

SCIENCE EDUCATION IMPROVEMENT PROJECT

February 1967 --- June 1973

PROJECT COMPLETION REPORT

Prepared by the NSF Science Liaison Staff, New Delhi

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## P R E F A C E

The Science Education Improvement Project was a project jointly funded by the U. S. Agency for International Development and the Government of India and jointly managed by the National Science Foundation and counterpart agencies including the National Council for Science Education, the University Grants Commission, and the National Council of Educational Research and Training. This report has been prepared by the NSF Science Liaison Staff in New Delhi in accordance with the relevant Manual Order and instructions from the AID Mission. It attempts to address that assignment directly without attempting to answer a number of other questions which might have been asked. Only a few gratuitous comments are included and those are here in the preface.

The difficulties encountered by anyone attempting to introduce changes into a traditional society are formidable, the more so when these changes are with respect to a traditional pattern of education. In the U.S., with its much vaunted progressive approach to education, the task of changing a curriculum is often compared with that of **moving a grave yard** -- the obstacles are enormous. In India attempting to introduce changes is a challenge for the bravest. With rapid expansion of an educational system there often is a lowering of standards. The teacher is impelled to adhere even more closely to the obsolete syllabus. The very effort to maintain educational standards often becomes an obstacle to needed change.

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Fortunately there are many who have faced the enormous challenge with a constructive response. The Science Education Improvement Project (SEIP) has provided a mechanism through which such persons in Government and in local institutions have been able to face the task of implementing science education improvement. In this process many Indian and U.S. scientists and teachers of science have been brought together in professional relationships which transcend the life of the project. The overwhelming majority of those involved have gone out of their way to confirm their interest in continued involvement. Thus, the project has been remarkably successful in invigorating the enthusiasms of a very large number of the key persons involved with science education. More than that, the stated goals of the project have been achieved in significant measure.

The overall success of the SEIP can be judged from the fact that there continues a self-sustaining national program for the training of science teachers at the conclusion of U.S. assistance. The summer institutes have been improved and adapted to local needs; the pioneering project in school development is generating materials including textbooks and teachers guides which are published in five different languages and are in use in one of the largest school systems in the world; the college development activity has expanded at a significantly greater rate than anticipated; a large number of novel science teaching kits and materials are now manufactured in India.

In addition there have been improvements in various institutions. The University Grants Commission (UGC) has incorporated a number of new national programs into its own program. The National Council of Educational Research and Training (NCERT) has assumed direct responsibilities for an expanded summer institute program. The Association for Principals of Technical Institutions has become the Indian Society for Technical Education.

The conspicuous failure of the SEIP is the failure of the National Council for Science Education (NCSE) to become a viable institution. As the project draws to a conclusion the question of whether or not the NCSE should become an officially recognized body is still pending in the Ministry of Education. For the third time the question is under active consideration. On two earlier occasions Ministers of Education have recommended that the NCSE become a registered society only to have the decision reversed when they were succeeded by new Ministers.

The following report includes a statement of goals and objectives; fiscal inputs; project activities; an evaluation of outputs; and recommendations. Other material either required by the Manual Order or relevant to the narrative presentation is included in a series of annexes.

## SECTION I -- GOALS AND OBJECTIVES

### A. Introduction

The Science Education Improvement Project had its antecedents in the summer institutes which were first supported by AID in 1974. Prior to this date\* the University Grants Commission had organized independently a few summer institutes for science teachers and in 1963, UISIS supported four summer institutes for high school teachers. From 1964 through 1966 the summer institute program expanded rapidly with support from AID - encompassing the fields of biology, chemistry, engineering, mathematics, physics and polytechnic education. In addition to the University Grants Commission, the National Council of Educational

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\* The summer institute activity in India appears to have started in 1958 by a group of concerned mathematicians at Delhi University. They received encouragement and a small grant (Rs. 1750) from an officer of the UGC who had previously been an invited visitor to NSF summer institutes in the U.S. Participants in this and the succeeding institutes were college teachers of mathematics but special attention was given to problems of teaching mathematics in the schools by inviting school teachers to participate in the final three days of the program. Evidence of the seriousness of purpose is found in the fact that this group translated and mimeographed the Bourbaki Volumes on Modern Mathematics. This series of summer institutes continued through the summer of 1962.

Research and Training and the Association of Principals of Technical Institutes supported this activity. The summer institutes were six-week inservice training workshops held during the summer break in the academic year. AID, through four different university contractors, provided the services of a number of U.S. school and college science teachers who assisted in the organization and presentation of the various programs.

With respect to the goal of introducing new materials into Indian classrooms, summer institutes were largely a failure. Indian teachers are not free to depart from rigidly prescribed syllabi and these summer institutes frequently made use of materials not included in the syllabi. On the other hand the institutes elicited enthusiastic responses from virtually everyone involved with them. It was clear that the cross-cultural interaction which was an important feature of the summer institutes was highly stimulating. However, improved strategies would have to be employed if the summer institutes were to propagate identifiable benefits to local classrooms. In this connection the National Science Foundation was asked by AID to assist in designing and implementing a "follow-up" program to improve

the yield of future summer institutes.

In 1966 a prestigious gathering was assembled at the UGC. The U.S. President's Science Advisor, Dr. Donald Horning, read out a greeting from the President of the United States. A delegation including members of the National Science Board received an advance invitation for NSF to become involved in science education developmental activities in India. During the following month, NSF participated in a program planning conference held in Srinagar. On that occasion the elements of the current comprehensive program which came to be known as the SEIP were identified.

#### B. The Original Comprehensive Plan

In the discussion of the "follow-up" program, it became quite clear that a three-fold effort would be required to improve the teaching of science in Indian classrooms. Teacher training through the summer institutes was only a part of the job. Improved teaching materials developed in India were urgently needed and the institutions responsible for education would have to be encouraged to endorse the experimental use of new materials. The deliberate strategy of the planning conference was to build flexibility into the

project. It was deemed important for the program to respond to the creativity which it stimulated and to correct its own course. Under the rubric of "special projects" key persons could be brought together to identify further the optimum course of the project.

In the original concept, the program was to be subject to the guidance of national advisory committees in each of the various disciplinary areas. Implementation would be through a body which could receive proposals and sanction grants for the support of science education development projects in each of the areas of activity described below. This was the conceptual origin of the National Council for Science Education and its national advisory panels.

The following activities were recommended.

1. Summer science institutes
2. College development
3. School development
4. Materials development
5. Special projects.

1. Summer Science Institutes

The planning conference recommended a continuation of the summer institute activity to provide a unique opportunity for junior teachers to participate in training programs involving senior teachers and scientists. Increased use of

teaching materials developed locally and increased involvement of local experts also were recommended. The institutes were viewed as an important instrument for enlisting the interest and enthusiasm of teachers who would be called upon to teach up-dated syllabi and prepare students to take revised examinations.

The original summer institutes for secondary school teachers of mathematics and science depended heavily on curriculum "packages" developed in the United States -- integrated sets of textbooks, teachers' guides, lab manuals, kits of equipment, films and other teaching aids. The conference recommended that summer institutes offer training of greatest use to participating teachers, particularly as new topics were added to the syllabus and old ones were deleted.

## 2. College Development

The planning conference recommended that strategic use be made of the affiliating relationship between universities and colleges in the institute "follow-up" program. Since the university sets the syllabus and final examination for all of its affiliating colleges, any change in the teaching of science authorized by the university would affect simultaneously all the colleges affiliated to that university. Thus the natural

module of change was a single university science department and the corresponding departments in its affiliating colleges. On the average there are approximately 50 colleges affiliated to each university. The conference recommended that a program supporting such **modular** changes be included in the comprehensive plan. It was proposed that selected university departments be encouraged to develop plans for upgrading the teaching of their disciplines and that summer institutes be used to retrain teachers from the affiliated colleges which would be affected by changes in the syllabus or examination. A coordinated program to improve libraries and laboratories in the local colleges was part of the recommended college development effort.

### 3. School Development

The planning conference gave its attention to possible mechanisms for changing school level education. It was noted that boards of study preside over the syllabi and examinations and that directors of public instruction manage school systems through a hierarchy of inspectors and sub-inspectors. Any real change in the teaching of science in the schools could be expected only in those jurisdictional areas in which the authorities welcomed and encouraged the intended change.

Without official encouragement, individual teachers could make very little use of the lessons they might have learned by participating in summer institutes. The planning conference recommended that support for the improvement of school level education be concentrated in those systems which had progressive leadership and which welcomed support for systematic changes.

#### 4. Materials Development

The planning conference recognized that improved teaching materials of every category were urgently needed. This need embraced textbooks, teachers' guides, laboratory manuals, equipment kits, charts and other visual aids. While U.S. curricular materials were often useful models, they usually could not be used without adaptation. In the field of polytechnic education, there were a number of areas in which syllabi had never been established. The materials development support recommended by the planning conference encouraged various initiatives.

#### 5. Special Projects

Recognizing the importance of maintaining a capacity to respond to project developments, the planning conference explicitly recommended that a category of special projects,

to be defined later, be included in the comprehensive plan.

C. Restatement of Goals

Throughout the life of the project, the constant goal has been the improvement of teaching science. The original Non-Capital Project Paper called for the creation of the National Council for Science Education, continuation of the summer institutes, and the undertaking of the additional program activities recommended by the conference. Subsequently the emphasis on assisting with the establishment of the NCSE declined and science curriculum development -- broadly construed -- became the principal focus.

In the Non-Capital Project Paper dated 7/10/69, science education was understood to cover primary, secondary and collegiate levels of mathematics, the physical sciences, the life sciences, engineering and polytechnic subjects. The three-fold approach emphasized training of personnel, institutionalizing project activities and developing new teaching materials. In-country training through summer institutes and other short training programs and in-US training through AID Participant Training were objectives. Institutional development was to be centered in the various

agencies responsible for science education in the Center, in States, and in Municipal Corporations. The development of new teaching materials was recommended.

A Non-Capital Project Paper Review dated 1/6/70 called for an accelerated phase-out of AID/NSF support of the summer institutes. NCERT was chosen to take the lead in the SEIP and emphasis was to be given to the production and trial use in schools of new materials developed by the various NCERT Study Groups.

The Non-Capital Project Paper dated 9/17/70 defines essentially the same **goals** as those of 7/10/69 but gives added weight to the development of an indigenous capacity for supporting continuous curriculum reform. The Indian Society for Technical Education is recognized as a successor to Association of Principals of Technical Institutions in the role of coordinating subproject activities in technical education.

On 3/12/71 a Revised Non-Capital Project Paper specified a greater concentration on the institution building phase of the project and the dropping of all support for polytechnic and engineering subprojects.

#### D. Project Logical Framework Targets

On November 19, 1971 the document called the Project Logical Framework was issued by AID. It covers the period from January 1, 1971 to December 31, 1975 and includes a quantitative projection of outputs in terms of trained staff, institutional programs, and improved materials. The Project Logical Framework specifies conditions expected at the end of the Project. Figure 1 gives a pictorial summary of these goals.

##### 1. Trained Staff

While training may occur during an in-country training program or through on-the-job experience, the Project Logical Framework specified that only returned AID Participant Trainees be counted for purposes of inventorying trained personnel. An analysis of the Participant Training activities will appear in Section IV of this report (pages 79-82).

The table below gives the magnitude of annual outputs of trained staff expected from the SEIP and is taken directly from the Project Logical Framework.

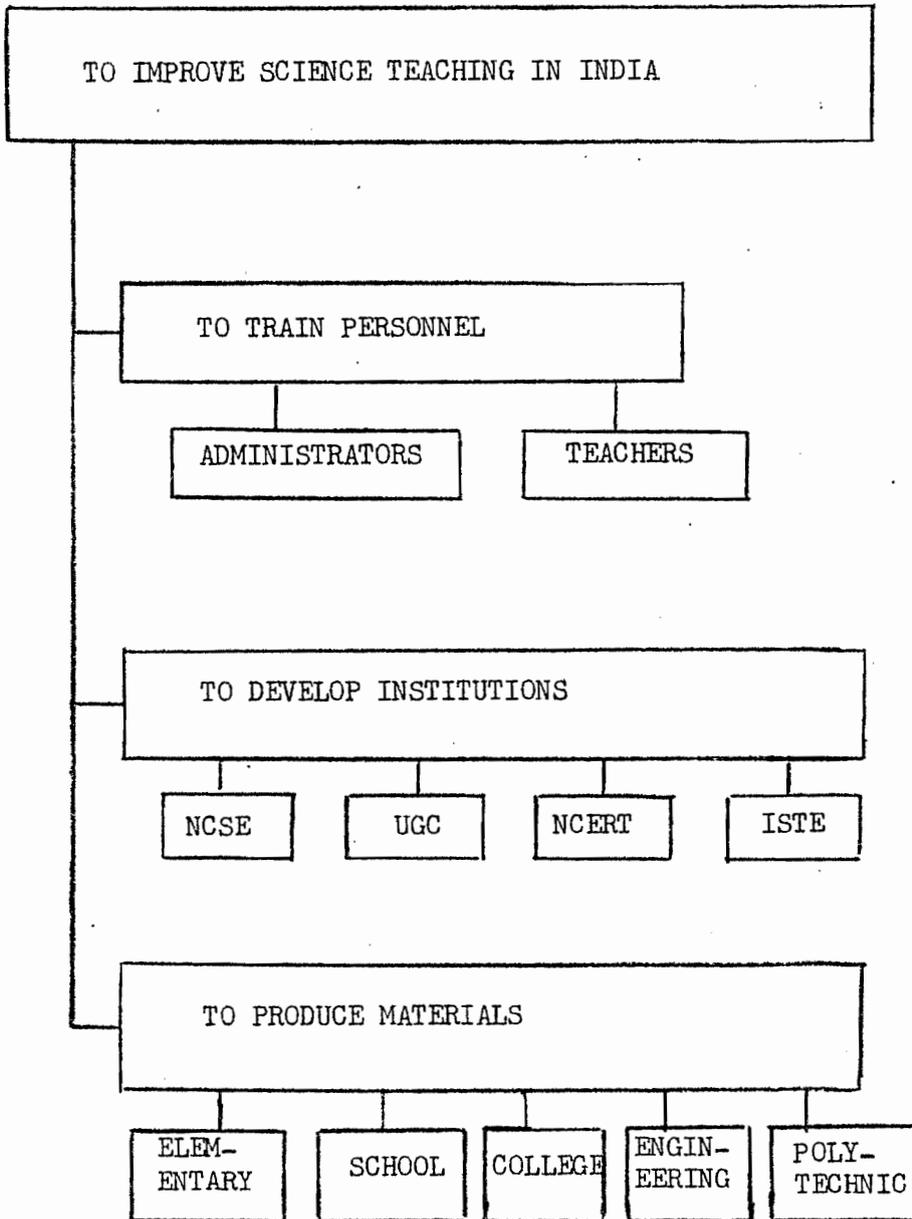


FIGURE 1. THE GOALS OF THE SCIENCE EDUCATION IMPROVEMENT PROJECT

Staff

"NCSE	- 5	: Prog. Coordinator (1); Sc. Mat./Spec. (4)
UGC	- 5	: COSIP Administrator (1); COSIP Supv. (4)
NCERT	- 2	: Prog. Coord. (1); Sc. Materials Sp. (1)
Bombay (BMC)	- 2	: Elementary Curriculum Specialists
Mysore (RCE)	- 2	: Elementary/Secondary Curriculum Specialists
Rajasthan (Ajmer)	- 2	: Elementary/Secondary Textbook Writers
CSC (Delhi)	- 2	: Elementary/Secondary Curriculum Specialists"

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BMC = Bombay Municipal Corporation  
 RCE = Regional College of Education  
 CSC = Central Schools Commission

## 2. Institutional Development

The Project Logical Framework acknowledge three institutions which have played key roles in the SEIP through planning, funding, and evaluating subproject activities.

There are the National Council for Science Education, the University Grants Commission, and the National Council of Educational Research and Training. The Indian Society for

Technical Education is not mentioned in the Project Logical Framework.

NCSE was established in 1966 through an instruction issued by the Secretary of the Ministry of Education. Direct support from the NCSE has been given to SEIP activities not coming under the purview of other agencies.

The UGC is a statutory body which provides development grants to universities. In addition the UGC announces various programs from time to time. The summer institutes for college teachers and other activities of the SEIP concerned with college level education are sponsored by the UGC.

The NCERT is also a statutory body consisting of a large number of departments and is generally concerned with all phases of school-level education. This agency has supported a number of curriculum development activities including the Study Groups Project and the UNESCO Project. The four Regional Colleges of Education are under the purview of NCERT.

The table below is taken from the Project Logical Framework and gives the magnitude of outputs with respect to institutionally supported programs.

Institutions:

- |       |  |
|-------|--|
| "NCSE | - Coordinates/evaluates all SEI higher secondary/college SEI teacher retraining programs.                    |
| UGC   | - Maintains/coordinates (4) mathematics (3) physics (3) Chemistry and (2) bioscience COSI Programs per year. |
| NCERT | - Maintains two (2) RCE Curriculum Development units (Mysore, Ajmer) per year."                              |

COSI Programs = College Science Improvement Programs

### 3. Improved Materials

Each of the key agencies with whom the NCF liason staff has worked has sought to encourage the design, development, production, use, and evaluation of new science curricular materials. The Project Logical Framework gives the following output targets.

