will not be very useful in determining inservice and preservice training needs of science teachers.*
- *Competency of science teachers and adequacy of science teaching programs cannot be determined from data kept in state data banks.*
- *It is known that some states have statutory limitations on data gathering that, in turn, will limit validity of national studies using state data banks.*
- *There is little correlation between kinds of data collected and the problems related to science teachers and science teaching.*

Analysis of the data from the initial survey indicated considerable consistency in data items but did not indicate in any way what the conditions are under which the various states collect their data. As a follow-up to the original survey a second form (see appendix) was designed and sent to the states to determine the frequency of data collection and sources of data for the same categories of information as those on the original instrument. These data are valuable in judging the reliability of the data describing the characteristics of the science teacher population. Because of the interaction of the source of information with the frequency of collection, the tabulation of these data is unusually complex.

As a matter of clarification, the data sources were identified as follows:

(1) Personal—report forms submitted by local education agencies to state departments of education. A common example would be the fall or annual reports that are often required.

(2) Certification—report forms submitted by individuals of local education agencies to certification sections of state departments of education. These could include applications for teaching licenses.

(3) Program—report forms submitted to the state department of education providing information about an individual teacher who is involved in a program involving state or federal funding.

(4) Finance—report forms submitted to the state department of education which provide information on nearly all teachers in the state. Such reports are related to state financial aids to local education agencies.

The results of this second survey are included on the following five pages.

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE
7. Home address	24 31	22	23	23	25	66	25	11 21 31 41	25 55	66	15	11 27	25	66	66	22	34	66	31	25	41	66	22		66	66	25	66	25	66	22	11 27	22	66	27	25	22	66	11 21 41 51	25	22	24 41	25	11	11		21	51	25	11	11 21 31 47	11
8. Marital status	24	22	11	23	66	55	66	11 21 31 41	25 55	25	15	27	11 25	66	25	66	66	66	31	25	66	66	22		25	66	66	66	25	66	11	27	25	11	66	25	66	11	17 21 41 51	51	11	45	25	11	11	25	21	66	11	11 25 47	11
9. Citizenship	24	22	23	66	66	66	25	11	25	25	15	11	25	66	66	25	66	66	66	25	66	66	22	52	66	25	25	15	25	66	25	27	25	66	66	25	22	66	17 21 41 51	25	22	66	25	66	66	55	21	25	25	66	15 25 45	25
B. Teaching Assignment																																																				
1. Name of school	41 51	11	11	31	66	51	31	11 21 31 41	11	41	11	11	51 27	11	11	11	11 41	31	31	25	41 31	66	21	10	31	31	41	11	21	11	11	11 27 41	11	51	11	11	51	11	51 21 47 57	11	11	51 41	11	11	31	31	51	11	11	11	31 21 31 47
2. Address of school	41 51	11		23	66	66	66	11 21 31 41	11	41	11	11 27	51	11	11	11 41	11	31	31	25 31	41	66	21	10	31	31	41	11	21	66	11	11 27 41	11	11	51	11	47	51	11 21 41 57	51	11	11 41	51	11	11	31	31	51	11	11	11 21 31	31
3. Name of school district	41 51	11	11	31	66	51	31	11 21 31 41	11	41	11	11 27	41 51	11	11	11 41	11	31	31	25 31	41	11	21	10	31	31	41	11	21	11	11	11 27 41	11	11	51	11	11 31 41 57	11	11 21 41 51	51	11	11 41	51	11	11	31	31	51	11	11	66	66
4. Name of courses taught	41 51	66		31	66	51	66	11	11	31	11	66	11		11 31	11 41	11	31	31	31	41	31	21	10	31	31	41	11	21	11	11	11 27 41	66	11	51	11	31 47	11	17 27 47 57	51	11	11	51	11	11	31	31	51	11	31	15 25 31	30
5. Name of courses assigned each period	51	66		66	66	66	66	66	66	31	11	66	66	66	66	11 41	11	31	66	31	66	66	21	66	31	31	66	11	21	66	11	66	66	11		11	66	66	17 27 47 57	51	11	11	55	11	66	31	66	51	52	31	31	30
6. Name of text(s) used in each course	41	66		31	66	66	66	66	66	66	66	66	66	32	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	66	11		66	66	66	11		66	13 27 47 57	51	66	66	54	66	66	31	66	51	66	66	31	31
7. Number of pupils per course	51	66		31	66	66	66	66	11	21	51	66	66	31	31	11 41	11	31	31	31	66	66	21	66	31	66	66	66	21	11	11		66	11	51	11	31	66	17 27 47 57	66	11	11	54	11	11	31	31	51	52	66	31	35
8. Duration of course (weeks or months)	41 51	66		31	66	66	66	57	11	31	51	66	66	55	31	11 41	11	31	31	31	66	66	66	21	66	31	66	41	66	21	11	66	66	66	11	51	11	31	66	17 47 57	51	11	11	54	66	11	31	31	51	66	31	31	35
9. Number of minutes per week each course meets	51	66		31	66	66	66	57	11	31	51	66	66	55	66	11 41	11	31	31	66	66	66	21	66	31	66	41	66	21	11	31	66	66	11	51	11		66	17 27 47 57	51	11	11	54	66	11	31	31	51	66	31	31	35

RESULTS OF SURVEY OF STATE DATA SYSTEMS

Frequency of Data Collection and Source of Data

Coding System

Explanation: Each item on the data survey form is provided space for four (4) double digit numbers. The 10's digit of any double digit number represents the source of data and the 1's digit represents the frequency of collection.

Source of Data Code No.

10	Personal
20	Certification
30	Program
40	Finance
50	Other
60	Not Collected

Frequency of Data Collection Code No.

0	6 months
1	Annually
2	2-5 years
3	6-10 years
4	10 years and over
5	One time only
6	Not collected
7	Other

Coding Sample

The State of Louisiana collects data on teacher names from two sources (i.e., Program 30 and Finance 40). The frequency of collection is annually (i.e., 1). This information will appear in the column of data under Louisiana as 31 41.

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IDWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DISTRICT OF COLUMBIA	CANAL ZONE
A. Personal																																																					
1. Teacher name	24 51	11	11	23 31	25	55	25	11 21 31 41	11 25 55	25 41	15	11 27	11 25	11 27	11 25	11 25 31	11	31 41	31	35 31 41	41	11	21	15	25 31	31	25 41	15	21	11	11	11 27 41	25	11	41	21	11 27 31 41	11	11 21 41 51	51	11	11 24 41	41	11	11	25	21	51	11 25	11	11 21 31 45	31
2. Social security number	51	11	11	23	25	55	25	11 21 31 41	25 55	25 41	15	11 27	11 25	11 27	11 25	11 25 31	11	41	31	25 31 41	41	66	21	15	25 31	25	25 41	15	21	11	11	11 27	25	11	41	25	11 27 41	11	17 21 41 51	51	11	66 24 41	41	11	11	25	21	51	11	11	11 21 31 45	45
3. Sex	24	11	11	23	25	55	25	11 21 31 41	25 55	25	15	11	11 25	11	11 25	25	11		31	25	66	11	21	15	25 31	66	25 41	15	25	11	11	11 27	25	11	41	25	11 22 41	11	11 21 41 51	51	11	24 45	41	11	11	25	21	51	11	11	11 21 31 45	15
4. Race	24	66	11	66	66	55	66	11 21 31 41	25 55	25	15	11 27	11 25	66	11	66	66	66	31	25	66	66	66	15	25 31	25	24 41	66	66	11		66	25	11	66	25	66	11	66	51	66	45	41	66	66	25	66	66	66	66	45	66
5. Date of birth	24	22	11	23	25	55	25	11 21 31 41	25 55	25	15	11 27	11 25	11 27	11 25	25	11	66	31	25	66	11	21	15	25 31	25	25 41	15	25	11	25	11 27	25	11	66	25	11 41	11	17 21 41 51	25	11	24 45	25	11	11	25	21	25	11	11	15 25 32 45	25
6. Place of birth	24	22		23	25	66	66	11 21 31 41	25	25	15	11 27	25	66	66	66	66	66	31	25	66	66	21	15	66	66	66	66	25	66	25	27	66	66	66	25	66	66	17 21 41 51	25	66	24 45	25	66	66	25	21	25	25	66	15 25 45	25

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH OAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE
4. Date certificate was issued	24	22	23	23	25	25	25	11	25	25	25	27	25	27	25	22	21	25	81	25	15	66	21	22	25	25	25	15	25	25	22	27	21 41	11	25	22	27	25	11 21	25	32	24 41	25	21	11	25	21	25	27	11 21	15 25 45	25
5. Date certificate was utilized	41 51	66		23	25	66	66	11	66	25 45	66	66	66	66	66	66	27	66	31	66	15	66	21	22	66	66	25	66	66	66	22	27	22	66	25	22		25	11 21	66	66	66	25	66	66	25	21	66	66	66	15 25 45	25
6. Date certificate expires	24	66	23	23	25	25	25	11	25	25 45	66	27	66	27	25	22	21	66	51	25	66	66	21	22	25	25	25	15	25	25	22	27	22	11	25	22	27	25	11 21	51	32	24 41	25	21	11	25	21	25	27	11 21	15 25 47	66
7. Certificate(s) held in other states	66	66		66	25	25		11	25	66	25	66	27	66	66	66	27	25	66	25	15	66	66	22	66	25	25	15	66	25	66	27	66		55	25		25	11 21	25	66	66	25	66	66	66	21	25	26	66	15 25	66
E. College Preparation																																																				
1. Total hours college credit	24 41 51	22	23	23	25	15	66	11 21 31	25	27	27	27	25	11 27	11 25	11 22 41	27	25	21	25	15	66	22	22	25 31	25	25	15	25	11	22	27	66	11	27	22	11 41	25	11 21	25	11	24	25	52	11	22	21	25	27	11	15 25 32	21
2. Year last credit was earned	24 41 51	22	23	23	25	66	66	11 21 31	25	25	27	27	25	66	66	22	27	27	31	25	66	66	22	22	25 31	25	25	66	25	25	22	28	66	11	28	21		66	11 21	51	32	24	25	11	11	22	21	25	27	11	15 21 32	21
3. Degree(s) earned																																																			
a. Type	24 41 51	22	23	23	25	15	66	11 21 31	25 55	25	25	27	11 25	27	11 25	22	11	25	31	25 41	15	21	22	22	25	25	25 41	15	25	11	22	27	25	11	27	25	11	25	11 21	51	32	11 24 41	25	11	11	27	21	25	11	11 21	15 25 35 47	25
b. Date earned	24 41 51	22	23	23	25	15	66	11 21 31	25 55	25	25	27	25	27	11 25	22		25	31	25	15	66	22	22	25	25	25	15	25	25	22	27	25	11	27	25	27	25	11 21	25	32	24	25	11	66	27	21	25	11	11 21	15 28 35 47	25
c. College name	24 41 51	22	23	23	25	15	35	11 21 31	25 55	25	25	27	11 25		11 25	22	11	25	31	25	15	66	22	22	25	25	25	15	25	25	22	27	25	11	27	25	27	25	11 21	25	32	24	25	11	66	27	21	25	11	21	15 25 32	25
d. College location	24 41 51	22	23	23	25	15	35	11 21 31	25	25	25	27	25	27	66	66	11	25	31	25	15	66	22	22	25	66	25	15	25	25	22	27	25	66	27	25	27	55	11 21	25	66	24	25	11	66	27	21	25		11 21	15 25 32	25
4. Transcript of credits	24	22	23	23	25	15	35	11 21 31	25	25	27	27	25	27	25	22 41	23	25	21	25	15	66	25	22	66	25	25	15	25	25	22	27	25	66	27	25	27		11 21	25	32	24	25	22	66	27	21	25	25	11	15 25	25

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE
10. Credit per course	51	66		31	66	66	66	57	66	31	51	66	66	55	31	11 41 51	11	31	66	31	66	66	66	66	31	66	41	66	66	11	66	41	66	11	51	11		66	17 27 47 57	51	11	11	57	66	66	31	31	51	60	66	31	35
11. Grade level of course	51	66	11	31	66	66	66	57	11	31	51	66	11	55	31	11 41	11	66	31	66	41	66	21	66	31	31	41	66	21	11	31	11 41	66	11	51	11		66	13 21 47 57	51	11	11	57	11	11	31	31	51	66	31	31	35
12. Assignments other than science teaching	41 51	66		31	66	51	66	57	11	31	51	66	11	11	11	11 41	11	31	31	31	66	66	21	66	31	31	41	66	21	66	11	27	66	11	66	11		11	13 21 41 57	51	11	11	57	11	11	31	31	51		31	47	35
C. Teaching Experience																																																				
1. Total years teaching experience	41 51	11 22	11	23	25	51	66	11 21 31 41	25 55	27 41	11	27	27	11	11 25	11 41	11	31	31	41	41	66	21	15	31 51	66	41	11	25	11	11	27	21 41	11	41	21	11 41	11	17 21 41 51	51	11	41	41	11	11	21	21	21	11	11	15 25 32 45	41
2. Years of teaching experience in state	51	22	11	23	25	51	66	11 21 31 41	25	66	11	27	11 27	66	66	11 41	66	31	21	51	41	66	21			66	41	11	25	11	11	27	66	11	41	21	11 41	11	17 21 41 51	25	11	41	25	66	66	21	21	21	66	11	11 21 32 45	41
3. New to state	41 51	22	11	23	25	51	66	11 21 31 41	25	66	15	66	11	11	66	21	11	66	31	45	41	66	66	15	66	66	41	11	66	11	11	66	66	11	66	25	11 41	66	17 21 47 51	25	11	41	25	11	66	21	21	21	66	11	15 25 31 45	35
4. New to district	41 51	22	11	23	25	51	31	11 21 31 41	11		15	66	66	11	11	11 41	11	66	31	45	41	66	21	15	31 51	66	41	66	66	11	11	11 41	21 41	11	66	25	11 41	11	17 27 47 57	51	11	41	25	11	11	21	21	21	66	11	15 25 31 45	
5. Previous years placement of employment	41 51	22		66	25	25	66	11 21 31 41	25 55	25	15	27	11	66	66	11 41	66	66	31	41	41	66	21	66	31	66	66	11	66	66	22	27	21 41	11	27	21		66	17 21 41 51	25	66	41	41	66	66	66	21	66	35	66	15 25 32	45
6. Years teaching present course(s)	51	66		66	25	66	66	11 21 31 41	25	66	16	66	27	66	66	66	66	66	66	66	41	11	66	66		66	41	66	66	66	66	27	66	66	66	21		66	17 27 47 57	66	66	66	25	66	66	21	66	66	66	66	15 25 31	31
D. Certification																																																			
1. Basis on which teacher certification was issued	24	22	23	23	25	25	25	11 31	25 55	25	25	27	25	27	11 25	22	23	25	21	25	15	21	21	22	25	25	25	15	25	25	22	27	22	66		22	25	66	11 21	25	32	24 41	25	66	11	25	21	25	27		15 25	25
2. Type of certificate held (e.g., life, admin., provisional, etc.)	24	22	23	23	25	25	25	11 31	11 25 55	25	25	27	11 25	27	25	22	23	25	31 41	25	15	21	21	22	25 31	25	25	15	25	11	22	27	22	11	27	22	27	11	11 21	51	32	24 41	25	21	11	27	21	25	27	11	15 25 47	66
3. Subject area(s) of certification (endorsement)	24	22	23	23	25	25	25	11 31	25 55	25	25	27	25	27	25	22	11	25	31	25	15	21	21	22	25 31	25	25	15	25	25	22	27	22	11	27	22	27	11	21	51	32	24	25	21	11	25	66	25	27	11 21	15 25 47	21

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE
5. Number of credits preparation in major teaching area	24 51	22	23	23	25	15	35	31	25	25	25	27	25	27	25	11 22 41	11	25	21	25	15	66	25	22	66	25	25	15	25	25	22	27	25	11	27	22	25	25	11 21	25	32	24	55	11	66	27	21	25	27	11	15 25 32	25
6. NSF supported projects attended	57	22		66	25	66	66		66	66	26	66	66		66	66	66	66	21	25	66	66	66		66	66	66	15	25	66	22	27	25	66	66	66		66	11 21	66	32	66	57	66	66	66	66	25	66	11	32	25
F. Salary																																																				
1. Salary	41 51	11	11	31	66	51	41	11 41	66	41	11	11	21 41	11	11	21 41	41	31 41	31	41	41	11	66	11	31	31	41	11	21	11	11	41	21 41	11	51	21	11 41	11	11 21 51	51	11	41	41	41	11	11	41		11	11	15 25 35 47	41
2. Days of contract	41	66	11	66	66	51	66	41	66	41	11	11	66	11	11	66	41	31 41	66	66	41	66	66	11	31	66	41	11	21	66	11	41	21 41	11	66	21	11 41	66	11 21 51	51	11	41	41	41	66	11	41		11	11	35 41	41
3. Full-time or part-time employee	41 51	66	11	31	66	51	41	41	66	41	11	11	21 51	11	11	21 41	41	31 41	31	41	41	11	66	11	31	31	41	11	21	17	11	41	21 41	11	66	21	11 41	11	11 21 51	51	11	41	41	41	11	47	41	66	11	11	35 41	41
4. Fringe benefits	66	66		66	66	66	66	41	66	41	11	66	66	66	66	66	41	66	66	66	41	66	66	11	66	66	66	66	66	66	66	41	21 41	66	66	66		66	11 21 57	66	11	66	41	66	66	47	66	66	66	66	35 41	41
5. Extra pay for extra duty	66	66		66	66	51	66	41	66	41	17	66	66	11	11	66	41	66	31	66	41	66	66		31	66	66	66	21	66	66	66	21 41	66	66	66	11 41	66	11 21 57	66	11	66	41	66	66	66	41	66	66	11	47	40
6. Percent of salary supported by federal funds	41	66		66	66	66	66	41	66	41	11	66	66	11	11	21 41	41	66	66	41	41	66	66		31	66	66	66	66	66	11	41	21 41	66	66	21		66	11 21 57	66	66	41	41	66	66	47	41		66	66	47	57
G. Miscellaneous																																																				
1. Military experience	66	66		66	66	66	66	21 41	25	25	15	66		66	25	66	66	66	11	25	15	66	25	66	66	66	66	66	15	66	66	25	22 42	21	66	66	25		66	11 21 51	25	66	41	55	66	66	57	11	25	66	66	15 25 35 45	25
2. Non-teaching job experience	23 57	66		66	66	66	66	21 41	25	25	15	66		66	66	66	66	66	66	25	15	66	25	66	66	66	66	66	25	66	25	66	66	66	66	66		66	11	25	66	66	55	66	66	57	11	25	66	66	15 25 35	25