Materials

- "NCSE - Teacher retraining materials developed, disseminated and tested in 200 MOE supported summer retraining institutes.
- UGC - University and college partners under COSIP program have developed and tested new math/science curricula in 12 programs noted above.
- NCERT -
- a. BMC elementary materials produced, adjusted, adopted for use in 200 schools by 1975.
  - b. RCE-Ajmer and State Institute of Science Education Class III-VIII science/math texts produced for use in 50 schools by 1975.
  - c. RCE Mysore and SISE Bangalore elementary/secondary materials produced for 20-25 schools by 1975.
  - d. Central Schools Commission (CSC) New Delhi: Class 1-8 teaching materials prepared for 5 pilot and 130 English media schools by 1975; materials augment class 9-11 materials developed by NCERT/UNESCO."

BMC = Bombay Municipal Corporation  
 COSIP = College Science Improvement Program  
 MOE = Ministry of Education  
 SISE = State Institute of Science Education

In Section IV an evaluation of project performance will be made using the Project Logical Framework standards as the yardstick of performance. In Section III an overview of project activities will be given. The next section gives an account of fiscal inputs by both governments.

## SECTION II -- FISCAL INPUTS

In this section of the report it was hoped that a complete report on the fiscal inputs to the SEIP including both the contributions of AID and the Ministry of Education could be given. In the limited time and manpower resources available at the time this report is written this proves to be a difficult task. However, the available information is included and is worthy of close inspection.

### A. Dollar inputs from AID

The project received an original grant of \$100,000 from AID. Although the intention was to provide for the dollar commodities for a program which would continue for five years or more, it was necessary to make a complete specification of requirements almost before the comprehensive program got underway. Some of the items were needed to establish the operation of the NCSE and the NSF Science Liaison Staffs. Science teaching equipment for which there was an explicit anticipated use as prototypes for possible Indian manufacture, or for the implementation of sub-projects was also included. The implementing document was Project Agreement number 131, dated Nov 1, 1966.

Through a series of funding documents listed in Appendix A \_\_\_\_\_, \$4,073,839 has been made available for the operation of the program. With the exception of \$31,000 earmarked for support of the Participant Training program and \$143,500 for commodities, this money has been allocated for dollar costs of staff and consultants.

### B. Rupee inputs from the Trust Fund

The rupee costs of operating the SEIP have come from the Trust Fund as authorized in the Program Agreements and corresponding PIO/Ts. Details are given in Appendix B. Slightly more than half of the total was used to pay overhead costs associated with the NSF Science Liaison Staff. The remainder was used for procurement of commodities (mostly books) needed to insure the productivity of consultants.

### C. Rupee inputs from the NCSE

While information concerning Indian Fiscal Years 67-68 and 68-69 is not available, information for subsequent years is given in Appendix C. Perhaps it is through these accounts that the vitality of the NCSE is most apparent. Clearly, the NCSE has successfully played the innovative role which had been envisioned at the outset. The NCSE has provided support for experimental programs which were high in merit but low in conformity to prevailing program categories.

It is interesting to note the active role of the Indian Institutes of Technology in the SEIP. These institutions do not ordinarily come under the UGC for funding. If the NCSE channel to the Ministry of Education had not existed, it would have been difficult to find support for the Indian Institutes of Technology to participate in the project. Thus, the NCSE provided a valuable mechanism through which the expertise concentrated in these institutions could be diffused into the educational systems of India.

The State of Rajasthan received support and encouragement for operating its own program of summer institutes through a grant from the NCSE. Similarly the Community Science Center in Ahmedabad received encouragement. The Bombay Municipal Corporation project in science education was assisted by the NCSE. Other grantees can be identified by consulting the Appendix.

The cost of office space for the NSF Staff was met through the NCSE budget.

#### D. Rupee inputs from the UGC/NCERT

The University Grants Commission has provided the major share of the operating costs of the SEIP. This embraced the summer institutes, the college development activity and a number of the materials development sub-projects. The NCERT regularly reimbursed the UGC and NCSE for the costs associated with the operation of summer institutes for school teachers up to but not including the summer of 1972 when it took over these expenses itself. Detailed information on rupee expenditures by the UGC and NCERT has not been made available at the time this report was prepared .

#### E. Rupee inputs from the ISTE

The Indian Society for Technical Education (formerly known as the Association of Principals of Technical Institutions) has played a key roll in the planning and implementation of the activities of the SEIP concerned with engineering and technical education.

Information on their contribution to the program is given in Appendix D. At the time this report was written information is unavoidably incomplete.

A further note on the Indian inputs to the SEIP is in order. In the operation of any program in the U.S., provision for overhead costs are universally included in program budgets. In the inventory of fiscal inputs made here, the overhead costs have not been counted. Hence the figures given should be increased by approximately 25% in order to get a more accurate indication of the real inputs.

Perhaps it would be in order to note at this point that throughout the program the National Science Foundation has not charged AID for any of its own overhead costs. The entire operation in Washington (procurement of commodities, recruitment of staff and consultants, the arrangement of training programs of the Participants) was a contribution to the program from the National Science Foundation.

## SECTION III -- PROJECT ACTIVITIES

A. Role of the NSF Staff

During the course of the SEIP NSF Staff Scientists have played a variety of roles. Initially there were administrative problems which pre-occupied the staff. It was necessary to establish a working relationship with AID, to organize a local staff, to draft position descriptions, and to recruit U.S. staff. In addition there were administrative problems relating to the NCSE. Quarters suitable for both the NCSE and NSF staffs had to be found. The office had to be provided with furniture and equipment.

Throughout the life of the SEIP Staff Scientists have worked closely with the directors of the authorized sub-projects. This has included:

- 1) planning aspects;
- 2) monitoring progress and solving problems when they arose;
- 3) supplying information on relevant educational developments in the U.S.;
- 4) providing an information conduit for the Indians.

This last point cannot be given too much emphasis. In India channels of communication are still primitive and there are relatively few opportunities for scientists and educators to

exchange ideas at professional meetings. An important function performed by the NCSE Staff was informing different sub-project directors of similar activities being carried out by others in India. Through these consultations needs for future consultants were established.

Staff scientists have worked directly with the consultants and invited visitors in a variety of ways.

- 1) Providing them with information about their assignment prior to departure from the U.S.
- 2) Reception and orientation on arrival in India. In almost all instances a prior site visit had been made by a Staff Scientist.
- 3) Debriefing and assistance with exit formalities. In every instance the Staff Scientist held a debriefing session with the consultant prior to his departure from India.

As the NCSE became operational Staff Scientists were involved with meetings of the NCSE Council and Panels. During the years in which there were professionals working as officers of the NCSE, there were frequent contacts on all phases of operations. Staff Scientists attended virtually all NCSE meetings on special invitation. As the NCSE assumed a lesser role in coordinating national programs for the improvement of science education in India, Staff Scientists sought closer relations with the other agencies which were entrusted with the implementation of the SEIP.

Following the India-Pakistan war of 1971, there was a period when no consultants were cleared by the Government of India. Even under the most recent operational work plan the number of consultants cleared has been small and often the NSF spent considerable time in dealing with Indians who could expedite the clearance procedures. As project activities slowed down during 1972 and 1973, the Staff Scientists often have played the role of consultants in a number of ways:

- 1) serving with boards of study of COSIP universities;
- 2) working with professors on the preparation of new textbooks;
- 3) consulting with sub-project directors on special workshops and on COSIP activities;
- 4) participating in regional COSIP meetings or followup meetings to binational conferences.

The Staff Scientists have maintained excellent professional contacts with their counterparts throughout the lifetime of the SEIP. This has been true even during the time of deteriorating political relationships between India and the U.S.

Members of the NSF Science Liaison Staff in New Delhi are listed in Appendix E. For additional details concerning the activities of Staff Scientists it is suggested that End of Tour Reports previously submitted to AID be consulted. It will be convenient to describe the project activities in SEIP in terms of

the canonical categories set forth in the original comprehensive plan recommended by the 1966 planning conference. Viewed from this perspective, the coherence of the SEIP activities is clear. The discussion treats summer institutes, college development, school development, materials development, and special projects/binational conferences.

#### P. The Summer Institutes

The summer institutes provided leading science teachers in India with an orientation to some of the new science curricula developed in the United States. A list of the U.S. materials used in the summer institutes is given in Appendix F. A brief summary of the number of summer institutes, the number of U.S. consultants, and the changing nature of the summer institutes program is given in Appendix G. The names of U.S. consultants are listed by year in Appendix H and invited travellers in Appendix I.

In the hands of local leaders, the summer institutes have become increasingly useful tools for implementing improvements in the teaching of science. The institutes have been supported by the NCSE, UGC, NCERT, the Indian Society for Technical Education as well as by the States of Andhra, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, and Municipal Corporations of Delhi and Bombay.

Figure 2 shows the number of institutes by type for each year of the program. The increase between 1971 and 1972 in the number of institutes for school teachers reveals the renewed interest of NCERT in summer institutes. Institutes for college teachers have been maintained at a level already reached by the time JEIP was defined. While the institutes for teachers from the polytechnics have suffered a mild setback with the abrupt termination of consultant inputs in 1971, they and the institutes for teachers from the engineering colleges continue to prosper.

Figure 3 shows the rise and fall of the number of summer institute consultants. The trend toward an increase in special consultants was frustrated by the December 1971 war between India and Pakistan. Figures 4 and 5 show the growing emphasis on advanced level institutes since 1967.

Some important developments in the summer institute program in India are enumerated below:

- 1967 NSF Science Liaison Staff took over management of the summer institutes and for the first time, dates for the summer institutes coincided with the break in the Indian academic year rather than the U.S. academic year.

The institute director had a voice in the allocation of consultants.

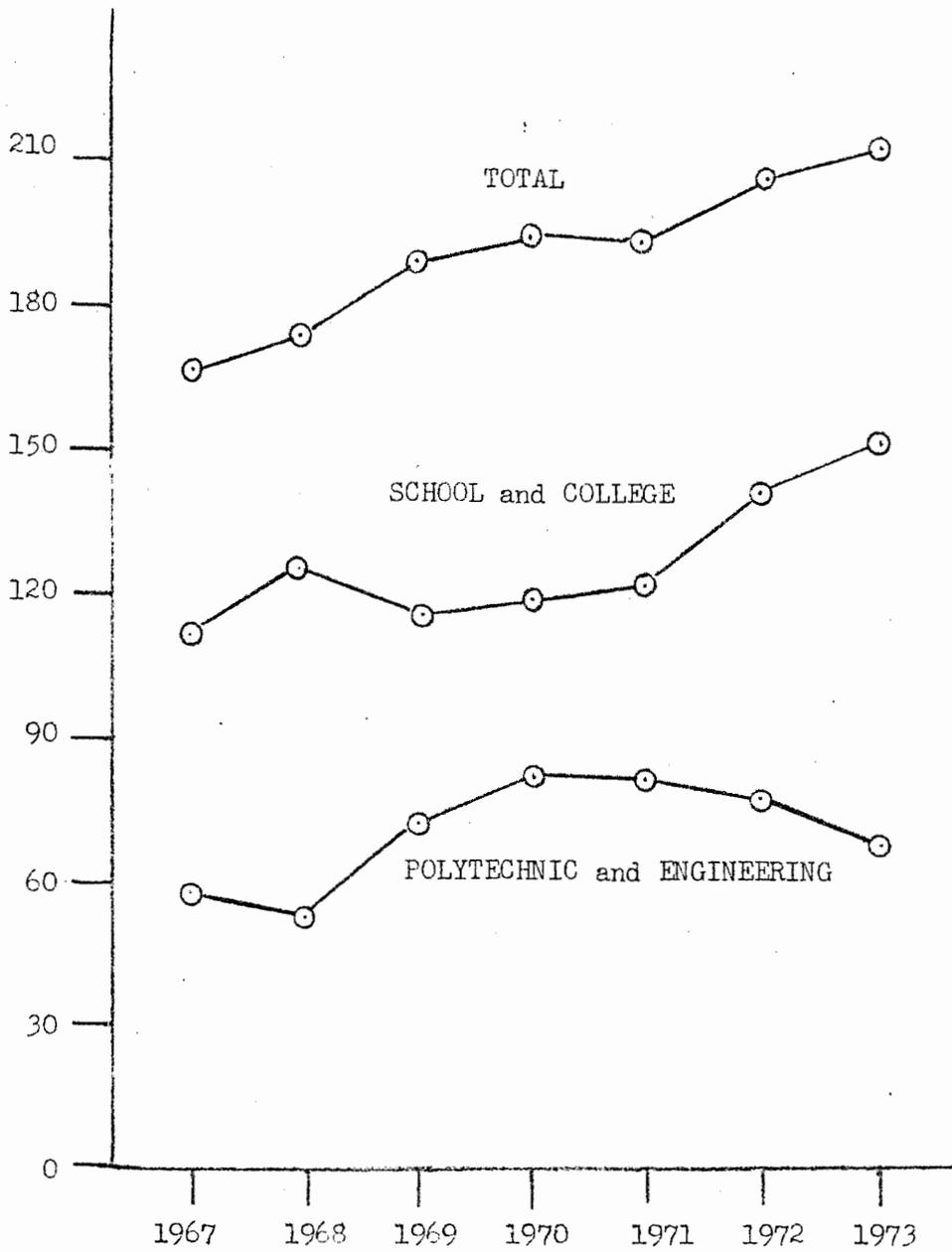


FIGURE 2. NUMBER OF SUMMER INSTITUTES BY TYPE AND YEAR

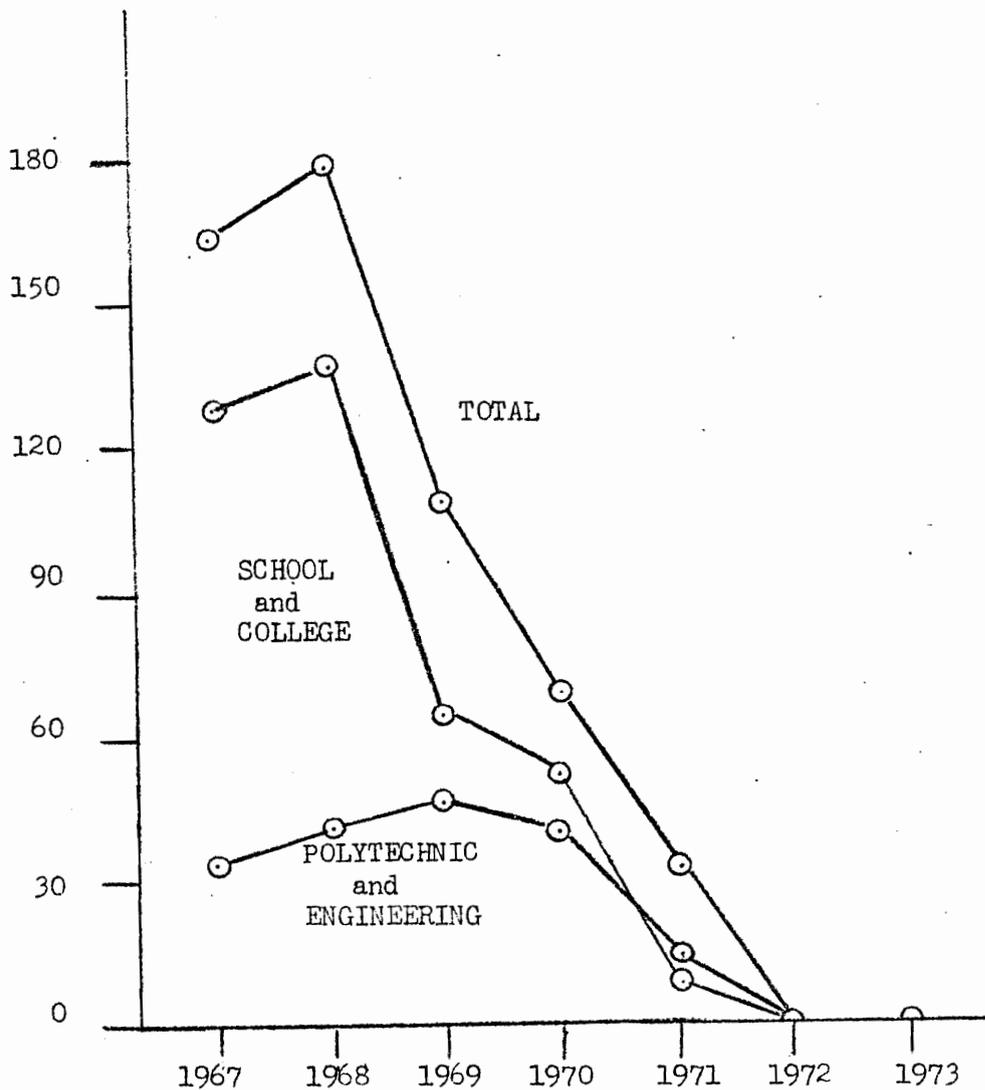
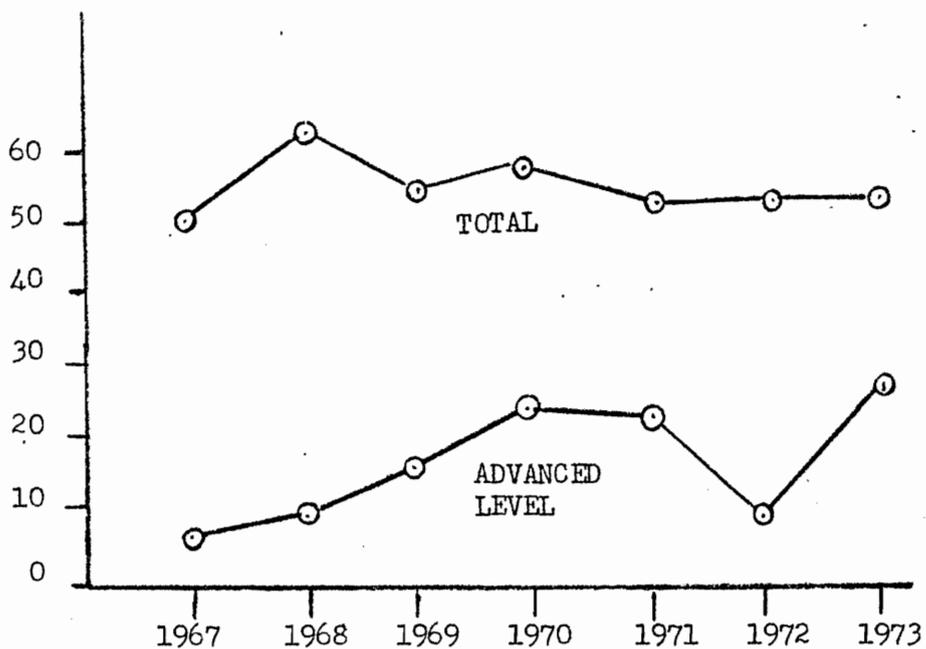
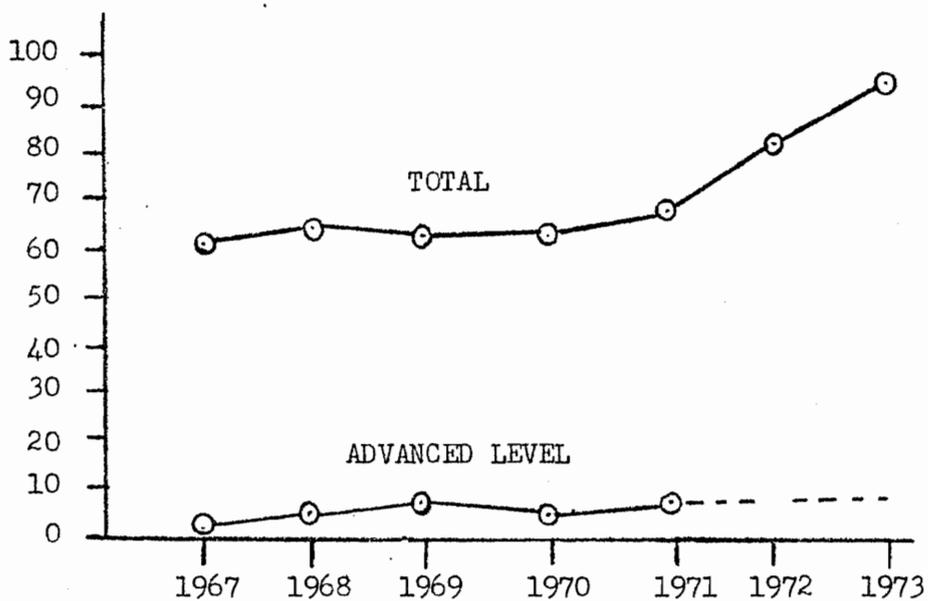


FIGURE 3. THE NUMBER OF CONSULTANTS FOR THE SUMMER INSTITUTES



COLLEGE SUMMER INSTITUTES



SCHOOL SUMMER INSTITUTES

FIGURE 4. THE CHANGING EMPHASIS OF SUMMER INSTITUTES

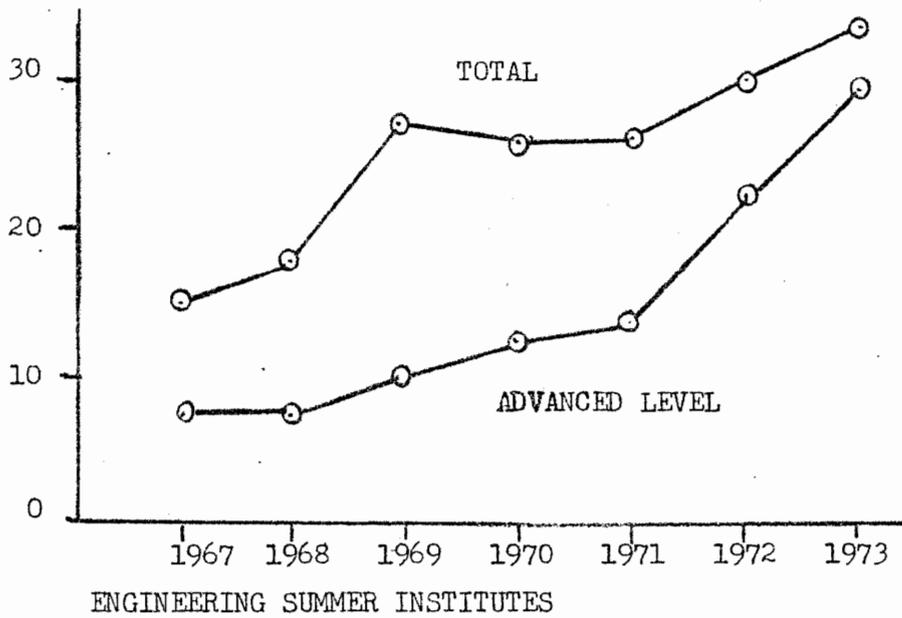
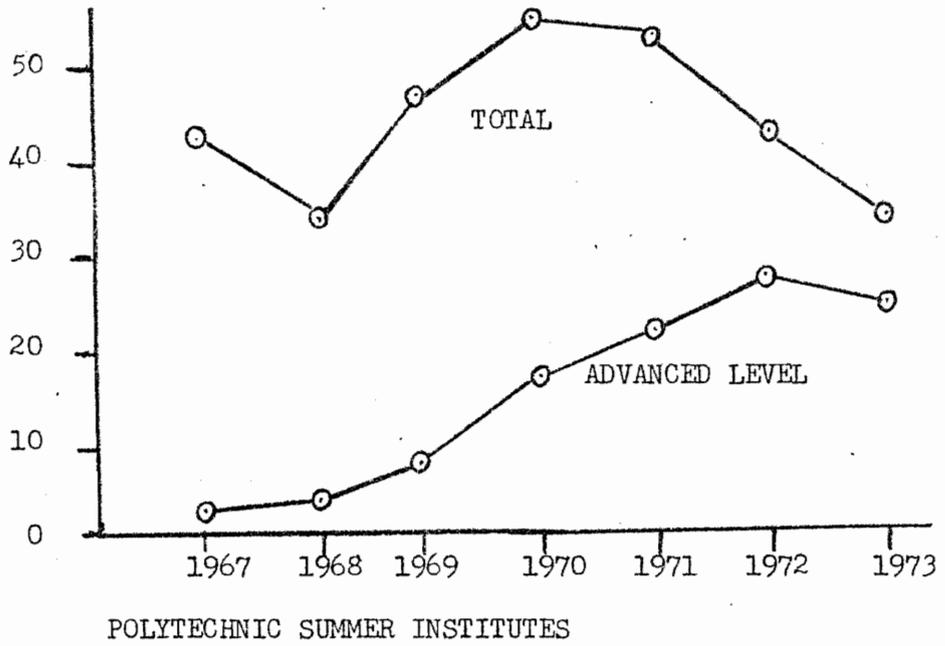


FIGURE 5. THE CHANGING EMPHASIS OF SUMMER INSTITUTES

The brochure announcing college level summer institute programs specified the presentation of specialized subjects giving prospective participants a basis for deciding whether or not to apply for admission.

1968 Proposals were solicited from prospective summer institute directors and reviewed by NCSE advisory panels, thereby insuring local sponsorship by committed leaders.

Consultants were assigned only to directors who were organizing a summer institute for the first time.

The State of Rajasthan initiated its own program of summer institutes patterned after the national program.

Osmania University conducted a college level chemistry summer institute for teachers of its own colleges. This was the first explicit use of the summer institute as a mechanism for teaching teachers who frame and work with a single syllabus and may be regarded as a prototype for the college development effort recommended by the planning conference of June 1965.

1969 Two institutes presented the Project Physics course recently developed at Harvard University.

The Earth Science Curriculum Project material which had ~~just~~ been published in the U.S. was used for the first time as a basis for a summer institute.

Two school level summer institutes were organized for homogeneous groups of teachers as recommended by the planning conference.

Six summer institutes were devoted explicitly to teachers of affiliated colleges, as recommended by the planning conference.

1970 The State of Rajasthan was in the third year of its own summer institutes program with financial support from the NCSE.

The State of Maharashtra had organized SIs and in-service institutes. Five school level institutes were organized for homogeneous groups of participants as recommended by the planning conference.

1971 At the direction of AID, support for engineering and polytechnic programs was curtailed.

Assignment of U.S. consultants was limited to summer institutes where special topics were presented.

American Chemical Society Short Courses were presented in India with outstanding reception. One Indian Short Course modeled on these lines was given in Bombay at the Indian Chemical Society meeting

1972 The brochure announcing college level institutes gave a unique description of the program at each institution thereby enabling all applicants for admission an opportunity to approach institutes which were offering courses of special benefit.

The school level institutes were organized and funded by NCERT for the first time. The UNESCO materials, developed at NCERT with assistance of UNESCO consultants, were used in these institutes which catered exclusively to homogeneous groups of teachers.

Short training programs patterned after the summer institutes were offered during the winter holidays, thereby extending the range of the original institute program and adapting it to local conditions.

Through 1971, 16,300 secondary teachers have participated in 413 summer institutes. Through 1972, 14,567 college teachers have participated in 409 summer institutes.

The concept of in-service training of teachers through short courses offered during the summer has been widely adopted in India. Increasing use has been made of summer institutes to implement the teaching of new curricula. At the college/university levels, not only are specialized short courses providing a further enrichment of science curricula but summer institutes have been used to enlist the participation of leaders in the development of new syllabi and curriculum materials.

### C. College Development

#### 1. Background

At the heart of the "follow-up" program recommended in the planning conference of June 1966 was the idea of making strategic use of the affiliating relationship of Indian colleges in implementing the use of new curricula. In India the university prescribes the syllabus, sets the external examinations and grants the degree; the college is responsible only for teaching in accordance with the set syllabus and in anticipation of the set examination. There are over 3,000 colleges affiliated to approximately 30 universities.

Following the recommendation of the 1966 planning conference, a few university departments made a pioneering

venture in the systematic use of summer institutes to reach the teachers from its own affiliating colleges. The participants in these summer institutes all followed the same syllabus and had the opportunity to discuss it in detail with the university faculty responsible for that syllabus. From the ferment of these summer institutes, a number of useful ideas were distilled. Conspicuous examples of this type of summer institute were those conducted by the chemistry department of Osmania University, which ultimately gave rise to the university adoption of a revised chemistry curriculum and the writing of new textbooks.

A **B**inational Conference on Chemical Education and Research was supported as a special project of the CEIP in the summer of 1969. A discussion of the conference and its recommendations will be given later in this section of the report. A leading role in the early experimentation with college development projects already had been taken by the chemists. One of the important recommendations of the chemistry conference elaborated a detailed plan for support of college development activities.

In 1970, the University Grants Commission announced a program for the support of College Science Improvement

Projects (COSIP) in the format recommended by the NCSE. The essential features of the college development activities discussed in 1966 were included. Two categories of grants were announced. One was designated as University Leadership Projects (ULP). Centered in a single university department, these projects were intended to provide leadership for the affiliated colleges in a comprehensive effort to improve education in that discipline. The other was called the Special College Program (SCP). Centered in a single grantee college, this program was intended to improve the mathematics and science departments in that college. The UCC solicited proposals from various universities and colleges. Those with greatest relevancy and merit were identified through a screening process including both external review and site visits. NSF staff scientists and special consultants participated in discussion of these plans.

During the first year of operation 15 university departments were chosen for support: 13 grants were actually made. Figure 6 shows the locations of these universities. At the same time grants were made to 77 colleges for the SCP. Figure 7 shows the locations of these colleges.

Figure 6

LOCATIONS OF UNIVERSITY LEADERSHIP PROJECTS

- SELECTED IN 1970
- ⊙ SELECTED IN 1973

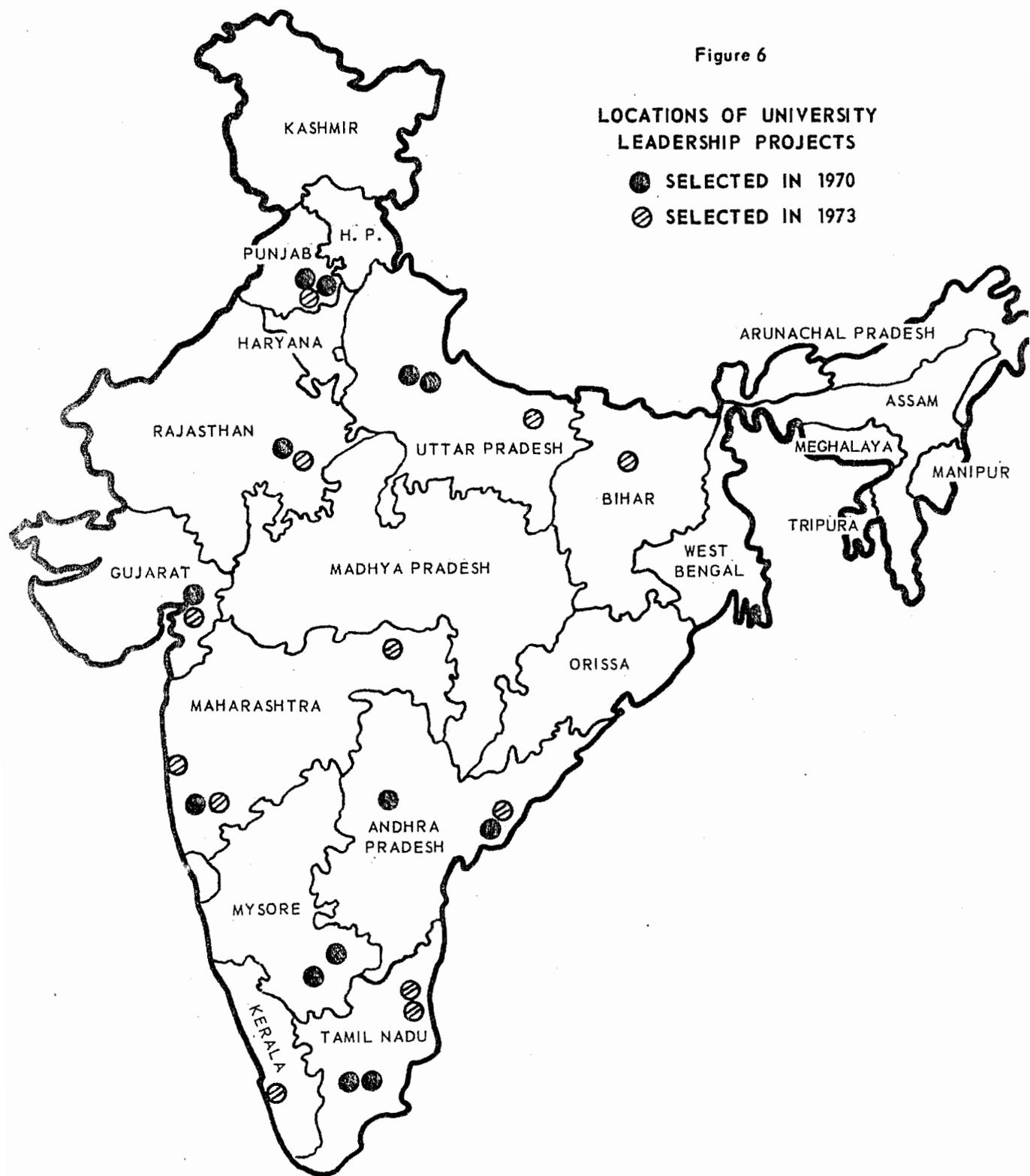
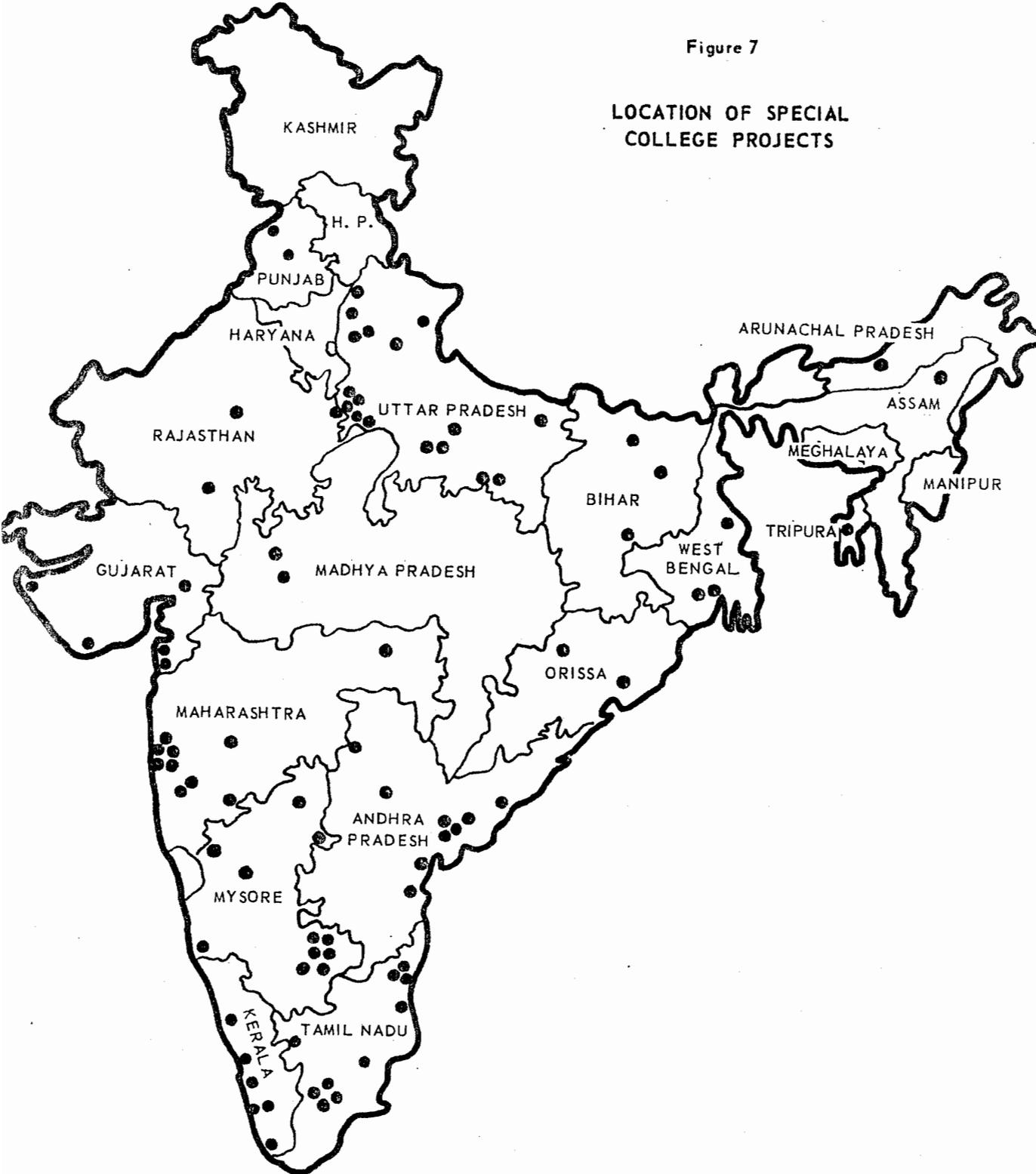


Figure 7

LOCATION OF SPECIAL COLLEGE PROJECTS



## 2. Selected Colleges Program

The College Development scheme adopted by the UGC includes a Selected Colleges Program under which individual colleges are selected for science education development grants. They have responded by the organization of improved science libraries, laboratory facilities, student projects, and special programs for the professional development of faculty. To assist various colleges in keeping abreast of new developments engendered by COSIP, a general Newsletter has been authorized by the UGC. It is published by Madurai University and distributed to all the COSIP grantees.