An analysis of the tabulated data reveals a number of pertinent observations:

- *As might be expected, there is very little consistency in source or in frequency of collection among states.*
- *The most common source of data is from personal reports. This is particularly true for data relating personal characteristics, teaching assignments, teaching experience and salary.*
- *The most common frequency of collection is once each year.*
- *Most states collect data items from only one source.*
- *Those states using multiple sources tend to be states with fewer districts although there are exceptions.*
- *As would be expected, the certification data comes primarily from certification reports.*
- *The primary sources for data on college preparation are certification reports.*
- *Data from certification reports are usually collected one time only, presumably at the time a license is issued.*
- *Lack of uniformity of sources and frequency of collection limits ways in which state data relating teacher characteristics may be utilized.*

Many other specific observations concerning individual state systems and geographical regions of the country may be made by studying the tabulated data and relating conclusions to the data on teacher characteristics that were included earlier.

Describing the Information Available Concerning the Parameters of Science Teacher Supply in the States

The magnitude and distribution of the science teacher population nationally, regionally, and within the states is important to decisions affecting preservice and inservice teacher education. In fact, the need for programs for inservice and preservice education of science teachers is established through knowledge of the number of well prepared teachers that are available and the number of well prepared teachers that will be needed in the future. This knowledge should be national in scope if funding for teacher training programs is to come from federal sources. As with the data that describe teacher characteristics, it was known that some states systematically collect data that can be used to describe teacher supply. However, the questions of compatibility, consistency, source, frequency of collection and others arise as they did relative to assessing teacher characteristics. On the original survey sent to the states items H and I were designed to determine whether the data being collected could be useful in determining the nature of the science teacher supply (see the survey instrument in the appendices). The results of the survey are tabulated on the following two pages.

Legend:
- 1 = Data Collected by State and in Computer
- 2 = Data Collected by State but not in Computer
- 3 = Data Not Collected by State
- · = Data Needing Further Clarification

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA
H. Teacher Supply and Need																												
Data Collected by Subject or Grade																												
1. Projected Vacancies for September Assignments	2	3	3	3	3	3	·	2	2	2	2	2	3	3	1	·	2	3	3	3	2	2	2	3	2	3	2	3	2	3
2. Projected Vacancies for January Assignments	3	3	3	3	3	3	·	2	2	2	3	2	3	3	3	2	3	3	3	3	2	2	2	3	3	·	3	·	3	2	3
3. Positions Remaining Unfilled after September Assignments	2	3	3	3	3	3	·	2	2	2	2	2	3	2	3	·	2	3	3	·	3	2	2	2	3	2	3	3	·	3	2	3
4. Positions Remaining Unfilled after January Assignments	3	3	3	3	3	3	·	2	2	2	3	2	3	2	3	2	3	3	3	3	2	2	2	3	2	3	3	·	3	2	3
5. Teachers Teaching out of Their Area of Certif.	1	3	3	2	2	3	·	3	2	1	1	2	2	3	·	2	2	1	1	2	·	1	1	2	2	1	1	1	2	2	1
6. Projected Teacher Graduates from State Institutions Within the State	3	3	3	3	2	3	·	2	2	2	2	2	2	2	1	2	3	2	3	3	2	2	2	2	2	2	1	3	·	3	2	3
7. State Institution Teacher Graduates Employed by the State	1	3	3	3	2	3	·	3	2	3	3	2	3	2	3	3	1	1	3	2	2	2	1	2	1	1	3	2	3			
8. State Institution Teacher Graduates Unemployed	3	3	3	3	3	3	·	3	2	3	3	3	2	3	2	3	3	3	3	2	2	2	3	2	3	·	3	3	3			
9. Other																												
I. Teacher Aides																												
1. Data on Paraprofessional Employees	2	3	1	3	3	3	3	1	1	1	2	1	·	2	1	2	2	1	3	1	3	2	2	3	·	1	2	2	2	3		

NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE	% of States Collecting Data Using Computer Storage (1)	% of States Collecting Data but not Using Computer (2)	% of States not Collecting Data (3)	Total Number of States in Each Category 1/2/3
3	3	3	3	1	3	3	3	3	1	1	3	3	3	2	2	3	3	2	3	3	2	1	2	10	35	56	5/18/29
3	3	3	3	1	3	3	3	3	3	1	3	3	3	2	2	3	3	3	3	3	2	1	3	6	23	71	3/12/37
2	3	3	3	1	3	3	3	3	1	1	3	3	3	2	2	3	3	2	3	3	2	1	3	8	35	58	4/18/30
3	3	3	3	1	3	3	3	3	3	3	3	3	3	2	2	3	3	2	3	3	2	1	3	4	29	67	2/15/35
3	3	1	1	3	1	1	2	3	1	1	1	1	2	2	1	3	1	2	1	3	1	2	2	45	35	21	23/18/11
2	3	2	2	3	3	2	2	2	1	2	3	3	3	2	1	2	2	2	3	3	3	2	3	8	54	38	4/28/20
3	3	2	3	1	3	2	2	3	1	2	1	3	3	2	1	2	2	2	1	1	1	2	3	25	35	40	13/18/21
3	3	2	3	3	3	3	3	3	1	3	2	3	3	2	3	3	3	2	3	3	3	2	3	2	23	75	1/12/39
1	3	1	1	3	1	1	2	2	1	2	1	1	3	2	3	1	3	3	1	2	2	1	3	38	31	31	20/16/16

As with the other data, the participants at the project conference considered the feasibility of using the available data to assess the science teacher supply. The following observations were made:

- *Compared to collection of data in other areas, the number of states collecting data on teacher supply and need is very low. The percentage of states not collecting specific items ranges from 22% to 74%.*
- *Data on teachers teaching outside their area of certification is collected more consistently than other items although 22% of the states do not have this information in any form.*
- *A relatively large number of states collect data on teachers graduating from state institutions.*
- *Data on paraprofessionals is gathered in a majority of states.*
- *By noting vertical columns it may be seen that many states make practically no effort to collect data reflecting teacher supply and need.*

From these observations it is apparent that the inconsistency in data collection and, in fact, the large number of states not involved in collecting such data makes broad generalization to the nature of science teacher supplies on a regional or national basis impractical. If questions are to be answered that will have meaning for preservice and inservice education of science teachers on a national basis, such as those that have been sponsored by the National Science Foundation, it will be necessary to seek sources of information other than the existing state data banks.

The second survey to establish frequency of data collection and sources of data was also applied to teacher supply and need. The results of that survey follow:

RESULTS OF SURVEY OF STATE DATA SYSTEMS

Frequency of Data Collection and Source of Data

Coding System

Explanation: Each item on the data survey form is provided space for four (4) double digit numbers. The 10's digit of any double digit number represents the source of data and the 1's digit represents the frequency of collection.

Source of Data
Code No.
- 10 Personal
- 20 Certification
- 30 Program
- 40 Finance
- 50 Other
- 60 Not Collected

Frequency of Data Collection
Code No.
- 0 6 months
- 1 Annually
- 2 2-5 years
- 3 6-10 years
- 4 10 years and over
- 5 One time only
- 6 Not collected
- 7 Other

Coding Sample

The State of Louisiana collects data on teacher names from two sources (i.e., Program 30 and Finance 40). The frequency of collection is annually (i.e., 1). This information will appear in the column of data under Louisiana as 31
41.