NSF Staff Scientists have participated in regional meetings of representatives of colleges participating in this program.

## 3. The University Leadership Projects

### a. Biology

Initially the UGC selected three sites for the ULPs in Biological Sciences. They were -

Botany Department, Madras University

Botany Department, Meerut University

Biological Sciences Department, Madurai University

Both Botany awards were to departments whose Chairmen were close to retirement age. The prospect of changing leadership has inhibited progress at these sites. However, the

Botany Department at Meerut University continues to be active in the summer institute program and under the ULP, inservice workshops on "Evaluation Methods for Biology Teachers" and "Topics in Modern Biology" have been conducted.

ULP at Madurai has benefited from the dynamic leadership of a young Chairman. During the first three years, primary emphasis has been placed on nine in-service courses covering sub-disciplines of bioscience. These courses are of 4-5 weeks duration and emphasize the experimental and inquiry method. All biology teachers from the affiliating colleges have had the opportunity to participate in at least one of these courses.

Laboratory manuals and charts have been developed for the in-service courses. Working in collaboration with the Universal Biochemical Company, Madurai, the ULP staff has developed apparatus and kits for these courses. A detailed listing is given in **Appendix J** of this report, on materials.

Each college, participating through its representative, receives books, chemicals and apparatus necessary to reproduce the course in the college. The affiliated colleges have been organized into four districts within which local meetings are held to sustain interest.

The University of Madurai publishes quarterly a journal called "COSIP News and Views" (Biosciences) which is distributed nationally. The journal keeps the bioscience community informed of ULP progress and solicits suggestions for activities and projects.

The Department of Biological Sciences at Madurai University is a pace-setting department. As a relatively new institution it has been possible to introduce new programs and policies to an unusual degree. Since 1968 the Department of **Biological Sciences** at Madurai has provided national leadership in Bioscience Education development and reform. It was the first university in India to present an integrated approach to the life sciences. Not only has the department presented a sophisticated series of summer institutes under the auspices of the NCSE and UGC but it has encouraged research participation by college teachers. The Indian adaptation of the **BSCS\* Yellow Version "Biology, An Inquiry Into Life"** was prepared by the staff of this department. Plans have been formulated to adapt the **BSCS\* Blue Version "Molecules to Man"**.

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\* BSCS: Biological Sciences Curriculum Study. See Appendix F for complete designation of the materials used in the summer institutes.

b. Chemistry

Three chemistry departments were invited in 1970 to participate in University Leadership Projects. These are at Osmania University, Hyderabad; Punjab University, Chandigarh; and Poona University, Poona.

Initially the ULP activities followed quite different approaches at each of the universities, partially because of the political restrictions involved in academic council approvals but also because of local leadership. As the third year of the initial ULP grants draws to a close, each has begun to draw on the experiences of the others and on teaching aids and equipment developed throughout India thereby reducing the duplication of effort which often takes place in India. A brief summary is presented describing each chemistry ULP.

(1) Osmania University, Hyderabad

The basic approach in this ULP entails planning workshops utilizing the staff of Osmania University and affiliated college teachers to develop ideas in five areas.

Textbook preparation

Experiments for the practicals based on the new syllabi and textbooks

Demonstration experiments

Teaching aids including books for the college libraries

Test construction and evaluation

Strong local leadership has resulted in progress in each of these areas. After locally organized planning workshops have made their recommendations, groups have carried through to write textbooks, to prepare laboratory guides, to recommend equipment and book purchases for the colleges, and to develop sample test questions. Subsequently, workshops held during the college vacations are utilized to orient teachers to the new programs. It is clear that the basic approach of the summer institutes has been adapted in the presentation of these workshops. The new textbooks already developed and published include:

General Chemistry (derived from the general chemistry book that came from the summer institutes)

Organic Chemistry

Problem book for physical chemistry.

Titles of several books soon to be published are:

Physical Chemistry

Quantum Mechanics for Chemists

Inorganic Chemistry

A variety of improved molecular models have been supplied to each college for use in lecture demonstrations; charts have been developed with a private company, Bio-Visual Production, Hyderabad; a basic booklist has been made available to each college library; equipment required to teach

topics prescribed in the syllabi have been furnished to each college.

A newsletter on the chemistry ULPs is published regularly at Osmania University and circulated nationally.

(3) Panjab University, Chandigarh

The experiences in trying to train teachers through summer institutes convinced the staff of the Chemistry Department at Panjab University that the most important first step was academic council approval of syllabi, followed by workshops based on the new syllabi. Consequently the ULP patterns at this University has some noticeable differences from that at Osmania and Poona Universities. It consists of these stages:

Discussions of university and college teachers lead to outline for new syllabi.

Submission of the new syllabi to the academic councils for approval.

Development of "blowups" for each syllabus, teachers' guides, experiments for the practicals and sample problems, and test questions.

Workshops based on the "blowups". In addition 2-3 day meetings in each district have been held with university staff.

The reception of the new approach has been outstanding, with four other universities in the Punjab, Haryana and Himachal Pradesh, including all of their affiliated colleges,

voting to adopt the ULP materials in their chemistry departments. Teacher and student response at the end of the first year was very favorable. Less emphasis has been placed on equipment and books during the first year but there will be more need in these categories in the second and third year courses. University faculty regularly visit the colleges to present lectures and to discuss any difficulties the teachers may have.

The "blowup" is an expansion of the syllabus for each course, meant primarily for teachers and not as textbooks for students. The teachers' Guide amplifies the blowup with detailed discussion of topics, outline and suggestions for the practicals, and sample problems and test questions. The first year course is a general chemistry presentation, with clear derivation from CHEM\* materials and represents a marked departure from the previous first year course. "Blowups" for the second year have been completed and will be printed in the summer of 1973.

### (3) Poona University

Because of academic unrest on the local campus, the start of the ULP at Poona University was delayed for almost a year. The primary step was the framing of a new syllabus by the university department and its acceptance by the academic

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\* CHEMS - Chemical Education Material Study. See Appendix F for complete designation of the materials which were used in the early summer institutes.

council. No textbooks or teachers' guides have been prepared. Instead, a major effort has been placed on development of laboratory manuals, demonstration manuals, and the equipment needed by the colleges to introduce the new syllabus. Summer workshops modelled after the summer institutes are devoted to specified topics. An innovative workshop scheduled in May 1973, for demonstrators from the colleges, is the first such effort to train people in this category. It is most appropriate because of the emphasis the Poona ULP has placed on equipment for both lecture and the laboratory use. In India the demonstrator has responsibility for this equipment.

The Poona ULP has taken advantage of charts developed at Osmania and Panjab Universities, molecular models at Andhra University and instruments designed through the biology ULP of Madurai University.

c. Mathematics

There are five ULPs in mathematics. These are located at these universities:

Bangalore University, Bangalore

Gujarat University, Ahmedabad

Madurai University, Madurai

Meerut University, Meerut

Panjab University, Chandigarh

The nature of the ULP activities at each centers is distinctive and reflects the fact that the number of affiliated colleges associated with the universities ranges from 15 to as many as 115. The staff at each university is generally well trained. They have identified the major problems that must be faced in improving mathematics education in India and the need for U.S. inputs to University Leadership Projects is small. The exchange of ideas between these universities has been slow. While requests for meetings to accomplish this have not been approved as yet by the University Grants Commission, it is anticipated that the 1973 binational conference on mathematics education will alleviate this problem.

(1) Bangalore University

There are 15 affiliated colleges participating in the mathematics ULP of Bangalore University. The development areas center in three areas: curriculum revision; textbooks and other teaching materials; and examination reform. Committees of college and university teachers have been organized to develop guidelines in each area and to prepare programs for trial use in the colleges.

In addition the University Department holds refresher courses throughout the year for retraining the college teachers in new topics introduced in the revised curriculum.

## (2) Gujarat University

The ULP is based on a five year plan to modernize the Mathematics Syllabus at the undergraduate level and to upgrade the teaching of mathematics in all 15 affiliated colleges.

There are three components in the program.

- a. Revision of syllabus and preparation of suitable textbooks;
- b. Strengthening library facilities in the colleges;
- c. Training teachers. Fifteen teachers from fifteen different colleges spend a full year in intensive study at Gujarat University. This training program is spread over a three year period (five teachers trained each year) and it is expected that these teachers will take up leadership positions at their colleges.

## (3) Madurai University

The primary emphasis under the ULP is a training program in which three teachers from each of ten affiliated colleges spend an academic year at the university. At the end of the three year period, the teachers at 30 affiliated colleges will each have three staff members who have completed the training program.

Emphasis is also placed on changing the nature of the examinations. There is considerable interest in changing the examination system with autonomy being granted to some colleges who would serve as examples of the benefits that result from autonomy.

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(4) Meerut University

This ULP has prospered under leadership which has played a particularly important role in framing the new mathematics syllabi of the Central Board of Secondary Education. Consequently, particular attention has been given to the secondary school/undergraduate interface. The coordinator of the project is also the vice-chancellor which has helped to give the project an unusual impetus. New materials of every category are under preparation and experimental use.

(5) Punjab University, Chandigarh

There are 115 colleges affiliated to Punjab University in the States of the Punjab, Haryana and Himachal Pradesh. As a consequence, the ULP activities effect a large number of teachers and students.

Major effort has been placed on syllabus revision and writing textbooks. This has been achieved with committees under the chairmanship of university staff with college teachers directly involved. Books on geometry, algebra and calculus have been prepared and printed. Summer training sessions are held each year to train mathematics teachers to use these new books. Simultaneously these teachers are oriented to the changes being introduced in the examinations.

### 5. Physics

There are three JLP centers for physics. These are located at Andhra, Mysore and Rajasthan Universities.

#### (1) Andhra University

Andhra University had the first University Leadership Program in Physics and as a consequence its program has made the most progress in four different categories -

revision of syllabus

change of examinations

retraining of teacher; and

development of laboratory equipment.

The new syllabus primarily involves the introduction of new topics and was approved by the University Board of Studies. It was recognized that the most effective way of implementing the new syllabus was by updating the examinations and consequently the JLP staff prepared about 300 model questions of an improved variety. These were sent to all the physics teachers in the colleges with the notification that 40% of the examination at the end of the year would consist of this new type of question.

Implementation of the new syllabus and examination required training programs for the teachers. Each year Andhra University has conducted three institutes of four week

duration so that at least one teacher from each college could receive additional training. These institutes included discussions of the syllabus, model examination questions, laboratory work and shop work.

Some equipment has been made by college teachers during these institutes; some has been purchased for distribution to the colleges. The UGC has agreed to support a program of scientific equipment construction based in the Physics Department. There will be a research wing and a development wing with a target of 50 instruments of a particular kind to be sent to the colleges.

A COSIP Newsletter is published regularly as a means of communicating with the affiliated colleges.

(2) Mysore University

The ULP at this university has followed a different strategy. Initially the syllabus was revised by means of a careful consideration of the consecutive development of topics and a coherent approach to physics. Since this new approach does not follow any available text, the university staff has undertaken writing new text materials for the three years course. There has been some revision of examination questions in order to follow the new syllabus.

Short courses are presented during the summer vacation and the University has attempted to bring all the college physics teachers to the university campus at least once each year.

PSSC\* equipment, originally imported for use in the early SSIs but now made in India by Dynam Corporation, and some equipment of indigenous design have been supplied to each college. Teachers are being trained in the use and maintenance of this equipment.

### (3) Rajasthan University

The ULP at this university was initiated in 1971-72. The major emphasis centers on development of new physics equipment for demonstration and for the laboratory.

## D. School Development

### 1. Bombay Project

The Municipal Corporation of Greater Bombay, executing statutory responsibility for education through its Department of Education, manages a system including 1600 schools, 17,000 teachers, and 650,000 pupils. Instruction is provided in ten Indian languages and in English. As a composite of the diverse peoples and cultural influences in Indian education, Bombay is an optimum site for pilot work

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\* PSSC = Physical Science Study Committee. See Appendix F for complete designation of the materials used in the summer institutes.

in elementary science and education. Excellent local leadership has been a key factor in making significant progress in the development of new science and math curricula, in reorienting local teachers and in the introduction of the new curricula in pilot schools.

Efforts to improve the teaching of elementary science in the Bombay schools predate the formalization of an SEIP subproject. Workshops were conducted as early as 1963. In 1965, 50 teachers assembled to prepare their own teaching aids. In 1966 a Fulbright Scholar worked 5 months with municipal teachers in devising inexpensive science teaching apparatus. Late in 1966 this scholar sought unsuccessfully to enlist AID/ED interest in assisting Bombay in a systematic way.

In 1967 the Municipal Corporation of Greater Bombay submitted two proposals to the NCSE. Both were commended and referred to NCERT. In the absence of uncommitted funds NCERT referred the proposal back to NCSE with the suggestion that NCSE provide funds and in February 1968 the NCSE Council accepted the NCERT suggestion. At the same meeting NSF was asked to assess what support could be made available under the SEIP. Following an AID freeze on recruitment of SEIP personnel NSF consultant services started in March 1969.

During the remainder of the year the project was provided 17 weeks of consultant services in addition to a number of NSF consultations.

At the outset of the project, it was evident that development of talent was needed along several lines simultaneously. Since the local staff lacked experience or training in science, in writing, in visual aids and in curriculum development, the first workshops assisted in identifying key staff members who would serve in leadership roles in later work.

The Education Officer in charge of elementary schools in Bombay visited the U. S. as a Participant observer in 1970 and was provided with the materials from all the U. S. elementary curriculum development projects. She, along with her select committee, decided that the Process Approach of AAAS provided the maximum flexibility in contrast to the existing syllabus.

In 1970 NSF provided six consultants to the project. In 1971 NSF provided five consultants and a full-time staff Scientist (Elementary) to the project.

Prior to the arrival of the Staff Scientist, two officers of the education department and two artists had become permanently assigned to the Teaching Aids Center where the

curriculum development work was being done. Drawing on the materials and experiences from earlier workshops the team of consultants and staff completed the teachers guides for Standards I-IV. Thirteen science booklets for students were printed for use in Standard I-II.

With the arrival of the Staff Scientist it was possible to coordinate several lines of concurrent work and to accelerate the rate new materials were generated.

1. Teachers Guides I-II were field tested, revised and republished.
2. Teachers Guides III-IV were field tested in draft, revised and published.
3. Development of Science Demonstration Kits for Standards I-II was completed, 350 were produced in the Teaching Aids Workshop, entirely of indigenous materials.
4. Demonstration kits for Standards III-IV were developed in prototype.
5. Translation into Hindi, Marathi, Gujarati and Urdu for all materials was completed.

As the new material became available from the project, workshops were organized to orient teachers to the new strategies in the schools.

## 2. Other School Development Activities

- a. Physics Resource Handbook - The Mysore Subproject  
Summer institutes in physics at the University of Mysore and the Regional College of Education Mysore, led to interest

in a writing project that would provide a teachers' resource book for secondary level physics. A long term NSF consultant was requested to assist in this project. Starting in 1970 a series of workshops were inaugurated with the twofold purpose of developing the handbook and of evaluating the materials produced. The Physics and Science Education Departments at the Regional College took the responsibility for these two phases of the project.

The first volume of the proposed three volumes of the handbook was completed and published by May 1972. An evaluation workshop was held in June 1972 to train the teachers who would use the handbook in their schools during 1972-73. Pre-tests, chapter tests and final tests were prepared for the evaluation study.

Following the completion of the NSF consultant's tour of duty there was a period of approximately six months (June to December 1972) where the question of NSF AID support remained unresolved. This question was resolved in the affirmative when NCERT requested AID support. Financial assistance through December 1973 has been approved. The second two volumes of Physics Resource Materials should be completed by the Physics Department and the evaluation program by the Science Education Department carried out by that time.