	ALABAMA	ALASKA	ARIZONA	ARKANSAS	CALIFORNIA	COLORADO	CONNECTICUT	DELAWARE	FLORIDA	GEORGIA	HAWAII	IDAHO	ILLINOIS	INDIANA	IOWA	KANSAS	KENTUCKY	LOUISIANA	MAINE	MARYLAND	MASSACHUSETTS	MICHIGAN	MINNESOTA	MISSISSIPPI	MISSOURI	MONTANA	NEBRASKA	NEVADA	NEW HAMPSHIRE	NEW JERSEY	NEW MEXICO	NEW YORK	NORTH CAROLINA	NORTH DAKOTA	OHIO	OKLAHOMA	OREGON	PENNSYLVANIA	RHODE ISLAND	SOUTH CAROLINA	SOUTH DAKOTA	TENNESSEE	TEXAS	UTAH	VERMONT	VIRGINIA	WASHINGTON	WEST VIRGINIA	WISCONSIN	WYOMING	DIST. OF COLUMBIA	CANAL ZONE
H. Teacher Supply and Need																																																				
1. Projected vacancies for September assignments	51	66		66	66	66	66	21	51	21	11	11		21	21	66	66	66	21	21	66	66	27	66	51	66	51	66	66	66	66	52	21	66	66	66	66	51	21	66	66	66	21	66	66	66	66	66	66	11 20 31	31
2. Projected vacancies for January assignments	51	66		66	66	66	66	21	66	66	11	66		66	66	66	66	66	21	21	66	66	27	66	66	66	51	66	66	66	66	66	66	66	66	66	66	66	21	66	66	66	21	66	66	66	66	66	66	11 20 31	57
3. Positions remaining unfilled after September assignments	51	66		66	66	66	40	21	51	66	11	11		66	66	66	66	66	21	21	66	66	27	66	66	66	51	66	51	66	66	52	21	66	66	66	66	51	21	66	66	66	22	66	66	66	66	66	66	10 21 31 41	66
4. Positions remaining unfilled after January assignments	51	66		66	66	66	40	21	66	66	11	66		66	66	66	66	66	21	21	66	66	27	66	66	66	51	66	66	66	66	66	66	66	66	66	66	66	21	66	66	66	22	66	66	66	66	66	66	10 21 31 41	57
5. Teachers teaching out of their area of certification	41 51	66		66	25	66	66	21	66	41	66	11		66	66	21 41	66	31	66	21	66	11	21	11	31	66	41	11	66	66	21	42	66	66	41	21	66	51	21	51	11	11	22	51	66	21	31	21	66	66	10 20 41	31
6. Projected teacher graduates from state institutions within the state	21	66		66	66	66	66	21	55	21	66	11		21	21	21	66	66	21	51	66	66		11	66	66	51	66	21	66	21	42	21	66	66	21	21 51	51	21	66	31	66	22	21	51	21	21	66	66	66	10	57
7. State institution teacher graduates employed by the state	66	66		66	66	66	66	21	55	66	11	11		21	21	66	66	21	21	66	66		11	66	66	51	66	66	66	66	66	21	66	66	21	21 51	51	21	66	66	66	22	11	51	21	21	66	57	66	66	57
8. State institution teacher graduates unemployed	66	66		66	66	66	66	21	55	66	66	11		21	21	66	66	21	51	66	66		11	66	66	51	66	66	66	66	66	21	66	66	66	21 51	51	21	66	66	66	22	66	66	66	21	66		66	66	
I. Teacher Aides																																																				
1. Data on paraprofessional employees	23 41 51	66	11	66	66	51	66	21	66	41	66	11		21	21	66	66	31	51	41	66	66	11	31	66	51	66	21	17	21	11 41	21	11	66	21	21 51	51	11 21	52	31	41	41	66	11	66	66	51	11	66	47	57

As was noted earlier, the number of states collecting data on teacher supply and demand is relatively small. In fact, the percentage is from 25% for state graduates unemployed to 79% for teachers who are teaching outside their area of certification. The noted inconsistency of sources and frequency of collection reiterates that the available data on teacher supply and demand has little use beyond local and specific questions that may be asked. Itemized observations are:

- *The persistence of the source category "other" indicates randomness of collection procedures.*
- *Certification reports provide data on supply and demand in the greatest number of states. This is particularly true for data items reflecting graduates of state institutions.*
- *More states (30) collect data on teachers teaching out of their area of certification than any other item relating supply and demand.*
- *More states (33) collect data on teacher aides than any item relating supply and demand.*

Describing Ways of Using Data in Improving Science Education in the States

It may be generally assumed that the more information one has for planning the more successful he will be in bringing about the changes he has judged to be desirable. However, it may be just as easily assumed that information will have limited use unless it is used systematically with conclusions restricted to those allowed by rigorous analysis procedures. To apply data to the process of improving science education requires careful study to avoid the temptation to base judgements on insufficient data processing. This project initiated that study by involving consultants who had varied experiences and responsibilities related to educational decision making in the project conference. Following formal presentation by the consultants small group discussions were held where questions were raised for further reaction in plenary sessions. There were six individuals who gave major presentations at the conference. For the purposes of this report only the context of their presentations and the major points they made will be included. These presentations are described in the order in which they were given at the conference.

Dr. Michael M. Frodyma
Program Manager
Instructional Improvement Implementation Section
Pre-College Education in Science Division
National Science Foundation

(Special Note: It was largely because of Dr. Frodyma's recognition of the need for data that could be applied to national problems in preservice and inservice education that the Council of State Science Supervisors undertook this project. His help has been essential to the progress that has been made.)

Dr. Frodyma indicated that the purpose of his presentation was to describe the development of National Science Foundation programs over a six year period and to offer two options to the established direction that may offer hope to do a better job in the future. He identified three models for decision making: the rational approach model, the bureaucratic model and the political expediency model. Originally, the development of NSF programs appeared to follow the rational model, but the involvement of various interests caused an evolution to a combination of all three with the emphasis gradually shifting to political expediency. The need now is to provide a rational base for bureaucratic and political decisions. This base will require systematic collection of data in the months and years to come in order to build a rationale for new programs as well as a defense for old ones.

Five types of information sources in increasing order of complexity were described: budget data, program data, modified program data, secondary analysis of existing data and designed studies. Examples of use of each of these sources as they have related to NSF programs were given. It was pointed out that in all cases data gathering and analysis must precede the recognition of need for it or bureaucratic and political decisions will be made under some other influence.

Two alternatives were offered:

1) Build summative and formative evaluation systems into original program structures in order to prevent misinformation in decision making. This kind of evaluation was built into the Comprehensive Program which required continuous evaluation over the four year period of the grant.

2) Data collection in a matrix format to provide maximum communication to decision makers. Essential to this system is the ability to select, prior to use, those data that will have maximum impact on decision making.

Dr. Frodyma predicted that the need for data in decision making will be even greater in the future than it has been in the past. He proposed that existing data banks be improved and used as extensively as possible in developing the rationale for new programs for improved education in the sciences.

Dr. William Richardson
Director of Advance Planning and Development
Montgomery County, Maryland Board of Education

Dr. Richardson has been extensively involved in systems development making extensive use of computer analysis. His objective at the conference was to describe ways in which the computer may be put to use with the data based concept—using hard data as the basis for developing school programs.

In the data based concept, a central data file is established in such a way that many independent computer applications are possible. In this system the general file is referred to as the data base. This concept requires that the data base be organized so computer applications can be made directly to the base in order to make decisions. The early applications have been directed at administrative management within the Montgomery County schools although the program of hard data utilization is being expanded into program development. The intent is to go from a Planned Program Budgeting System (PPBS) to a Planned Program Budgeting and Evaluation System (PPBES).

Dr. Richardson was enthusiastic in his recommendation for data based decision making through computer utilization. Further information may be had from a publication entitled *The School Information System* produced by the Montgomery County Public Schools, Rockville, Maryland.

Dr. William S. Graybeal
Assistant Director
Research Division
National Education Association

Dr. Graybeal has been extensively involved in data collection and analysis related to science teachers and science teaching positions. This involvement has led him to carefully study systems for data gathering.

To demonstrate the effectiveness of data gathering to identify trends in science education, Dr. Graybeal discussed in considerable detail the results of studies on science teacher supply and demand and used these results to extrapolate into the future. He proposed, for example, that the increasing supply, which he verified using hard data, will lead to high teacher competency in the future. He also identified a trend toward increased numbers of women entering the science teaching field.

The sources used by NEA in gathering educational data include direct contact with teachers, school systems, institutions of higher learning and state departments of education. Reliable sources of professional literature are also used as extensively as possible.

Dr. Graybeal indicated that the NEA could benefit considerably by improved specification of data to be collected by state departments of education. He asserted that characteristics of data affecting their usefulness are relevance, timeliness, objectivity, validity and credibility. Perhaps even more important to data usefulness is prior assessment of information needs of constituent educators. This assessment is critical to effective dissemination of research results which leads to effective educational planning.

Dr. J. Myron Atkin, Dean
College of Education
University of Illinois

Dr. Atkin began his presentation with the very strong statement that using the available data is "exactly the wrong approach." He suggested that it is much better to ask "How do we get the data we need?" He equated the need for data based research with the desire for positive change. It is assumed by many that research and development activities have broad implications for change. This quest by the researcher for generalizable characteristics that may cause change is in error in that it overlooks the social-political climate in which change must occur. To formulate educational policy the total climate must be known. In state-federal relationships it must be remembered that educational change really occurs in the classroom. Thus, teachers must be responsible for change and in the future it should be expected that they will have a greater input into decisions that will result in change.

In general, the broader and more transplantable an educational concept is the more trivial, according to Dr. Atkin, it will be. He cited recent structures for individualizing education as an example of generalized trivia. He also referred to the discrepancy between goals established in the National Assessment of Educational Progress and the measures that were used as an example where generalizing to a format for testing defeated assessment purposes.

In identifying models for educational change, Dr. Atkin proposed a problem solving model for teachers as an alternative to formal research and development. However, the lack of a well defined problem is a difficulty teachers face as they modify their activity. Change must involve the unique nature of each situation and, therefore, projects designed to educate teachers for change should deal with the processes of change that make it possible to accommodate that uniqueness.

If education is treated as a craft, there are obvious shortcomings in applying a scientific (data based) approach to assessing educational change. Dr. Atkin recommends highly localized empirical approaches over the broad based experimental efforts. He sees the state supervisors as being in an advantageous position for disseminating local empirical results in an effort to combat generalized societal pressures that tend to overwhelm local and individual values.

Dr. Atkin identified three conditions that prevent educational change: the concept of the role of schools in society, the limitations placed on support and the quality of those entering the education profession. He noted that we have lost esteem by failing to bring about the changes we advocate. In the future we should base our decisions for progress on the recommendations of accomplished practitioners (teachers) rather than on specialists with central authority. The decisions *should not* be based on incomplete factual data such as that now available from the states.

Dr. Herbert J. Wahlburg
Research Professor of Urban Education
University of Illinois

Dr. Wahlburg prefaced his remarks on "methodological suggestions" with a quote from Mark Twain: "There are lies, damn lies, and statistics." On that note, Dr. Wahlburg proposed some cautions:

1) Do not be misled by statistical reporting.
2) Realize that survey studies are, by nature, very complex.
3) Be careful in using social data in decision making.

Dr. Wahlburg pointed out that there must always be trade-offs in collecting educational data to answer specific questions. Ideals are never reached in collecting data and, correspondingly, care must be used in accepting results. Effective collection requires future orientation and anticipation of new questions. Immediacy in accumulating data causes limitations that result in ineffectiveness.

Budgeting is a necessary and important component of educational research. Research is expensive and efficiency is low. Therefore, simplicity in design is of great importance and there should be a preference for continuing questions over specific one-time questions.

Dependence on existing data banks does reduce cost but such use of data should be limited to spot surveys that must be done in a short period of time. Data collected from various sources have questionable value because of inconsistency in collection practices. Such data may have its greatest value in pilot studies that precede planning for more complex research designs.

Where surveys are conducted to obtain specific data, short simple questionnaires have many advantages. Even so, such studies are complicated by the necessity of randomness and stratification. Non-returns always bias the sample as can the nature of the items on the questionnaire.

Data analysis should also be kept as simple as possible in order to make it easy to communicate results. Often simple tabulation, cross tabulation and use of means provide sufficient answers. More complex methods, use of computers and involvement with outside contractors create problems that will require wisdom and choice of decision makers. However, Dr. Wahlburg concluded, it must always be remembered that trade-offs in simplicity and cost must depend upon the original informational need and available resources.

Mr. Edward J. Meade
Educational Director
Ford Foundation

In his discussion of the Ford Foundation Comprehensive School Improvement Program (see report entitled *A Foundation Goes to School* produced by Ford Foundation, Office of Reports, 320 East 43rd Street, New York, New York 10017). Mr. Meade cast doubt upon the assumption that we should learn from the past. The school projects in the Comprehensive Program were directed at innovation of the mechanical aspects of school operations. The report on these projects is subjective, but it measures the extent to which changes were successfully implemented.

Mr. Meade recognized a need for "educational pathology"—a looking at experience where as much can be learned from failures as from successes. It was learned through the evaluation that funding alone will not assure change. General noncategorical grants were not effective in causing change. Also, the size of the grant did not affect its success. Success, it was discovered, was dependent upon local involvement and the inclusion of local funds in the project budget. Planning money was more effective than operational money. An interesting observation was that higher education did not effectively serve the project schools. As might be expected, other factors being equal, small (simple) schools changed more easily than did large (complex) schools. Projects wasted money where internal conflicts existed while it appeared that teachers received the most help in teacher centers that were established away from universities. Above all, it was shown that local people—teachers, administrators and other school employees—are critical to change and, hence, they must be involved.

The importance of Mr. Meade's presentation is in the nature of the evaluation he described. Many of the observations were made subjectively without dependence on hard data. This procedure is significant when presented at a conference directed at effective data utilization whether those data be hard or soft.

Although the six consultant-presenters at the conference prepared individually and although there are major differences in the philosophies and strategies they used it is possible to see definite interrelationships in the recommendations made and the discussions that followed. Among other things, there is an apparent interrelation between purpose and strategy in data utilization. Where the purpose is to collect and tabulate data as a simple indicator of trends and events, the strategy is simple and the use of existing data banks is appropriate. However, when the purpose is to inquire into the subtle aspects of education that deal with program or educational competencies the strategy for research becomes correspondingly subtle and complex. From the presentations and discussions at the conference it is possible to establish several observations that provide direction in using data to improve science education in the states:

- *In working with bureaucratic and political enterprises it is essential that objective data be collected and analyzed on a continuous basis in order to establish the rationale for initiating, continuing or changing educational programs. In the competition for funding, intuition and professional testimony is not enough.*
- *In developing the rationale for educational programs, some data is better than no data.*
- *Using objective data to support proposed governmental action at the local, state or federal level is not the same as using data in educational research.*
- *Computer technology is essential to data utilization. However, at the present state of technology and computer theory, computer application to data systems is more appropriate to administrative management than to program development and assessment.*
- *When the purpose of data utilization is educational research, it is essential that the question be clarified and the design established before the search for data begins. Research procedures forbid designing a study to accommodate existing data.*
- *Reliance on objective, quantitative data in the study of educational procedures may limit the kinds of questions that may be asked. Subjective, empirical observations have definite application in making educational decisions.*
- *Simplicity in design and in reporting of results is important in translating educational research into educational change.*
- *Where the ultimate purpose of data utilization is to produce a change in educational practice the practitioners must be involved in making decisions based on the data. Decisions by central authorities have not been effective in producing change.*

Describing the Elements Needed for the Creation of a Data Collecting and Sharing Network Embracing All States

From the efforts to study ways of using data to improve education in the sciences, a generalization emerged that identified the major value of data systems as being the source of support for administrative decision making. However, for supervisors working in state departments of education who are involved with national as well as state and local programs, this function may often have greater importance than the pure research function as it is applied to educational programs. Therefore, state supervisors continue to be interested in the development of a data system that is compatible among states and has sufficient data items to provide application to a broad assortment of educational questions that have administrative implications. In small group discussions the conference participants identified a series of informational needs that could be satisfied by an interstate data network. Examples of these needs not met by the existing data banks are expressed in terms of the ability to determine or describe the following:

- *Classroom practices employed in local schools.*
- *The number of semester hours or quarter hours accumulated by teachers in each teaching area.*
- *Special programs accomplished by teachers for certification, i.e., student teaching, internship.*
- *The amount budgeted for teaching equipment and materials in the sciences.*
- *Extra duties that are assigned to teachers and extra pay that is derived.*
- *Consultant help available to teachers from the local system.*
- *The kind of program taught (elementary as well as secondary) and associated texts and printed materials.*
- *The percent of instructional time spent in laboratory activities.*
- *The nature of the organization of academic departments in local schools.*
- *Special offerings such as mini-courses, independent study and other innovative practices.*
- *The percent of certified teachers who because of upgraded standards do not meet present certification requirements.*
- *The number of years specific courses have been offered in given schools.*
- *Total experience of teachers by given course and grade level.*
- *Preparation time available to teachers of science courses.*

These needs represent those that could be met by an extension and improved consistency and reliability of the present state data systems. However, it is not possible with such systems to answer other questions which kept emerging unless it becomes possible to collect data that reflect competencies in teaching as well as affective attributes of teachers and students. Some of the questions recorded at the conference are:

- *What are the perceptions of teachers in relation to various program rationales?*
- *How do teachers perceive student achievement?*
- *What do teachers believe to be their needs for inservice education?*
- *What is the extent of teacher competency?*
- *What do students regard as needed changes in their classrooms?*
- *How do teachers value the subjects they are teaching?*

From such questions and a knowledge of the limitations of data systems a design was outlined that is included here as a model for state departments of education to consider as their efforts in data collection evolve. Recognizing that there are limited possibilities for collecting items of data that will be entirely useful in answering questions that must be asked after the data is collected, it is obvious that there are advantages in having state data banks with a high degree of uniformity among the states. To promote this uniformity the number of items recommended is minimized.