The interest in this project can be recognized by two facts. The Regional College of Education Mysore continued to move ahead even during the period when AID support was being reviewed. The Chemistry Department of the College has initiated an analogous program. The goal is to write a resource book for chemistry teachers without any outside assistance. This project is being carried out with the financial assistance of NCERT, the agency under which the Regional Colleges of Education operate.

.b. Board of Secondary Education, Rajasthan (Ajmer)

In February 1973, the Board of Secondary Education in the State of Rajasthan transmitted to the NSF office a document that summarized the educational programs and activities undertaken by the Board since 1964. Although NSF has not participated directly in any of these programs initiated by the Board of Secondary Education in Rajasthan, there have been many occasions when the NSF Staff has had opportunities to meet members of the Board and be informed of their activities and to make occasional site visits in the State. The State of Rajasthan has conducted its own summer institutes since 1968. In 1970, 1971, and 1972, these institutes have been based on the new syllabi in collaboration with NCSE and NCERT. Extensive use has been made of films borrowed from NSF.

The new science curriculum in science subjects was introduced in all schools in Rajasthan in 1970. The first examination based on the curriculum was conducted by the Board in 1972 and the higher secondary examination will be instituted in 1973. Some aspects of the programs carried out in Rajasthan are listed here. (The statistical data is taken **directly** from the report of the Board.)

<u>Types of Institutes and Workshops</u>	<u>Teachers trained</u>
Training Paper Setters	641
Orientation of teachers for new concepts of evaluation	
Elementary mathematics	635
Physics	225
Chemistry	209
Biology	110
Headmasters	75
Examiners for practical examinations	
Higher secondary science	916
Secondary science	90
Summer science institutes (65)	
Assistant teachers	2926
Senior teachers	604

In addition to these training activities, The Board has established units which concentrate on:

- preparation of instructional materials
- follow-up work to the summer institutes
- revision of the curriculum
- organization of refresher courses
- supervision of examinations, including internal assessment.

In summary, the State of Rajasthan has pursued a vigorous program of educational reform since 1964. Summer institutes were introduced in 1968 and constitute a major device for orienting and training secondary teachers to these changes.

#### c. Delhi Directorate

There has been an active program of science curriculum revision in the Delhi Directorate which supervise the elementary and secondary schools in the Federal Territory, Delhi, and in the Central Schools throughout India.

The mathematics teachers from Delhi University who were responsible for the organization of the first summer institutes in 1958 were responsive to the complaints of summer institute participants concerning the difficulty of introducing new content into the teaching of mathematics without a corresponding change in the syllabus and examination. They addressed this problem by eliciting

the involvement of the Central Board of Secondary Education which prescribes the syllabus and sets the examination for all schools in the Union Territory of Delhi and for the Central Schools throughout India. With encouragement from NSF a proposal for support of a program for the retraining of 1000 teachers in a series of inservice programs was submitted to the NCSE in 1967. The NCSE endorsed the proposal and was effective in getting the **UGC** to release the needed funds. In two and one half years the teachers were prepared for the new syllabus. This work is now been taken over by the Delhi Directorate of Education and has become a regular program. In 1970 a workshop was organized for the purpose of reviewing and evaluating the new curriculum in mathematics and for framing recommendations for additional changes. NSF staff and consultants have been associated with workshops, particularly in mathematics, held at Ramjas College for teachers in the Delhi school system. (There has been a close working relationship between the mathematics departments of Ramjas College and Meerut University, one of the JLP mathematics centers.) Staff Scientists have been invited to contribute to the in service training programs for Delhi science teachers.

### E. Materials Development

Under the aegis of the SEIP, new teaching materials in many categories have been produced. For the purpose of this report they are divided into two categories, publications and other teaching aids, and listed in Appendix J. The publications used in teaching at the elementary level have come out in Hindi, Gujarati, Marati, and Urdu as well as English. Several others have parallel texts in two languages. Teachers Guides and other resource material are conspicuous on the list.

An activity which deserves special mention is the development of an indigenously designed and manufactured super-8 cartridge motion picture projector. The single concept short silent film is particularly well adapted for use in India. This format of motion picture avoids the problem of local languages and minimizes the problem of cost of filmed materials. A trial lot of 50 projectors were manufactured. They have been used in experimental programs organized by the Regional Technical Teachers Training Institute Madras and have been made available for use in the Polytechnics throughout Tamil Nadu. Unfortunately, the gift of a large number of film sets proffered by another international assistance agency was not

accepted by the Government of India and the large scale experimental manufacture of projectors now must await the development of indigenous sources of film programs.

Priority has been given to items of widest potential interest and low unit cost. Polystyrene spheres for use as molecular models are now manufactured in India. The equipment kits developed in connection with new programs for teaching physics in the U.S. are now available exstock from an Indian manufacturer. A low cost simple microscope has been produced and made available throughout the CEIP.

**More** expensive items which are of strategic interest in the overall educational development effort of India were also supported. An example is the manufacture of cathoderray oscilloscope tubes. In this connection an engineer from the Hewlett-Packard Corporation came to India to help organize a limited production run of cathode ray oscilloscope tubes. This item is an indispensable component of an oscilloscope which is a critical item in any physics teaching laboratory. As well it is closely related to the ordinary television tube which is now a prime item of need as India expands educational programs via television.

Among the various highlights which can be cited in the area of materials development is the program for entrepreneurial training. This sub-project had as its objective the retraining of unemployed engineers so that they might start small engineering enterprises. After a few experimental summer institutes with an NSF consultant, the scope for entrepreneurial training was assessed by faculties of the engineering colleges. On the basis of their recommendation and with the encouragement of key persons in the Ministry of Education, a course has been organized at the Indian Institute of Technology in Delhi. An NSF consultant assisted with the first two cycles of this course. This pioneering effort was frustrated by the lack of consultant inputs that resulted when AID dropped support for engineering and polytechnic education. The general scheme has been officially adopted as a strategy for reducing unemployment among the technically educated.

#### F. Special Projects/Binational Conference

The provision in the 1966 planning conference for the support of special projects was **predicated on the assumption** that the SEIP, if successful, would engender creativity and disclose further opportunities to make critical inputs. It is not possible to predict the order in which university or school

districts will be able to unshackle themselves from tradition, Thus for the project to flourish, a built-in capacity to respond to breakthroughs as and when they occurred was needed.

In practice the Indian directors of various sub-projects made considerable progress subsequent to the original planning conference. However, as plans were renewed by the NCSE panels the need for program review, at an approximately high professional level, was recognized. The idea of bringing a panel of experts in a given disciplinary area to India under SEIP gained favor. In effect, the category of special projects became translated into binational conferences.

In 1968 the NCSE Chemistry Panel proposed that a binational conference on chemical education be held in India. The success of the chemistry conference (1969) led quite naturally to conferences for physics (1970), the life sciences (1971) and mathematics (originally scheduled for 1972; to be held June 1973). At the instruction of AID the conference on mathematics education was specifically noted as the last conference to be sponsored under SEIP.

### 1. Chemistry Conference, 1969

The Conference on Chemical Education and Research sponsored as a special project of the CEIP was held at Srinagar and Bangalore June-July 1969. The participants at this conference are listed in Appendix K. This conference provided an opportunity to review the overall philosophy of the 1966 planning conference and to articulate the guidelines developed at that time.

A series of actions were recommended to increase the vigour of chemistry and chemical education in India. The overriding appeal issued by the conference was for the development of flexibility in the educational system in India particularly through the college development program. The hope for India to accelerate its rate of growth and its rate of development seems to reside in the willingness of its administrators to allow some institutions to carry out educational experiments and for its teachers to pursue with imagination and energy the difficult task of training students as independent and innovative thinkers. The detailed recommendations issued by the conference have been published by the UGC in the report "Chemistry : Design for Innovation".

The conference reviewed the study and teaching in Chemistry and made important recommendations for improvement of teaching

and research, for development of new areas of specialization, for indigenous production of equipment, and for preparation of textbooks, monographs, and a journal devoted to chemical education.

During the period since the conference, a large number of the recommendations have been implemented. The most important recommendation, that is college development, was acted on by the UGC in 1970 in a two-fold program called the College Science Improvement Project (COSIP) which has been discussed in section III-E of this report. Many of the specific recommendations have been carried out through COSIP. It should be recognized that not only chemistry but also physics, biology and mathematics departments have participated in COSIP.

The Indian Journal of Chemical Education has been published since February 1970. A number of special institutes on test construction and evaluation, electronics for chemists, and instrumental methods have been held during 1970-72. Four American Chemical Society Short Courses were presented during 1970-71 at approximately 15 universities. An Indian counterpart was presented at the **Indian Chemical Society** meeting in Bombay, 1971.

## 2. Physics Conference, 1970

The Conference on Physics Education and Research met in Brinagar in June 1970. The participants in this conference are given in Appendix L. The Conference provided a unique opportunity for Indian physicists from universities, national laboratories, and research institutes to exchange ideas not only with their foreign colleagues, but also with one another. During the meeting, the delegates participated in discussions which reviewed the state of physics in India, recommended specific steps for the improvement of physics teaching and research, and suggested areas of specialization with reference to national needs and potentials.

The conference recognized the desirability of administratively decoupling Indian colleges and universities from the present monolithic, centralized system, and thus of encouraging local initiative. At the same time stronger links must be established between individual teachers and physics departments on the one hand, and other college and university science departments, and local industries on the other.

The report "Physics in India : Challenge and Opportunities" published by the JCC, enumerates the conference recommendations. As is true in chemistry, many of these

recommendations have been implemented through COGIP. The Indian Physics Association has been organized. It publishes a bulletin for physics teachers on a regular basis and sponsors the "Indian Journal of Physics Education" which was initiated in September 1971.

### 3. Biosciences Conference, 1971

The Conference on Education and Research in Life Sciences was held in Bangalore in June 1971. The participants at this conference are listed in Appendix M.

The Conference served as a forum for discussing the current status of teaching and research in life sciences and for sharing experiences and information between the Indian and U.S. biologists. Some of the specific problems discussed were: the need for ending compartmentalization/fragmentation between different disciplines of life sciences; an integrated approach to the teaching of biology at the undergraduate level, and suggestions for developing specialized courses relevant to the country's growing needs; the importance of offering a generalized B.Sc. degree. The measures recommended are expected to enable the student to attain a wider understanding of biology. At the undergraduate level it was generally felt that the curriculum needed simplification rather than diversification to reflect the growing and intelligent unity of Biology. Courses

should be evolved which are designed to motivate students to do independent thinking and analysis.

The Conference also considered in depth the problems of obtaining and maintenance of costly equipment, so vital for the pursuit of research in frontier areas in biosciences. Considerable thought was given to the question of sharing costly equipment between a number of universities on a cooperative basis.

The recommendations of this conference appear in the report "Biological Sciences and National Development : Strategy for Progress," published by the UGC.

Because all biologists could not be accommodated at the main conference and a need existed to discuss the recommendations at a lower level, the UGC sponsored four Regional Conference on Education and Research in Life Sciences. Sites selected were:

Western Zone, Saurashtra University, Rajkot, December 1972, (52 participants)

Northern Zone, Delhi University, Delhi, December 1972 (79 participants)

Northern Zone, Delhi University, Delhi, December 1972, (79 participants)

Eastern Zone, Calcutta University, Calcutta, January 1973, (54 participants)

In addition, two other sponsored conferences made the conference proceedings the subject of deliberations:

Firla Institute of Technology, Pilani, March 1972  
(50 participants)

Indian Science Congress, Chandigarh, January 1973  
(100 participants)

COSIP has proved in several cases to be an appropriate, flexible matrix within which the conference recommendations could be tested prior to the acquisition of institutional endorsement.

Subsequent to the Regional Conferences at least three universities have held meetings to study implementation of reforms recommended. These include, Delhi, Indore, and Bombay University. Indore and Tirupati Universities have introduced an integrated course of study in Bioscience. Bombay University with encouragement and support from the UGC, has initiated a new university department of Life Science.

#### 4. Mathematics Conference, 1973

Originally scheduled for 1972, this conference will be held in June 1973 in Bangalore. Like the other conferences, this one is sponsored jointly by the UGC and NCSE and is a recognized subproject of the JSEP.

The delegates to the conference are listed in Appendix N. Pre-conference papers have been prepared and it is expected that conference recommendations will be published by the JGC. A series of regional conferences is planned for the purpose of promulgating the recommendations.

## SECTION IV - EVALUATION

There are several difficulties that arise in attempting to write an evaluation of the Science Education Improvement Project. The original guidelines developed in the 1966 planning conference have been modified from time to time, thereby changing the emphasis of the project. Over twenty people have served on the NSF Staff since the start of the project and at the present time only three of these people have the responsibility of framing the terminal report.

The arbitrary decision has been made to base this section of the report on the planning document called the Project Logical Framework. Initialed on November 19, 1971, this document covers the period January 1, 1971 through December 31, 1975. This report will address in particular those blocs of the Project Logical Framework concerned with

"Conditions expected at end of project"

"Magnitude of outputs"

### A. Conditions Expected at End of Project

- "1. Key Central and State education agencies (NCSE, UGC, NCERT) have trained staffs and are introducing and administering curricula research and improvement programs.
2. NCSE, UGC and NCERT have coordinated and funded curriculum development units for implementing SEI on a permanent basis.
3. Improved materials are being used in twelve University/Leadership/Comprehensive Science Improvement Programs (COSIP); in 200 teacher retraining institutes and in selected elementary/secondary programs instituted by NCERT in the states of Mysore, Rajasthan, Maharashtra and by the Central Schools Commission (CSC) in New Delhi".

### 1 and 2 Key Agencies Organized and Operating

The SEIP has operated through three key central agencies - the National Council for Science Education, the University Grants Commission, and the National Council for Educational Research and Training. The latter two agencies are established by Acts of Parliament and receive their funds directly from the Ministry of Education. They have trained staffs and administer programs intended to improve science education. Their work is a matter of public record.

On the other hand, the NCSE was established through a letter issued by the Secretary to the Government of India in the Ministry of Education; its budget derives from funds provided by NCERT. One of the conditions expected at the

end of the project was that the NCSE would be a properly constituted and viable agency for supporting science education development projects which were innovative in nature. While the NCSE has partially fulfilled these expectations, it has not become a viable agency.

At this time (May 1973) the NCSE secretariat consists of 15 persons and a maintenance staff of six. The nominal membership of the Council and its various advisory panels consist of the very top leaders in science. The latest published list of NCSE panel members is given in Appendix 2. The potential role and utility of professional advisory panels has been demonstrated in the operation of the NCSE. Through panel meetings convened for the purpose of evaluating proposals and formulating other advice to the NCSE, panelists have developed a much broader conception of their proper interest and responsibility for maintaining and upgrading the quality of science education. Panel meetings have been particularly effective in keeping the academic community informed of successful educational experiments which otherwise might have received much less attention.

The NCSE has supported a number of experimental projects through grants and has incurred net expenditures of Rs. 75,000 during the Indian Financial Year 1972-73. An account of these

expenditures is given in Appendix C. The NCSE sponsors a number of educational journals, including the Science Resource Letter published at Indian Institute of Technology Kanpur; the Indian Journal of Chemical Education published at Indian Institute of Technology Delhi; the Indian Journal of Physics Education published in Bombay; the Journal of Technical Education published by the Indian Institute of Science, Bangalore.

Throughout the lifetime of the SEIP, the University Grants Commission has announced a number of new programs derived either directly or indirectly from activities supported by the NCSE. They include an improved program of summer institutes for college teachers; a program for support for seminars, workshops, and refresher courses; the College Science Improvement Program through which university departments are given science development grants; a program for the support of writing of new science textbooks. These programs have program directors, professional supporting staffs and budgets. They are fully institutionalised.

In 1973 the NCERT took over the management of the summer institutes for school teachers which had originated as UGC/NCSE activities. It is interesting to note that NCERT adopted to the maximum extent possible a strategy for making use of the summer

institutes first articulated in the 1966 planning conference and subsequently endorsed and implemented by the NCSE. One example is the support of the comprehensive program of summer institutes for middle school teachers of science in Rajasthan.

For a number of years the NCSE Panels for Engineering and Polytechnic education assisted in organizing the sequential summer courses and advanced courses for faculties from the engineering and polytechnic institutions. The Indian Society for Technical Education continues to support these programs.

Draft legislation for the constitution of the NCSE through an act of Parliament has been prepared for the third time and is again under consideration in the Ministry of Education.

The above facts notwithstanding, it appears that the NCSE is not a viable institution. The Chief Executive of the Secretariat who had been seconded to the NCSE by the UGC has been recalled; the Deputy Chief Executive who had been seconded by the NCERT has been recalled; the Chairman of the Council has resigned. The Council held its last meeting on October 1971 and it is doubtful that it will ever meet again. The Member Secretary, the ranking NCSE official, has expressed his intention of resigning in view of the slow movement of the Ministry of Education in confirming a regular role for the NCSE.

Summary of Conditions #1 & 2 Expected at End of  
Project

<u>Attribute</u>	<u>NCSE</u>	<u>UGC</u>	<u>NCERT</u>
Professional Staff	No	Yes	Yes
Secretariat	Yes	Yes	Yes
Regular Meetings	No	Yes	Yes
Own Funds	No	Yes	Yes
Supports Dev. Proj.	Yes	Yes	Yes
Viable	No	Yes	yes

3. Improved materials in Use

The third condition expected at the end of the project was that there would be 12 University Leadership Projects in operation and 200 teacher retraining institutes in Mysore, Rajasthan, Maharashtra and New Delhi. In section III of this report the operation of the College Science Improvement Program including 13 University Leadership Projects has been described (see pages 39-52) It has been learned from the University Grants Commission that an additional 15 university departments will be chosen for COSIP/ULP grants during the current year. Thus the program which has made such a strong beginning will be doubled in size. Additional special colleges are to be selected soon for COSIP grants.

The Project Logical Framework goes on to specify in the third condition expected at the end of the project that there be

200 teacher retraining institutes and selected elementary/secondary programs instituted by NCERT in the States of Mysore, Rajasthan, Maharashtra and the Central Schools' Commission in New Delhi by 1975.

The following chart gives the number of summer institutes supported during 1972 by various agencies in the target areas.

1973 Summer Institutes (201)

<u>Sponsoring Agency</u>	<u>Rajasthan</u>	<u>Maharashtra</u>	<u>Mysore</u>	<u>Delhi</u>	<u>Total All Locations</u>
NCERT					
1. Sequential and All-India Project Technology	3	-	2	-	11
2. Secondary/PUC/Intermediate/pre-degree colleges	4	4	4	4	65
3. National Science Talent Scholars	3	1	1	4	15
UGC					
1. College	3	2	3	1	31
2. All-India Advanced Level	-	7	2	1	22
ISTE					
1. Engineering	-	2	4	3	32
2. Polytechnic	2	-	3	-	25
Totals	15	16	19	13	201

### E. Magnitude of Outputs

STAFF	
"NCSE	- 5; Prog. Coordinator (1); Sc. Mat./Spec. (4)
UGC	- 5; COSIP Administrator (1); COSIP Supv. (4)
NCERT	- 2; Prog. Coord. (1); Sc. Mat. Spec. (1)
Bombay (BMC)	- 2; Elementary Curriculum Specialists
Mysore (RCE)	- 2; Elementary/Secondary Curriculum Specialists
Rajasthan(Ajmer)	- 2; Elementary/Secondary Textbook Writers
CSC (Delhi)	- 2; Elementary/Secondary Curriculum Specialists

BMC    Bombay Municipal Corporation  
 RCE    - Regional College of Education  
 CSC    - Central Schools Commission"

The Project Logical Framework specifies that AID Project Implementation Order/Participants should be the means of verifying the output of trained staff. NEF arranged study tours for 77 AID participants. Figure 8 shows the number of participants by year. Participant Trainees are selected by the Government of India. In general, a distinguished group of science teachers and administrators has been included in the program. A list of participants is given in Appendix P. Figures 9 and 10 show the distribution of the 77 participants by occupational category and by discipline.

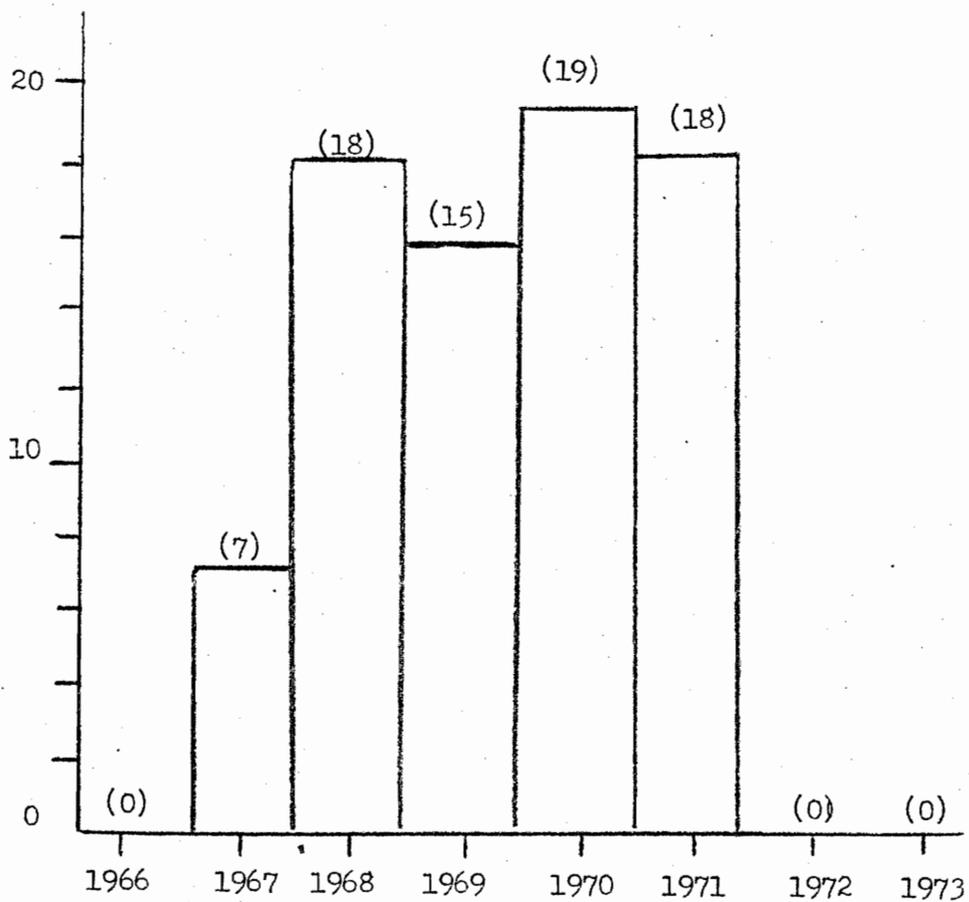


FIGURE 8. USAID PARTICIPANT TRAINEES  
TOTAL NUMBER = 77

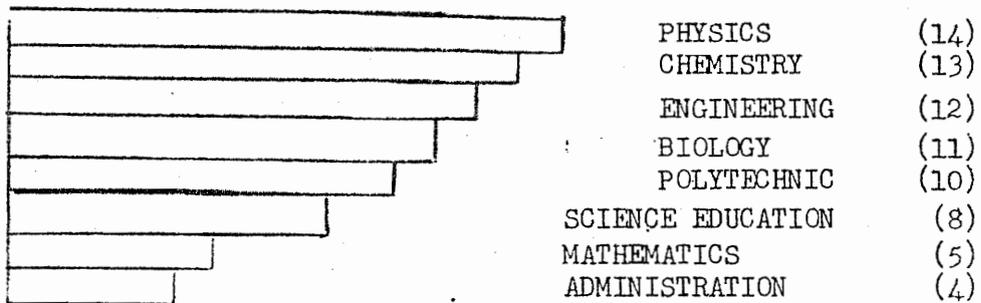


FIGURE 9. USAID PARTICIPANT TRAINEES BY DISCIPLINE

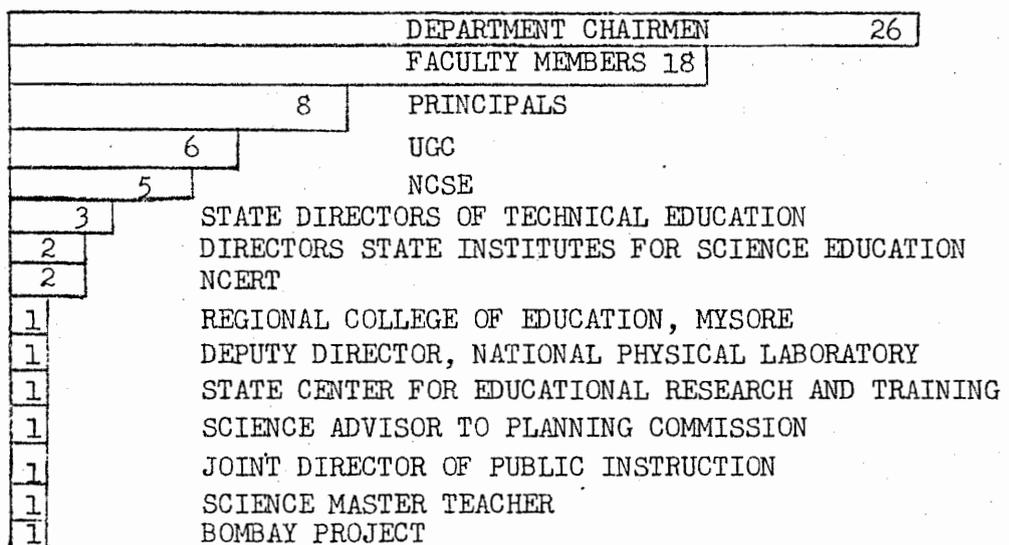


FIGURE 10. USAID PARTICIPANT TRAINEES BY OCCUPATIONAL CATEGORY

Many of the 77 AID Participants can be related closely to the staff positions mentioned in the Project Logical Framework. The following tabulation compares the targeted output of trained staff with AID Participants.

Output of Trained Staff

<u>Agency</u>	<u>Targets</u>		<u>Actuals</u>	
NCSE	Coordinator	1	Staff	2
	Specialists	4	Counselors	3
			Panelists	29*
UGC	COSIP Adminis- trator	1	COSIP Adminis- trator	1
	Supervisors	4	ULP Project Directors	7*
			ULP Project Faculty	5
NCERT	Coordinator	1	Staff	3
	Specialist	1	Study Group Memb.	8*
Bombay	Specialists	2	Project Director	1
Mysore	Regional College of Education		Director of Public Instruction	1
	Specialists	2	Director State Institute of Science Education	1
			Regional College of Education Specialists	1
Rajasthan	Textbook Writers	2	NIL	
Delhi	Central Schools	2	NIL	

\* There are duplications in this listing. For example three of the NCSE Panelists are also given under the headings NCERT Study Group Members and five under ULP Project Directors.

### C. SUMMARY

Any formal evaluation must consistently adhere to stated criteria of accomplishment. In the preceding evaluation an attempt has been made to do this. In terms of the Project Logical Framework standards, one can conclude that the program ~~has~~ failed to institutionalize the NCSE but has enhanced the UGC and NCSE through the encouragement and support of new, authorized national programs. While these programs operate on a national scale, specific reference is made in the Project Logical Framework to targets in Mysore, Rajasthan, Maharashtra and Delhi. The volume of activity in these four areas is significantly below the target levels. Participant Trainees have been sorted into the categories specified in the Project Logical Framework. Depending somewhat on the categories assigned to persons who have shifted positions and taking into account the fact that no Participant Trainees were nominated after the Project Logical Framework was written, performance in this area is creditable.

Any meaningful evaluation must not only treat the question of how output measures meet specified standards but must include an account of the validity of the standards themselves. The Project Logical Framework targets are intended for calendar years 1971-75 but this report covers the life of the

project since its inception in 1966. Thus, support of technical education which was an important part of the original program and continued to be of major importance up until the time that it was arbitrarily excised, finds no standard of accomplishment specified for it. The three state directors of technical education, the vice-chancellor of the first technological university in India, and two directors of Indian Institutes of Technology who were SEIP Participant Trainees contribute nothing to the measure of success of the SEIP. There are no standards of accomplishment in the area of technical education prescribed by the Project Logical Framework.

This report does not seek to redress any deficiencies in measurement standards but merely takes note of the fact that a considerable part of the SEIP and its sequela are invisible from the perspective of the Project Logical Framework. The national effort charted out in 1966 continued with unflagging support from key agencies of the Government of India after AID restricted its own concept of the program. It was AID, not the counterpart agencies, which changed the official definition of the SEIP thereby limiting authorized activities. Perhaps there will be some future opportunity to assess the larger effort with which we have been associated.

## SECTION V -- RECOMMENDATIONS

An attempt will be made in this section to develop some recommendations for science education improvement programs where U.S. assistance might be provided to another country. Many of these have been stressed in Annual Reports and in End of Tour Reports already submitted to AID by departing NSF Liaison Staff Scientists. Others have appeared in consultants' reports. These documents should be referred to for a more detailed discussion than can be given in this report. Although the context of these recommendations is of course India, they have broad implications for any science education development effort.

### A. Recommendations

1. The National Science Foundation is primarily concerned with the development of science, science education, and technology within the United States. It has unique capabilities and contacts within the community of scientists, educators and engineers. AID should recognize the National Science Foundation as the premier agency for advice or participation in any technical assistance programs having to do with pure and applied science.

2. At the same time NSF should reassess its own potential role in foreign assistance activities. NSF could take a much more active role than it has in the past. From its own conspicuous success in the U.S. in stimulating and supporting the development of science NSF has demonstrated the capacity to design and

implement large scale science development schemes.

3. The division of responsibility between NSF and AID for implementing the SEIP in India was at times obscure. In any future collaboration improved guidelines for program management should be developed.

4. Some of the difficulties arose from the fact that the NSF Liaison Staff was largely drawn directly from the U.S. academic community\*. Few of the Staff had had prior experience with either NSF or AID operations before coming to India.

There are several ways to approach this problem.

- Assignment in Washington before assuming position in the field;
- Mid-tour experience of several months in Washington;
- Overlapping assignments for Staff members to improve continuity in the program. In addition direct introduction of new Staff members to their counterparts would enhance chances for successful transition as Staff changes took place.

Collaboration with foreign governments necessarily places American participants in a new cultural setting. This transcends the trivial aspects of "culture shock" for the staff, consultants and their families.

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\*The National Science Foundation frequently follows this pattern in the development of new national programs. Vigorous leadership in activities has successfully been provided by one or two year appointments of academic scientists and engineers.

The inescapable bureaucratic structure of the agencies with which one deals is a new and wondrous experience for the academic scientist. Over-lapping Staff assignments would prove particularly useful here. The decision-making process often appears to consist of administrative fiat with geographical and political factors outweighing the professional. Important questions follow and often the answers are obscure.

5. In general the NSF Staff should be given major responsibility for the technical direction of programs, particularly in any matters involving professional judgements. There have been a number of instances during the lifetime of the SEIP in which this has not occurred. For example NSF Staff advice was either not sought or discarded without discussion in these instances:

a. Establishment of procedures for eliciting equipment lists for the Higher Education Loan.\*

b. Termination of support for engineering and polytechnic education. Any argument that NSF lacked expertise in this area is nullified by the fact that the NSF/New Delhi Staff Scientist responsible for technical education moved from this position to one with the United Nations Industrial Organization in Bangkok.

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\*Plans had been mooted to enlist direct NSF help in the evaluation of the loan but in light of conditions during and after the 1971 war, it was too late to take useful action. (Comment from the Program Division, AID).

He was subsequently approached by the Mission to serve as as AID consultant to assist in a feasibility study for a new AID project in the area of technical education. The fact that the Mission could consider support of the proposed new project at the Regional Technical Teachers Training Institute in Calcutta verifies the interest of the Mission in technical education per se. It should be pointed out that one of the active sites for technical education development under the SEIP was the Regional Technical Teachers Training Institute in Madras, a sister to the very institution which the Mission was considering for support.\*

c. Transfer of responsibility for the Travelling Science Workshop from a university team to NSF.

d. Interruption of consultant and staff inputs to the Bombay elementary science program.

e. The insertion of an activity concerned with programmed instruction into the Bombay arena.

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\*Point (b) represents a USAID decision which may have been unilateral from NSF's point of view. It was USAID's intention in 1970-1971 to reallocate reducing resources to two areas which were identified as high priorities. Some USAID officials believed that SEIP would have more impact if it limited itself to science education improvement at the college and university levels with some activity at the secondary level. As a consequence the polytechnic and engineering education phases of the SEIP were phased out. (Comment from the Program Division, AID).

In this instance NSF/New Delhi advised the Mission that making the Bombay Municipal Corporation one of the loci of another education project would strain available local leadership. Competition for Bombay Municipal Corporation personnel would be **harmful** both to the interests of the on-going project and to the proposed project. The Director of the Bombay education project also expressed **this** point to AID/Washington when she was a participant observer.

Some of the earlier frictions between NSF Staff and the Education Program Divisions of AID would have been avoided if there had been real consultation on such matters.

6. In the United States, the major strength in the developments in science and technology supported by the National Science Foundation lies in the proposal/grant system. Program review by a peer group precedes award of grants and continuation of grants is based on performance. The NSF Staff in India has consistently encouraged the introduction of an analogous system for the programs carried out under the NCSE and the UGC. Regretably, one must admit failure in these efforts. In India, administrators have too often made arbitrary decisions on the assignment of program activities and then instructed affected persons to submit a proposal. Thus, there is a grant/proposal system which is vulnerable to heavy-handed administration. There has not been sufficient reliance on enthusiastic local leadership and expertise in the design and

implementation of educational changes. The NSF Staff can claim that the successes in the summer institutes, in COSIP, and in the Bombay elementary education project are due chiefly to the vigorous support of the ideas of innovative, energetic, local leaders. These programs have followed in some approximation the proposal/grant strategy of support.

There are enough examples of the benefits of the proposal/grant system in the U.S., Great Britain, and Canada to urge AID/NSF to continue in efforts to introduce it in countries where collaborative programs are undertaken. The experience of the NSF Staff in the SEIP shows clearly how difficult this may be in another cultural setting. This however does not argue against future efforts.

In retrospect it can be claimed that the 1966 Planning Conference in Varanasi should have been followed by a conference in Washington. This would have provided the opportunity for leading Indian administrators and scientists to learn directly about the successful operation of the proposal/grant system by the National Science Foundation.

B. Concluding Remarks

The Science Education Improvement Project has been in operation for nearly seven years. It has survived two major wars between India and Pakistan and an unprecedented polarization in Indo-U.S. relations. As the program comes to a conclusion it does so with a commendable degree of cooperation with all associated with it. The way is clear to plan new activities.