In order to make these data systems as useful and comprehensive as possible it is necessary to go beyond the basic identification data that are now available in many, but not all, of the states.

To promote uniformity it is recommended that three levels of data be identified based upon the nature and apparent complexity of these data. These levels may be described as:

Complexity Level I—basic identification data such as those being presently collected and described earlier in this report.

Complexity Level II—data describing teachers and teaching situations. Some of these data are unique to science education.

Complexity Level III—data reflecting specific cognitive and affective characteristics of teachers and teaching programs.

If should be recognized that as the complexity level increases there is a decreasing value in data that may be collected prior to identifying specific questions and research designs for answering them. For this reason it may not be as important that state data banks contain Level III items as Level I items. The nature of Level III data should be identified but the specific information needed may vary from state to state. However, state data systems should be geared to collecting higher level data when the need for it arises. It is important at all levels of data that there be a uniform coding system in the states so that items can be pulled out of given state systems to answer regional or national questions.

Level I is unique in that most of the data existing at the present time in the state data banks falls into this category. However, because some states collect almost none of these data, and because there is a conspicuous lack of certain important items in other states, it is recommended that eventually all of the following identification items be collected in all of the states and kept in computerized systems.

Level I

A. Personal data
   1. Teacher name
   2. Social security number
   3. Date of birth
   4. Home address
   5. Status of citizenship

B. Teaching assignment data
   1. Name of school
   2. Address of school
   3. Name of school district
   4. Name of courses taught
   5. Name of texts used in science courses
   6. Number of pupils in each course
   7. Credit per course
   8. Grade level of each course

C. Teaching experience data
   1. Total years teaching experience
   2. Years of teaching experience in state
   3. Years of teaching experience in present school district
   4. Years teaching present courses

D. Certification data
   1. Basis on which certification was issued
   2. Type of certification held
   3. Subject area(s) of certification
   4. Date certification was issued
   5. Date certification was utilized
   6. Date certification expires

E. College preparation data
   1. Total hours of college credit
   2. Year last credit was earned
   3. Degree(s) earned
      a. type
      b. date earned
      c. college name
      d. college location
   4. Transcript of credits
   5. Number of credits preparation in major teaching area
   6. N.S.F. supported projects attended
   7. Other special teacher training programs attended

F. Salary data
   1. Annual salary
   2. Full- or part-time employee

Level II data is of a more subjective nature than Level I. The following is an attempt to illustrate these items, but is in no way intended to be all inclusive. These items are classified in the same way as those in Level I.

Level II

A. Personal data
   1. Nature and amount of administrative duties required of teacher
   2. Extra duties such as department head, curriculum coordinator, etc.
   3. Additional duties and extra pay
   4. Profile of teaching philosophy and methodology
   5. Involvement in innovative programs and materials development
   6. Evaluation of degree of happiness with present teaching assignment
   7. List of previous teaching assignments indicating grade levels, subjects and years taught
   8. Preparation and planning time each day
   9. Inservice training needs
   10. Curriculum projects used and teacher preparation in each
   11. Membership in local, state and national professional organizations
   12. Evaluation of facilities, program, equipment, etc.
   13. Special awards or contributions to science education
   14. Special interests or skills

B. Teaching assignment
   1. Name of school
   2. Address of school
   3. Name of system
   4. Name and schedule of all courses taught (including planning time)
   5. Satisfaction with present assignment (subject, grade, school)
   6. Non-teaching duties
   7. Teacher freedom in selection of texts, equipment, assignments
   8. Relation of classroom strategies to student achievement
   9. Names of textbooks used in each course
   10. Identify interest in new curricula
   11. Summer institutes, workshops attended every two years
   12. Evaluation of suitability of program, equipment, materials for laboratory-oriented teaching

13. Clerical assistance (number of people and hours/week)
14. Curriculum projects used

C. Teaching experience
1. Courses, curriculum projects taught by number years
2. Number of years teaching special courses or curriculum projects
3. Non-teaching experience (military skills, hobbies)
4. Participation in professional activities or groups
5. Experience in innovative assignments or programs (open-space, modular scheduling, etc.)

D. Certification
1. Correlation of degree training with salary
2. Summary of coursework completed (name, content, date, location) each two years
3. Certification categories based on characteristics, skills, or other systems rather than academic preparation

E. College preparation
1. Non-subject area preparation in other areas such as social studies and special concerns

The highest level of data-gathering and analysis is Level III. The major categories of this data base must be carefully developed and studied in order to include the complex information in this area. Only two examples have been listed for demonstrational purposes.

Level III

A. Teacher attitude and job compatibility analysis
1. Development of data to compare success of program implementation with teacher effectiveness and student achievement
2. Identification of obstacles to effective teaching
3. Identification of needs (material, educational, financial) of teachers, students, administrators
4. Determination of teacher attitude toward students and teaching
5. Determination of student attitude toward science education and teacher
6. Determine non-subjective training needs to assist teachers in classroom management procedures

B. Financial planning systems
1. Analysis of expenses involved for various programs or materials and comparisons of alternative systems
2. Collection of expenses and analysis of expenditures in each state and federal program

These recommendations for the design of the data collection and sharing network were made without an effort to incorporate the Elementary-Secondary General Information System (ELSEGIS) which has been developed by the United States Office of Education. Comparison of the survey forms for that program (O.M.B. No. 51-s1037) with the recommendations in this report will show that many of the data items included here as Level I coincide with items that will soon be collected in a uniform way through the Office of Education. However, Level II and Level III items are not included. For further information, see Department of Health, Education and Welfare Publication No. (O.E.) 73-11400.

Describing the Elements Currently Available for Constructing A Comprehensive Supply and Demand Picture of the Current Science Teacher Market

The survey of the states for information related to science teacher supply and demand left little doubt that the state data banks are not adequate to establish a reliable quantitative distribution of science teachers in the United States. In a few states it would be possible to make determinations of teacher supply but obviously, to use data from only those states that collect sufficient data would bias the sample so seriously that few generalizations could be made from it. Other sources and completed studies, such as that described by Dr. Graybeal provide an adequate picture of the national trends but because such studies are based upon national samples there is no way provided to compare a given state to the national situation nor to make comparisons among states.

The responsibility of state departments of education to teachers and to teacher education programs makes it important for state personnel to be well informed about the ratio of trained teachers with specific training in given fields to the demand for such teachers. It is also important to be aware of trends in teacher competencies as a result of preparation programs as well as the competency expectations of school systems seeking to employ teachers. This dynamic interaction requires constant monitoring if a satisfactory balance is to exist between adequate teachers and teaching opportunities. In this area of concern, there are few characteristics that are unique to science education although the specific questions to be asked about science teachers and science teaching positions may differ somewhat from other teaching areas.

Most of the data that apply to assessing science teacher supply and demand are basic, quantitative identification items corresponding to the Level I items identified for the data network described earlier. To adequately conduct an assessment in this area the same uniform collection and coding procedures should be applied to a specific set of items that could be included as part of a more general survey of the schools conducted by the state departments of education. Data items recommended as necessary by the conference participants are:

A. Teacher supply and demand (data collected by subject or grade)
   1. Projected vacancies for September assignments
   2. Projected vacancies for January assignments
   3. Teachers teaching out of their area of certification
   4. Projected teacher graduates from state institutions within the state
   5. State institution graduates employed by the state
   6. State institution graduates unemployed

B. Teacher aide data
   1. Number of paraprofessionals employed
   2. Preparation required for licensing

For a more complete picture of the nature of teacher supply and demand it would be necessary to identify those items in the model presented earlier in the report that relate to expectations for teachers and teaching conditions.

Providing A Learning Experience for Conference Participants in Data Based Policy Formulation

The role of the science supervisor in a state department of public instruction is primarily one of leadership. He is often involved in problem situations only to the extent that decisions are made and then implementation is left to others. Because of this early involvement he is expected to have sound information and to be able to supply supporting data when he expresses views. There is definitely a need for him to be aware of the positive values and limitations of data utilization in making judgements within school programs. He needs to know how to use data and he needs to have the necessary data accessible when he needs them.

The total project on data utilization was designed to give participants an introduction to as many aspects of the art as possible. the survey of the state data systems made all of the supervisors involved more aware than they had been of the advantages and disadvantages of the data collection procedures employed by their states. Perhaps more important, the survey provided an opportunity to compare procedures of all the states as they contribute to what may be considered a sort of national data bank. In this comparison, the problems of using these accumulated data to make regional and national decisions became obvious to the extent that recommendations emerged that may lead to more comprehensive data collection in the future. At the same time, the participants recognized from their discussions that there are barriers within states presented by traditions, policies and legislation that cannot be easily overcome for the sake of better data collection.