## APPENDIX A

COMMODITIES PROCURED

		\$
Office Supplies	NSF, NCSE Office	30,871
Teaching	Equipment	28,122
	Films	23,672
Audiovisual Equipment		11,439
Packing and Shipping		5,896
	Total	<hr/> 100,000 <hr/>

SCIENCE EDUCATION IMPROVEMENT PROJECT

O B L I G A T I O N S -- Total \$ Inputs

PIO/T No.	PASA Amendment No.	Total	US Personnel	Participants	Commodities
70003 A-4	NESA (NA) 34-66 A-5	1,598,058	1,489,058	-	109,000
80126	NESA (NA) 34-66 A-6	630,000	615,000	-	15,000
90104 A-1	NESA (NA) 34-66 A-9	743,000	738,000	-	5,000
00166 A-3	NESA (NA) 34-66 A-15	564,000	527,000	30,000	7,000
10099	NESA (NA) 34-66 A-14	-	-	-	-
10358	NESA (NA) 34-66 A-16	265,000	265,000	-	-
20089 A-3	NESA (NA) 34-66 A-20	273,781	265,281	1,000	7,500
		<hr/>	<hr/>	<hr/>	<hr/>
		4,073,839	3,899,339	31,000	143,500
		<hr/>	<hr/>	<hr/>	<hr/>

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SCIENCE EDUCATION IMPROVEMENT PROJECT

C B L I G A T I O N S -- Total Re. Inputs

PIO/T No.	PASA Amendment No.	Total	US Personnel	Commodities	Other costs	DSR
70003 A-4	NESA (NA) 34-66 A-5	6,270,000	5,591,000	-	679,000	-
80126	NESA (NA) 34-66 A-6	2,232,000	-	-	2,232,000	-
90104 A-1	NESA (NA) 34-66 A-9	3,873,400	3,509,500	-	363,900	-
00166 A-3	NESA (NA) 34-66 A-15	3,564,400	1,554,700	-	1,509,700	500,000
10099	NESA (NA) 34-66 A-14	150,000	-	-	150,000	-
10358	NESA (NA) 34-66 A-16	1,933,000	770,500	-	849,500	313,000
Cost component adjustments made in FY 71		-	(250,000)	-	(165,000)	415,000
- do -		-	(928,000)	150,000	778,000	-
20089 A-3	NESA (NA) 34-66 A-20	1,322,400	241,100	-	1,073,300	8,000
Cost component adjustments made in FY 73 in PIO/T 20089		-	(34,500)	-	63,500	(29,000)
		<u>19,345,200</u>	<u>10,454,300</u>	<u>150,000</u>	<u>7,533,900</u>	<u>1,207,000</u>

EXPENDITURE INCURRED BY THE NATIONAL COUNCIL  
FOR SCIENCE EDUCATION DURING FY 1970-71

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
Grant-in-aid to Aligarh Muslim University for the development of new teaching methods, materials and aid for the development of physics education at the undergraduate level. (Project continued during 1971-72 and 1972-73).	Rs. 16,000.00
Setting up of a Science Service Centre at Andhra University campus.	Rs. 1,400.00
Organization of Resource Persons Workshop and Summer Institutes - Board of Secondary Education, Rajasthan.	Rs. 4,35,000.00
Holding of a special institute in Industrial Engineering, Applied Mathematics and project programmes in Materials Technology at S.V. Government Polytechnic, Bhopal.	Rs. 40,860.00
Holding of a Symposium on General Chemistry Curriculum Development at IIT Kanpur.	Rs. 8,850.90
Holding of a Winter School in Modern Physical Methods in Chemistry at IIT Kanpur.	Rs. 25,459.25
Holding of a Workshop on Test and Evaluation of School Chemistry Material -- Osmania University, Hyderabad.	Rs. 6,803.88
Publication of the Indian Journal of Chemical Education.	Rs. 60,000.00
Publication of Science Resource Letter.	Rs. 60,000.00
Holding of a summer institute for teachers in elementary science at Delhi.	Rs. 19,750.00
Evaluation work of the Summer Institutes including systematic analysis of data, etc. at IIT Kanpur.	Rs. 2,500.00
Holding of a two week advanced level Winter Workshop in Fluid Mechanics at IIT Delhi.	Rs. 20,000.00
Writing of text books on new curricular material developed for polytechnic faculty in mathematics at S.V. Government Polytechnic, Bhopal.	Rs. 9,853.12
	Rs. 7,06,477.25

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
B.F.	Rs. 7,06,477.25
Project on upgrading of science and mathematics in Bombay schools -- Bombay Municipal Corporation	Rs. 2,74,000.00
Implementation of the project on General Chemistry -- IIT Kanpur.	Rs. 40,000.00
Advance to Prof. N.V. Subba Rao, Principal, University, Hyderabad, for meeting incidental expenses in connection with the work relating to NCSE Advisory Panel in Chemistry.	Rs. 500.00
Publication of the Indian Journal of Technical Education.	Rs. 30,500.00
Holding of a Mini-Physics Institute for teachers employing Nuffield and AISTA Study Group Curriculum at Delhi Public Schools, Delhi.	Rs. 27,274.91
Implementation of the project on design and fabrication of teaching laboratory - Apparatus and equipment for Physics Instructional Laboratories at IIT Kanpur.	Rs. 30,900.00
Preparation of Resource Material in Physics for Secondary School Teachers at RCE Mysore.	Rs. 24,270.00
Holding of a Mathematics Olympiad for Xth Class students of Delhi by the Delhi Association of Mathematics Teachers.	Rs. 1,000.00
Holding of a Seminar on Particle Technology at IIT Madras.	Rs. 8,500.00
Holding of a Regional Conference of Chemists - Osmania University, Hyderabad.	Rs. 20,000.00
Grant-in-aid to Community Science Centre, Ahmedabad (Grant also given during 1971-72 and 1972-73).	Rs. 75,000.00
Grant to the State Institute of Science Education, Udaipur, for undertaking two projects namely (1) Project on the spot guidance in teaching of science in rural secondary schools with the help of mobile laboratory and (2) Project on demonstration lesson of interest of the students of secondary and higher secondary schools.	Rs. 32,400.00

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 Rs. 12,70,822.16

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
B.F.	Rs.12,70,822.16
Setting up of a Graphic Art Workshop at Allahabad Polytechnic.	Rs. 11,500.00
For conducting a Workshop on Project Technology in Bombay.	Rs. 11,500.00
TA & DA payments made to various members of NCSE Panels and other sub-committees on account of their participation in the NCSE sponsored meetings and conferences.	Rs. 44,408.77
Expenditure on Contingencies (This Includes: Rent of the Office Building, Telephone Charges, Water and Electricity Charges, Wages of Staff on daily wages and other miscellaneous expenses.)	Rs. 1,24,170.72
Salaries and allowances of Officers and Staff and contributions of NCSE on salaries.	Rs. 48,656.11
Total	<hr/> Rs.15,11,057.76 =====

EXPENDITURE INCURRED BY THE NATIONAL COUNCIL  
FOR SCIENCE EDUCATION DURING FY 1969-70

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
Organization of a Winter School in Solid State Chemistry at IIT Kanpur.	Rs. 26,648.83
Publication of the Indian Journal of Chemical Education. (A further sum of Rs.60,000.00 was released for this purpose during 1970-71).	Rs. 20,000.00
Holding of a Seminar with Dr. S.W. Gouse of Carnegie Mellon University -- IIT Delhi	Rs. 5,000.00
Programme of Curriculum Development for the Polytechnic Faculty in Mathematics - preparation of text books, etc. -- S.V. Government Polytechnic, Bhopal. (A further sum of Rs.14,800.00 was released for the continuation of this project during 1970-71).	Rs. 9,200.00
Holding of a Winter School in System Engineering for the benefit of teachers in Engineering Colleges of Southern Region -- P.S.G. College of Technology, Coimbatore.	Rs. 4,227.88
Organization of a Conference on Functional Analysis and Its Applications at IIT Kanpur in collaboration with Indian Mathematical Society.	Rs. 12,522.38
Publication of Science Resource Letter. (A further grant of Rs.60,000.00 was released to IIT Kanpur for this purpose during 1970-71).	Rs. 25,000.00
Programme of development of teaching equipment as a part of the follow-up of Summer Institutes at IIT Kanpur	Rs. 750.00
Grant-in-aid to the Community Science Centre, Ahmedabad for undertaking various projects for the improvement of science education in Gujarat.	Rs. 75,000.00
Organization of Orientation-cum-In-service project for teachers from Bombay Municipal Corporation Schools, TIFR Bombay.	Rs. 21,347.40
Organization of a Course on Molecular Biology of Bacter Bacterial Viruses at the Indian Institute of Science, Bangalore.	Rs. 10,000.00
	<hr/> Rs. 2,09,696.49

PARTICULARSNET EXPENDITURE

B.F.	Rs.2,09,696.49
TA & DA payments made to various members of NCSE Panels and other sub-committees on account of their attending the NCSE sponsored meetings and conferences.	Rs. 15,213.91
Expenditure on contingencies (This includes: Rent of Office Building; Telephone Charges; Water and Electricity Charges; Daily Wages of Staff on daily wages and other miscellaneous charges).	Rs.1,17,218.14
Salaries and allowances of Officers and Staff	Rs. 15,388.62
Total	Rs.3,57,517.16 =====

EXPENDITURE INCURRED BY THE NATIONAL COUNCIL  
FOR SCIENCE EDUCATION DURING FY 1971-72

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
Preparation of instructional materials in basic semi-conductors electronics at V.J.T.I., Bombay.	Rs. 28,130.00
In-service training of school teachers of mathematics; M.S. University of Baroda.	Rs. 17,000.00
Organization of ACS Short Course on Infrared Spectroscopy, IIT, Kanpur.	Rs. 4,168.38
Financial assistance to Prof. M.R. Bhide, University of Poona, for fabrication of prototype laboratory equipment.	Rs. 15,000.00
Workshop on Project Technology for teachers of Delhi at IIT, Delhi.	Rs. 10,399.85
Second Winter School in Solid State Chemistry at IIT, Kanpur.	Rs. 37,660.00
Indian Journal of Physics Education, reimbursement of secretarial expenses.	Rs. 4,981.80
Development of special tube for measurement of excitation potential in gases at R. E.C. Kurukshetra.	Rs. 7,400.00
Organization of the first national heat and mass transfer conference at IIT, Madras.	Rs. 20,000.00
Organization of seminar for development of physics instructional laboratory and demonstration apparatus at IIT, Kanpur.	Rs. 9,302.88
Financial assistance for the development of new teaching methods materials and aids for physics education at Aligarh Muslim University, Aligarh.	Rs. 30,123.41
Financial assistance to the Community Science Centre, Ahmedabad.	Rs. 47,891.82
Interdisciplinary Laboratory Course on Environmental Studies, Institute of Science, Bombay.	Rs. 484.90
	Rs. 2,32,543.04

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
B.F.	Rs. 2,32,543.04
"Adaptation of Harvard Project Physics Material in India", Nagpur University.	Rs. 45,000.00
Seminar on creativity and undergraduate science education held in February 1972 at Aligarh Muslim University, Aligarh.	Rs. 11,103.27
Seminar on speech and hearing -- initial expenditure on steering committee meeting at Aligarh.	Rs. 1,000.00
Special program in "Activation Analysis" at the Institute of Science, Bombay.	Rs. 45,800.00
Organization of the ACS Short Course on the "Interpretation of Mass Spectra" held at the Indian Institute of Technology, Madras.	Rs. 6,000.00
Organization of the ACS Short Course on the "Interpretation of Mass Spectra" held at National Chemical Laboratory, Poona.	Rs. 6,000.00
Organization of the ACS Short Course on the "Interpretation of Mass Spectra" held at Central Drug and Research Institute, Lucknow.	Rs. 6,000.00
Organization of a second sequential orientation-cum-implementation project for teaching AISTA study group curriculum at Tata Institute of Fundamental Research, Bombay.	Rs. 25,544.55
Holding of Northern Regional Conference at Rajasthan University, Jaipur, for follow up of the recommendation of chemistry conference held in Srinagar.	Rs. 20,000.00
Organization of Instructional Conference on Hological Methods in Commutative Algebra at Tata Institute of Fundamental Research, Bombay.	Rs. 32,735.00
Organization of Special Program in Electronics at Indian Institute of Technology, Kanpur.	Rs. 79,918.95
Setting up of Educational Development Centre at IIT, Kanpur.	Rs. 2,50,000.00
	<hr/>
	Rs. 7,61,644.81

PARTICULARSNET EXPENDITURE

	B.F.	Rs. 7,61,644.81
Publication of the First Issue of the Journal of Physics Education.		Rs. 9,772.83
Cost of Glazed Paper		Rs. 10,707.96
Binding Charges		Rs. 8,026.00
Grant-in-aid to IIT Delhi for the setting up of the Bio-Medical Engineering Unit.		Rs. 41,267.88
TA & DA payments made to various sub-committees.		Rs. 35,558.20
Contingencies (This Include: Rent of the Office Building, Telephone charges, Water & Electricity charges, and other miscellaneous expenses.)		Rs.1,27,019.08
Salary and allowances of Officers and Staff and contribution of NCSE on salaries.		Rs. 68,001.52
		<hr/>
	Total	Rs.10,61,998.28
		=====

EXPENDITURE INCURRED BY THE NATIONAL COUNCIL  
FOR SCIENCE EDUCATION DURING FY 1972-73

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
Financial assistance for the holding of a Third . Sequential Orientation-cum-Implementation Project for Bombay Corporation Teachers using AISTA Study Group Curriculum Materials.	Rs. 53,900.00
Grant-in-aid to Aligarh Muslim University for the holding of a Seminar on Speech & Hearing.	Rs. 13,800.00
Expenditure incurred by NCSE for the holding of of a Seminar on Teaching of Science, Vocational Courses and Educational Technology at Indian Standards Institution New Delhi.	Rs. 8,143.55
Setting up of an Educational Development Centre, IIT Kanpur.	Rs.1,00,000.00
Financial assistance for the development of new teaching methods, materials and aids for physics education at Aligarh Muslim University.	Rs. 15,390.00
Purchase of 5,000 copies of "Basic Physical and Chemical Data".	Rs. 8,828.00
Preparation of instructional materials in basic semi- conductors electronics at V.J.T.I., Bombay.	Rs. 2,500.00
Financial assistance to the Community Science Centre, Ahmedabad.	Rs.2,00,000.00
Setting up of the Bio-medical Engineering Unit at IIT, Delhi.	Rs.2,65,000.00
Publication of the Indian Journal of Technical Education.	Rs. 20,000.00
Publication of the Indian Journal of Physics Education (2nd and 3rd issues).	Rs. 18,431.89
Publication of the Indian Journal of Chemical Education (7th issue).	Rs. 12,796.84
Printing of Dr. D.S. Kothari's article published in the Physics in India -- Challenges and Opportunities.	Rs. 2,925.78
	<hr/> Rs.7,21,716.06

<u>PARTICULARS</u>	<u>NET EXPENDITURE</u>
B.F.	Rs.7,21,716.06
Organization of a Conference in the field of Quantum Biology -- AIIMS Delhi.	Rs. 3,933.21
TA & DA payments made to various members of NCSE Panels and other sub-committee/participants on account of their attending the NCSE sponsored meetings/National Science Exhibition.	Rs. 7,993.70
Contingencies (This include: Rent of the Office Building, Telephone charges, Water & Electricity charges, and other miscellaneous expenses).	Rs.1,06,576.55
Salaries and allowances of officers and staff and contribution of NCSE on salaries.	Rs. 60,235.55
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TOTAL	Rs.9,00,455.07
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EXPECTED EXPENDITURE BY NATIONAL COUNCIL FOR  
SCIENCE EDUCATION DURING FY 1973-74

<u>PARTICULARS</u>	<u>AMOUNT</u>
Setting up of Bio-medical Engineering Unit" at IIT, Delhi.	Rs.1,00,000.00
Setting up of "Educational Development Centre" at IIT, Kanpur.	Rs.2,00,000.00
Financial assistance to Community Science Centre, Ahmedabad.	Rs.2,00,000.00
Publication of Indian Journal of Chemical Education.	Rs. 32,000.00
Publication of Journal of Physics Education.	Rs. 32,000.00
Publication of Journal of Technical Education.	Rs. 32,000.00
	<hr/>
TOTAL	Rs.5,96,000.00
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EXPENDITURES INCURRED BY THE INDIAN SOCIETY  
FOR TECHNICAL EDUCATION FOR SUMMER INSTITUTES  
IN ENGINEERING AND POLYTECHNIC LEVELS

<u>YEAR</u>	<u>EXPENDITURES</u> Rupees
1964-65	48,620
1965-66	375,645
1966-67	614,068
1967-68	1,060,953
1969-70	1,480,989
1970-71	1,637,124
1971-72	1,771,573
1972-73	Information not available

## APPENDIX E

## TECHNICIANS SERVING DURING CY 1967

## Long Term Staff Members (12)\*

Name	Position	Dates
ABEL, William R. W. Washington St. College, Bellingham, Wash.	Staff Scientist (Mathematics)	6/20-12/31
DEIWILER, Daniel P.** Ohio State University	Staff Scientist (Physics)	1/1-12/31
ELLER, Herbert Southern Technical Institute, Marietta, Ga.	Staff Scientist (Polytechnic)	7/8-12/31
HIEBERT, Gordon L.*** Bowdoin College, Brunswick, Me.	Deputy Head	1/1-12/31
KOPPELMAN, Ray University of Chicago	Head	8/7-12/31
LAURELLI, Ramona NSF/Washington	Secretary	3/3-12/31
MEINERS, Harry F. Rensselaer Polytechnic Institute	Staff Scientist (Materials Development)	10/14-12/31
ORTON, William R. University of Arkansas	Staff Scientist (Mathematics)	9/6-12/31
RILEY, William R. Ohio State University	Staff Scientist (Physics)	4/30-12/31
RONKIN, R.R. University of Delaware	Staff Scientist (Biology)	1/27-12/31
SHURTLEFF, Miller F. NSF/Washington	Administrative Officer	2/1-12/31
SUSSMAN, Martin V. Tufts University	Staff Scientist (Engineering)	8/6-12/31