The opportunity at the conference to hear presentations from experts and practitioners involved in a broad spectrum of data related activities gave a perspective to data utilization that most of the participants had not been exposed to before. The range of activities discussed included developing data-based rationale for decisions, computer application in data systems, problems of national surveys in education, strategies for educational research, and appealing to direct sources for empirical data. The interaction with the speaker—consultants and the group discussions made it possible for the participants to formulate the observations and recommendations that are included in this report.

As a follow-up to the learning experience for those who participated in the project will be the efforts of the Council of State Science Supervisors to ask questions pertinent to improving science education in the states and to have participants in their positions with the departments of education supply necessary data or data sources and become involved in analyzing the data to formulate answers. Hopefully, the educational experience and service to improved science education will continue to be concurrent.

Familiarizing Conference Participants With New Directions for Educational Programs of the National Science Foundation

Science specialists in state departments of education, by the nature of their work, have had a very direct involvement with the teacher education projects and curriculum development projects of the National Science Foundation Division of Pre-College Education in Science. In many cases, state specialists have been directly involved in assessing needs within their states or regions and in generating proposals to the National Science Foundation that have resulted in successful projects. In addition, the state science specialists, including those in social studies and mathematics, have been constantly involved through their respective organizations, the Council of State Science Supervisors, the Council of State Social Studies Specialists and the Association of State Supervisors of Mathematics, with conferences and projects that relate to National Science Foundation projects. Through all of these activities it has been essential that individual specialists be well informed of plans for future educational programs of the Foundation and that they have an opportunity to present their perception of needs in science education as they might affect future programs to the Founda-

tion staff members. For these reasons, a special general session was included in the conference for a presentation by the Director of the Division of Pre-College Education in Science.

Dr. Howard J. Hausman, Director
Division of Pre-College Education in Science
National Science Foundation

Dr. Hausman prefaced his presentation by endorsing the data gathering process that had been under discussion throughout the conference. He indicated that the use of data gathered from independent sources is important to making the kinds of educational decisions that his division constantly faces.

The major purpose of Dr. Hausman's presentation was to acquaint the conference participants with the new directions the Foundation's educational programs would be taking in the immediate future and in Fiscal Year 1974. He indicated that the changes to be made were not due to lack of success in the past, but rather, they were due to changing educational needs as well as financial restrictions that were being applied to the Foundation's educational budget.

In this first public discussion of coming changes, Dr. Hausman announced the termination of the institute program as the participants had known it along with termination of the comprehensive program that had originated only a short time before. Systems grants were to be cut in half along with grants for resource personnel workshops. A most significant change was the withdrawal of participant support in terms of stipends and expenses.

Four new themes had been adopted by P.E.S. They are:

- *Improvement of education for careers in science.*
- *Development of scientific literacy.*
- *Increasing efficiency of educational processes.*
- *Experimental projects and problem assessment.*

Dr. Hausman elaborated on each of these themes and stated that a major effort will be given in the coming fiscal year to programs directed at the development of scientific literacy.

Developing new programs has required a reorganization of the Division of Pre-College Education in Science. In this structure there are two major sections that are directly responsible to the Division Director. These are the Educational Materials and Instruction Development Section and the Instructional Improvement Implementation Section. In each section the programs will be conducted by a program head and program managers along with support personnel. Dr. Hausman explained that it is intended that funding will be closely aligned with the need for course content materials and that implementation will be confined to NSF-sponsored materials. However, at the time of Dr. Hausman's presentation the nature of the implementation activities to be conducted was not developed. (Since the conference, the National Science Foundation has prepared and distributed "Guidelines for Preparation of Proposals for Instructional Improvement Implementation," publication number E-74-4. Another publication, E-74-1 entitled "Announcement of Education Programs," details many of the points included in the conference presentation.)

Dr. Hausman concluded his remarks by urging the science, social studies and mathematics state consultants, as well as the organizations that represent them, to continue their close communication and interaction with the Foundation. Finally, he indicated that grants will be made to proposals that originate from outside the Foundation and thus emphasized the importance of state consultants working with educators at the local level to generate proposals to meet local needs.

Providing an Opportunity for State Science Supervisors to React/Respond to NSF Educational Program Changes

Throughout the conference, Dr. Frodyma and Dr. Hausman were available for individual and small group informal discussions. Also, Dr. Wayne W. Welch, who was serving with the Foundation while on a one-year leave from the University of Minnesota, was available to interact with participants. Dr. Welch had also been involved with the Conference Planning Committee in establishing guidelines for the conference.

These opportunities to discuss Foundation involvements within the states, as well as new direction the Foundation was taking, were culminated by a session held immediately after Dr. Hausman's presentation where individuals were able to take the floor to present their concerns to the group and to ask for responses to their questions. Many expressed concern for the established programs that had served well in the past. Others were concerned that newer programs such as those funded by Comprehensive Grants and Systems Grants would not be carried to completion. However, it was inevitable that the fiscal pressures under which Foundation programs must now operate were recognized and general satisfaction was expressed with the statement by Dr. Hausman that continuing consultation by the Foundation with state consultants would be important to refining the new directions that have been established.

To provide further opportunity for interaction, Dr. Hausman invited the participants to attend regional meetings of grant directors to be held in Washington, D.C., New Orleans, Chicago and San Francisco during the month of February, 1973

Data Utilization in the Future: Involvement of the Council of State Science Supervisors

This project was undertaken because the state consultants in science, social studies and mathematics recognized the need for information that would help them, individually and collectively, to make educational decisions. If the project had revealed that the state data systems were an ideal source of the needed information, the next steps to be taken would obviously be to identify questions and formulate answers using those systems. However, as was expected at the outset, the state data systems fell far short of ideal when applied to the specific characteristics of science education. Therefore, with a much more precise picture of the nature of existing data, the Council of State Science Supervisors and their colleagues in the other areas are in a position to identify alternatives that will most probably solve the problems that were recognized in the position papers presented at the NSF Regional Conference in 1972. The following procedures may be undertaken by the Council in the future dependent upon the resources available and the priorities that will be established.

- *Because of the national involvement of the Council, a cooperative effort with agencies involved in collection of educational data on a national scale could provide data on a sampling basis relative to science teacher characteristics. The most probable agency to work with is the National Center for Educational Statistics, a division of the United States Office of Education under the direction of the Assistant Commissioner for Educational Statistics. The Council, in this role, would provide consultant service that will result in identification of useful and needed data items. The advantage of working with the Center for Educational Statistics would be complete consistency in sampling and in data collection and treatment procedures. A recent project of the Center, the development of the Elementary-Secondary Information System, is an indication of this ability to standardize. A major disadvantage would be the apparent inability of the Center to collect data on a regular basis with a frequency that would keep data current.*
- *A second alternative for cooperative effort would be for the Council to work with the Committee on Evaluation and Information Systems (CEIS), a committee functioning under the Council of Chief State School Officers. This committee, with a member from each state department of education, offers an excellent opportunity for interaction with members of the Council of State Science Supervisors. Through such interaction the recommendations of the Council for improved data gathering (see pages 28-30) could be consistently incorporated into state data systems.*
- *The Council, with support from the National Science Foundation or other interested agencies, could do its own data gathering in an effort to identify the characteristics of the science teaching staff within the states as well as the nation. From such a study the inservice and preservice needs of science teachers could be determined. Such a study would have to be based on the assumption that student needs can be translated into teacher needs. Such a study would have to be done on a one-time basis but its successful completion could be used to demonstrate the value of data relating the status of teachers in subject areas. Results of such a study could be instrumental in establishing national science teacher education programs and developing the rationale for federal funding of programs that are shown to be needed.*
- *The Council could support and cooperate with individual members to conduct pilot studies within their particular states. The results of such studies would be meaningful in planning teacher education projects within states and regions and in developing proposals for funding. State pilot studies could also be used as precedents to regional or national studies. The Council, and individual members with information from the Council, could on a limited basis act as a clearinghouse for science education data. However, this function could be best accomplished by cooperation with other agencies or organizations.*

Throughout this project and in its succeeding phases the limitation of the Council of State Science Supervisors must be considered. The Council must operate primarily with contributed time of its members. For financial needs the Council is entirely dependent upon external grants to conduct worthy projects. Therefore, with limited professional time and unassured funding, it is difficult for the Council to undertake a project as massive as the proposed improvement of the data gathering and processing systems of the fifty states and the territories. For this reason, the Council encourages those agencies, organizations and foundations with a greater capacity for causing change to cooperate in the effort to provide information that can establish and maintain a direction toward improved science education.

Evaluation

In the initial planning for this project, eight well defined objectives were established. In conducting the project a specific activity was directed at each of these objectives. Each of these activities is discussed in the eight sub-sections of this report under the chapter entitled "Project Accomplishments, Observations and Recommendations."

In addition to planning sessions, the preconference activities were very critical to the success of the project. The data gathered by surveying the state departments of education were essential to meeting four of the project objectives and were closely related to the remaining four. The judgement of the success of the data gathering activity may be accomplished by observing the fact that all states responded to both forms and that the responses were complete in every case. In addition, the data from the first major survey were tabulated and made available to the participants prior to the conference. Because the need for the second survey was not recognized until the data from the first survey were inspected, those results were delivered to the person in charge of data collection and analysis on the first day of the conference. The combined sets of data were the basis for much of the discussion at the conference and made it possible for participants to establish guidelines for their planning for future data utilization.

The conference was such a critical aspect of the project that an independent evaluator was hired to make observations during all of the sessions as a basis for judging the degree of success in meeting the objectives that had been established. The results of this evaluation were largely positive. The following is excerpted from the evaluator's report:

> In general, the sessions were considered successful by the conferees. All were well prepared, and together presented an assortment of ideas and philosophies concerning the use of data in policy formation. The points of view of Richardson compared with Atkin provided the conferees with extreme positions not only from a theoretical analysis, but from the point of view of practice. They may have caused participants to reflect upon the use of data and tempered some initial points of view.

The small group work sessions were a second major type of conference activity. Although reported in the proposal that work and study sessions would dominate the conference, the fact was that many of the work sessions tended to be rushed and participants felt they did not have sufficient time to complete their tasks.

Apparently, however, this fact was observed by the conference planning committee as the comments and evaluation of the work sessions were more positive for later sessions. The high mean score for the first session, particularly with respect to productivity and relevancy to the charge, was probably the result of the conferees' need to establish who they were, and to find who their colleagues were. Once this was taken care of, the groups tended to become more productive as the data shows.

The success of the group sessions, which will be significant to the success of the entire conference, will only be known by examination of the Conference Planning Committee's final report. However, based on the written reports of the groups in Las Vegas, a tentative conclusion can be prepared stating that they addressed their tasks in a professional manner and were conscientious in providing written summaries of their efforts.

The complete evaluation report entitled "Evaluation of A Conference on Data Utilization in Assessing the Needs of Science Education in the States" may be seen by contacting the Council of State Science Supervisors, Inc.

The actual measure of success for this project must be based upon changes brought about in state data systems and their use in application to problems in science education. In the post-conference discussions it has been suggested that a possible follow-up survey might be conducted at a time to be designated to determine the extent of change in state data collection as a result of this project. At this time no definite plans exist for carrying out this suggestion.

Survey form used to collect data on the nature of state data banks on science teachers employed in the states.

Appendix A

Council of State Science Supervisors Science Teacher Data Survey

STATE: Prepared by:

Title: Phone:

Directions: Place an "X" in the appropriate space and list other items of data that your state collects on individual teachers in the appropriate spaces.

ITEM	Data collected by state and in computer	Data collected by state but not in computer	Data not collected by state
A. *Personal*			
1. Teacher name			
2. Social security number			
3. Sex			
4. Race			
5. Date of birth			
6. Place of birth			
7. Home address			
8. Marital status			
9. Citizenship			
10.			
11.			
12.			
B. Teaching Assignment			
1. Name of school			
2. Address of school			
3. Name of school district			
4. Name of courses taught			
5. Name of courses assigned each period			
6. Name of text(s) used in each course			
7. Number of pupils per course			
8. Duration of course (wks. or mo.)			
9. Number of minutes per week each course meets			

ITEM	Data collected by state and in computer	Data collected by state but not in computer	Data not collected by state
10. Credit per course			
11. Grade level of course			
12. Assignments other than science teaching			
13.			
14.			
15.			
C. *Teaching Experience*			
1. Total years teaching experience			
2. Years of teaching experience in state			
3. New to state			
4. New to district			
5. Previous years place of employment			
6. Years teaching present course(s)			
7.			
8.			
9.			
D. *Certification*			
1. Basis on which teachers certification was issued			
2. Type of certificate held (eg., life, admin., provisional, etc.)			
3. Subject area(s) of certification (endorsement)			
4. Date certificate was issued			
5. Date certificate utilized			
6. Date certificate expires			
7. Certificate(s) held in other states			
8.			
9.			

ITEM	Data collected by state and in computer	Data collected by state but not in computer	Data not collected by state
E. *College Preparation*			
1. Total hours college credit			
2. Year last credit was earned			
3. Degree(s) earned			
a. type			
b. date earned			
c. college name			
d. college location			
4. Transcript of credits			
5. Number of credits preparation in major teaching area			
6. NSF supported projects attended			
7.			
8.			
F. Salary			
1. Salary			
2. Days of contract			
3. Full or part time employee			
4. Fringe benefits			
5. Extra pay for extra duty			
6. Percent of salary supported by federal funds			
7.			
8.			
9.			
G. Miscellaneous			
1. Military experience			
2. Non-teaching job experience			
3.			
4.			

ITEM	Data collected by state and in computer	Data collected by state but not in computer	Data not collected by state
H. Teacher Supply and Need Data collected by subject or grade			
1. Projected vacancies for September assignments	☐	☐	☐
2. Projected vacancies for January assignments	☐	☐	☐
3. Positions remaining unfilled after Sept. assignments	☐	☐	☐
4. Positions remaining unfilled after January assignments	☐	☐	☐
5. Teachers teaching out of their area of certification	☐	☐	☐
6. Projected teacher graduates from state institutions within the state	☐	☐	☐
7. State institution teacher graduates employed by the state	☐	☐	☐
8. State institution teacher graduates unemployed	☐	☐	☐
9.	☐	☐	☐
10.	☐	☐	☐
I. Teacher Aides			
1. Data on para-professional employees	☐	☐	☐

ATTENTION: The **DEADLINE** for the return of this data survey form is

OCTOBER 25, 1972

Return all requested information and materials to:

Ray Thiess, Specialist
Science Education
State Department of Education
942 Lancaster Drive, N.E.
Salem, Oregon 97310

Survey form used to collect data on the source and frequency of collection of items in state data banks.

Appendix B

Council of State Science Supervisors Science Teacher Data Survey

STATE: _____ Prepared by: _____

Title: _____ Phone: _____

Directions: Place the appropriate number from the list below which most closely indicates the frequency of collection in the column most appropriate as the source of collection.

0.5 every six months	3.0 6-10 years	6.0 not collected
1.0 annually	4.0 10 years and over	7.0 other:
2.0 2-5 years	5.0 one time only	

ITEM	PERSONAL	CERTIFICATION	PROGRAM	FINANCE	OTHER	NOT COLLECTED
A. Personal						
1. Teacher name						
2. Social security number						
3. Sex						
4. Race						
5. Date of birth						
6. Place of birth						
7. Home address						
8. Marital status						
9. Citizenship						
10. _____						
B. Teaching Assignment						
1. Name of school						
2. Address of school						
3. Name of school district						
4. Name of courses taught						
5. Name of courses assigned each period						
6. Name of text(s) used in each course						
7. Number of pupils per course						
8. Duration of course (weeks or months)						
9. Number of minutes per week each course meets						
10. Credit per course						
11. Grade level of course						
12. Assignments other than science teaching						
13. _____						
C. Teaching Experience						
1. Total years teaching experience						
2. Years of teaching experience in state						
3. New to state						
4. New to district						
5. Previous years place of employment						
6. Years teaching present course(s)						
7. _____						
D. Certification						
1. Basis on which teacher certification was issued						
2. Type of certificate held (e.g., life, admin., provisional, etc.)						
3. Subject area(s) of certification (endorsement)						
4. Date certificate was issued						
5. Date certificate was utilized						
6. Date certificate expires						
7. Certificate(s) held in other states						

	PERSONAL	CERTIFICATION	PROGRAM	FINANCE	OTHER	NOT COLLECTED
E. College Preparation						
1. Total hours college credit						
2. Year last credit was earned						
3. Degree(s) earned						
a. Type						
b. Date earned						
c. College name						
d. College location						
4. Transcript of credits						
5. Number of credits preparation in major teaching area						
6. NSF supported projects attended						
7. _____						
F. Salary						
1. Salary						
2. Days of contract						
3. Full-time or part-time employee						
4. Fringe benefits						
5. Extra pay for extra duty						
6. Percent of salary supported by federal funds						
7. _____						
G. Miscellaneous						
1. Military experience						
2. Non-teaching job experience						
3. _____						
H. Teacher Supply and Need						
Data collected by subject or grade						
1. Data on paraprofessional employees						
2. _____						
I. Teacher Aides						
1. Projected vacancies for September assignments						
2. Projected vacancies for January assignments						
3. Positions remaining unfilled after September assignments						
4. Positions remaining unfilled after January assignments						
5. Teachers teaching out of their area of certification						
6. Projected teacher graduates from state institutions within the state						
7. State institution teacher graduates employed by the state						
8. State institution teacher graduates unemployed						
9. _____						

ATTENTION: The source and frequency of collection information which is requested at this time constitutes the last charge to you prior to the CS[3] National Conference in Las Vegas, Nevada, January 25-30, 1973

You must bring this information with you to the conference and be prepared to surrender the data at the first general assembly.

Transcribed Data Science Supervisors