\* All Staff Members were assigned to New Delhi

\*\* Detwiler arrived in India on 11/27/66

\*\*\* Hiebert arrived in India on 8/6/66

TECHNICIANS SERVING DURING CY-1968

Long Term Staff Members (13)

Name	Position	Dates
ABEL, William R. W. Washington St. College, Bellingham, Wash.	Staff Scientist (Mathematics)	1/1-12/31
DEIWILER, Daniel P. Ohio State University	Staff Scientist (Physics)	1/1-12/31
ELLER, Herbert Southern Technical Institute, Marietta, Ga.	Staff Scientist (Polytechnic)	1/1-12/31
HIEBERT, Gordon L. Bowdoin College, Brunswick, Me.	Deputy Head	1/1-8/7
KOPPELMAN, Ray University of Chicago	Head	1/1-12/31
LAURELLI, Ramona NSF/Washington	Secretary	1/1-12/31
MEINERS, Harry F. Rensselaer Polytechnic Institute	Staff Scientist (Materials Development)	1/1-12/31
MIKOL, Edward P. University of Wisconsin	Staff Scientist (Engineering)	9/11-12/31
ORTON, William R. University of Arkansas	Staff Scientist (Mathematics)	1/1-9/6
RILEY, William R. Ohio State University	Staff Scientist (Physics)	1/1-9/3
RONKIN, R.R. University of Delaware	Staff Scientist (Biology)	1/1-12/31
SHURTLEFF, Miller F. NSF/Washington	Administrative Officer	1/1-12/31
SUSSMAN, Martin V. Tufts University	Staff Scientist (Engineering)	1/1-8/6

TECHNICIANS SERVING DURING CY-1969

Long Term Staff Members (16)

Name	Position	Dates
ABEL, William R. W. Washington St. College, Bellingham, Wash.	Staff Scientist (Mathematics)	1/1-2/28
ASHBY, Ebert A. Florida State University	Staff Scientist (Biology)	3/14-12/31
BLANPIED, William A. Case Western Reserve University	Staff Scientist (Physics)	8/10-12/31
CHADAYAMMURY, Harriet M. NSF/Washington	Administrative Officer	6/20-12/31
DETWILER, Daniel P. Ohio State University	Staff Scientist (Physics)	1/1-9/1
ELLER, Herbert Southern Technical Institute, Marietta, Ga.	Staff Scientist (Polytechnic)	1/1-7/24
HELLMANN, Max NSF/Washington	Head	9/21-12/31
HUNEKE, Harold V. University of Oklahoma	Staff Scientist (Mathematics)	9/23-12/31
KOPPELMAN, Ray University of Chicago	Head	1/1-9/15
LAURELLI, Ramona NSF/Washington	Secretary	1/1-3/3
McGREAL, John E. Ohio Coll. of Applied Science, Cincinnati, Ohio	Staff Scientist (Polytechnic)	8/8-12/31
MEINERS, Harry F. Rensselaer Polytechnic Institute	Staff Scientist (Materials Development)	1/1-10/1
MIKOL, Edward P. University of Wisconsin	Staff Scientist (Engineering)	1/1-12/31
O'CONNOR, Paul R. University of Minnesota	Staff Scientist (Chemistry)	3/26-12/31
RONKIN, R.R. University of Delaware	Staff Scientist (Biology)	1/1-5/19
SHURTLEFF, Miller F. NSF/Washington	Administrative Officer	1/1-1/19

TECHNICIANS SERVING DURING CY-1970

Long Term Staff Members (8)

Name	Position	Dates
ASHBY, Ebert A. Florida State University	Staff Scientist (Biology)	1/1-12/31
BLANPIED, William A. Case Western Reserve University	Staff Scientist (Physics)	1/1-12/31
CHADAYAMMURY, Harriet M. NSF/Washington	Administrative Officer	1/1-12/31
HELLMANN, Max NSF/Washington	Head	1/1-12/31
HUNEKE, Harold V. University of Oklahoma	Staff Scientist (Mathematics)	1/1-12/31
McGREAL, John E. Ohio Coll. of Applied Science, Cincinnati, Ohio	Staff Scientist (Polytechnic)	1/1-12/31
MIKOL, Edward P. University of Wisconsin	Staff Scientist (Engineering)	1/1-7/31
O'CONNOR, Paul R. University of Minnesota	Staff Scientist (Chemistry)	1/1-8/28

TECHNICIANS SERVING DURING CY-1971

Long Term Staff Members (11)

Name	Position	Dates
ASHBY, Ebert A. Florida State University	Staff Scientist (Biology)	1/1-12/31
BECKER, Jerry P. Rutgers University	Staff Scientist (Mathematics)	7/26-12/31
BLANPIED, William A. Case Western Reserve University	Staff Scientist (Physics)	1/1-7/31
CHADAYAMMURY, Harriet M. NSF/Washington	Administrative Officer	1/1-6/20
DART, S. Leonard Claremont College	Staff Scientist (Physics)	7/28-12/31
HELLMANN, Max NSF/Washington	Head	1/1-10/22
HIEBERT, Gordon L. NSF/Washington	Head	10/6-12/31
HUNEKE, Harold V. University of Oklahoma	Staff Scientist (Mathematics)	1/1-7/31
McGREAL, John E. Ohio Coll. of Applied Science, Cincinnati, Ohio	Staff Scientist (Polytechnic)	1/1-9/14
O'CONNOR, Paul R. University of Minnesota	Deputy Head	10/6-12/31
WALLACE, Charles W.* Syracuse University	Staff Scientist (Ele. Sci. Edu.)	8/11-12/31

\* Wallace was assigned to Bombay

TECHNICIANS SERVING DURING CY-1972

Long Term Staff Members (6)

Name	Position	Dates
ASHBY, Ebert A. Florida State University	Staff Scientist (Biology)	1/1-12/31
BECKER, Jerry P. Rutgers University	Staff Scientist (Mathematics)	1/1-6/30
DART, S. Leonard Claremont College	Staff Scientist (Physics)	1/1-6/30
HIEBERT, Gordon L. NSF/Washington	Head	1/1-12/31
O'CONNOR, Paul R. University of Minnesota	Deputy Head	1/1-12/31
WALLACE, Charles W.* Syracuse University	Staff Scientist (Ele. Sci. Edu.)	1/1-6/22

\* Wallace was assigned to Bombay

## U. S. Curricular Materials Used in SEIF

1. PSSC. "Physical Science Study Committee". Textbook, teachers' guide, laboratory manual, films, equipment kits. First three reprinted in India by NCERT.
2. CBA. "Chemical Bond Approach". Textbook, teachers' guide, laboratory manual.
3. CHEMS. "Chemical Education Materials Study." Textbook, teachers' guide, laboratory manual, films. First and third reprinted in India by NCERT.
4. "Chemistry: Experiments and Principles." Authorized CHEMS revision. Textbook reprinted in India by NCERT.
5. BSCS. "Biological Science Curriculum Study." Two versions called Yellow and Green. Textbook, teachers' guide, laboratory blocks. Encyclopedia Britannica, American Institute of Biological Sciences, and BSCS films. Yellow version reprinted in India by NCERT.
6. SM3G. "Science Mathematics Study Guide." Textbooks, teachers' guides, elementary through secondary. Reprinted in India by NCERT.
7. ESCP. "Earth Science Curriculum Project." Textbook, teachers' guide, laboratory manual, films.
8. HPP. "Harvard Project Physics." Textbook, resource books, teachers' guide, laboratory guide.
9. TOPS. "The Overhead Projector Sequence." Teachers' guide, equipment kit including overhead projector, "Arm-chair Chemistry" laboratory manual.
10. IPS. "Intermediate Physical Sciences." Textbook laboratory manual, teachers' guide.

11. SCIS. "Science Curriculum Improvement Study" (Elementary Science). Resource material for Delhi and Bombay projects.
12. SPA. "Science Process Approach." Textbook, teachers' guide, laboratory manual, model kits.
13. ACS. American Chemical Society short course materials for mass spectrometry, spectrometric methods, infrared spectroscopy, gas chromatography.

## APPENDIX G

1967

Engineering College Teachers (10 U.S. Consultants)	7  7	First year of 3 year sequential institutes Topics: mathematics, linear circuits analysis, electrical and electronic devices  Advanced level institutes Topics: Soil mechanics, stress analysis, manufacturing processes, fluid mechanics, control systems; numerical analysis, instrumentation
Polytechnic teachers (24 U.S. Consultants)	42	Topics: circuits and measurements, electrical machines, basic electronics, design of structures, highway engineering including elementary soil mechanics, public health engineering, hydraulic engineering including irrigation, heat power engineering refrigeration and air conditioning, engineering materials and heat treatment, manufacturing.
Secondary teachers (79 U.S. consultants)	60	Programs based on curricular materials developed in the U.S. PSEC Physics, CHEMS chemistry, BSCS biology, EMSG mathematics
College teachers (50 U.S. consultants)	50	Five institutes presented specialized subjects: marine biology, animal physiology, modern algebra and operational research, heat and thermodynamics, electronic instrumentation.

1968

- Engineering College 3 First year of three year sequential  
teachers institutes  
(15 U.S. consultants) 7 Second year of three year sequential  
institutes  
Topics: Electrical engineering:  
network theory, control systems,  
energy conversion, electrical  
engineering materials, electro-  
magnetic fields, power systems, high  
voltage engineering, instrumentation,  
high voltage D.C. systems.
- Civil engineering:
- structural behavior design, soil  
mechanics and foundation engineering,  
principles of water and water treat-  
ment, design of folded plate and shell  
structures, soil dynamics, theoretical  
soil mechanics, open channel  
hydraulics, sanitary chemistry and  
microbiology.
- Mechanical engineering:
- applied mathematics, materials  
technology, instrumentation and  
control, computer science, gas  
turbines, gas dynamics, heat transfer,  
fluid mechanics, applied elasticity  
and plasticity, experimental stress  
analysis, metal processing, production  
engineering, metallography and heat  
treatment, fans and compressors,  
fuels, combustion, refractories.
- 7 Advanced level institutes.  
Topics: numerical analysis, design  
processes, structural engineering,  
vibration control, soil mechanics,  
digital computation and control,  
materials science.

Polytechnic	12	First year of sequential institutes
teachers	18	Second year of sequential institutes
(25 U.S. consultants)	3	Advanced level.

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Secondary	61	Four SIs offered, <b>Specialized</b>
teachers		programs, for teachers from
(69 U.S. consultants)		training colleges.

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College.	61	Nine SIs offered, <b>Specialized</b>
teachers		topics: ecology, genetics,
		comparative endocrinology, food
		and nutrition, functional analysis,
		solid state physics.

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1969

Engineering	6	<b>First year of three year sequential</b>
teachers		<b>institutes.</b>
(25 U.S. consultants)	3	Second year of three year sequential
		institutes.
	7	<b>Third year of three year sequential</b>
		<b>institute.</b>
	10	Advanced level institutes
		Topics: Computational techniques
		in control system design, materials
		science, numerical analysis,
		textile engineering, design of
		chemical process equipment,
		structural engineering, fluidics
		and control engineering, solid
		state devices, fluvial hydraulics.

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Polytechnic	12	First year of three year sequential
teachers	12	institutes
(19 U.S. consultants)	15	Second year of three year
		sequential institutes
	7	Third year of three year
		sequential institutes
		Advanced level institutes
		Topics: industrial engineering,
		laboratory design, physics, foundry
		technology, production technology,
		industrial electronics, semi-
		conductor devices, circuits.

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Secondary teachers (39 U.S. consultants)	60	<p>Three BSIs offered new programs. Earth Science Curriculum Project presented for first time, Special institutes included physics at NCERT and a sequential institute for mathematics teachers</p> <p>Three institutes for science methods teachers</p> <p>Two institutes used NCERT Study Group materials.</p>
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College teachers (25 U.S. consultants)	54	<p>Six institutes were devoted explicitly to affiliating college teachers.</p> <p>Two special institutes presented the Harvard Project Physics curriculum.</p> <p>Twelve institutes presented specialized topics: microbiology, genetics, marine biology, inorganic chemistry, operational research, abstract algebra, linear analysis and partial differential equations, advanced statistical inference and sample surveys, applied physics, solid state physics, electronic instrumentation, food and nutrition.</p>
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1970

Engineering College teachers (12 U.S. consultants)	3 6 4 <b>12</b>	<p>First year of three year sequential institutes</p> <p>Second year of three year sequential institutes</p> <p>Third year of three year sequential institutes</p> <p>Advanced level institutes.</p> <p>Topics: ground water engineering and hydrology, rock mechanics, measurement techniques in electrical engineering, industrial engineering, design engineering, computing, experimental stress analysis, material science, process dynamics and control, semi-conductor electronics, Fluids and control engineering.</p>
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Polytechnic teachers (15 U. S. consultants)	12 15 9 15	<p>First year of three year sequential institutes</p> <p>Second year of three year sequential institutes</p> <p>Third year of three year sequential institutes</p> <p>Advanced level institutes</p> <p>Topics: structural engineering, soil mechanics, electrical instrumentation industrial engineering (2 centers), air conditioning and refrigeration, machine tool technology, production technology, automobile technology, examination techniques, programmed writing.</p> <p>1 Sequential institute for art teachers</p> <p>1 Advanced level printing technology</p>
Secondary teachers (20 U. S. consultants)	60	<p>Four special institutes: NCERT Study Group materials in chemistry; pedagogy; writing SSI in physics; elementary science teachers.</p>
College teachers (19 U. S. consultants)	56	<p>Twenty eight specialized topics: applied biology, ecology, genetics, marine biology and oceanography; college development, test construction and evaluation, spectroscopy, food and nutrition (2 locations); modern algebra, functional analysis and topology, operational research, theory of partial differential equations, advanced statistical inference, inference with Markov chains; theoretical physics (sequential) electronics, solid state, Moire techniques, molecular structure, electronic instrumentation. (More than one SSI for a number of these topics.)</p>

Engineering college teachers (5 U. S. consultants)	12 13	Sequential institutes Advanced level institutes.
Polytechnic teachers (7 U. S. consultants)	29 20	Sequential institutes Advanced level
Secondary teachers (1 U. S. consultants)	64	Two for teacher educators One for teachers of Poona City One for teachers from Sainik schools (for dependents of military).
College teachers (7 U. S. consultants)	53	Three for affiliated college teachers of new universities. Twenty three special topics: plant physiology, applied biology, applied microbiology, micro and molecular biology, geology, earth sciences (2), analytical chemistry, activation analysis, solid state physics (2) electronic instrumentation, diffraction physics, advanced spectroscopy, mathematical analysis, functional analysis, recent advances in K-Theory, numerical analysis, operations research, abstract harmonic analysis, probability theory, statistics stochastic processes and applications.

1972

Engineering College teachers	8 21	Sequential institutes Advanced level (two were scheduled for the winter vacation period).
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Polytechnic teachers	26 15	Advanced level Sequential institutes
Secondary teachers	83	For the first time, school level SSI's organized and funded by NCERT. The materials developed at NCERT with assistance of UNESCO consultants used as the SSI program
College teachers	53	The brochure announcing the SSI's gave a unique description of the program at each institution.

## APPENDIX H

## Short Term Consultants (173) CY-1967

Name	Field/Level	Dates	Place Assigned
AGRE, Courtland L. Augsburg Coll., Mpls., Minn.	Chemistry/College	5/6-6/29	Aligarh
AKKERMAN, Richard P. Univ. of Houston	Civil Engrg. (Polytech)	5/29-7/27	Gauhati
AUFFENBERG, Walter Univ. of Florida	Biology/School	4/16-6/13	Madurai
BACHMAN, Charles Syracuse Univ.	Physics/College	4/23-6/13	Waltair
BAXTER, John F. Univ. of Florida	Chemistry	6/11-7/29	Various Places
BECKER, Jerry P. Stanford Univ.	Mathematics/School	5/7-7/22	Patna
BEIZ, Joseph Garfield H.S., Seattle, Wash.	Mathematics/School	4/24-6/13	Bangalore
BLANPIED, William A. Case Inst. of Tech.	Physics/College	4/28-6/20	Sagar
BLASS, Gerhard A. Univ. of Detroit	Physics/College	4/23-6/17	Baroda
BOAL, Jan List Univ. of S. Carolina	Mathematics/College	5/7-7/15	Patna
BOEKELHEIDE, Irving F. Chico State Coll., Chico, Cal.	Physics/College	5/8-6/25	Gauhati
BORER, Gerald J. Rockhurst H.S., Kansas City, Mo.	Physics/School	4/30-6/20	Sagar
BRASTED, Robert C. Univ. of Minnesota	Chemistry	5/31-7/1	Various Places
BROBERG, Joel W. North Dakota State Univ.	Chemistry/School	4/21-6/15	Nagpur
BROWN, Charles K. Westtown School, Westtown, Pa.	Mathematics/School	4/23-6/13	Calcutta

Name	Field/Level	Dates	Place Assigned
BUCY, David A. Oregon State Univ.	Mechanical Engg. (Polytech)	4/28-7/1	Ahmedabad
BURNET, George Iowa State Univ.	Chemical Engg.	4/23-7/8	Kharagpur
BUSH, Kenneth H. West Lafayette H.S., West Lafayette, Ind.	Biology/School	5/7-6/27	Agra
CAFFEY, James E. Arlington State Coll., Arlington, Texas	Civil Engg. (Polytech)	5/8-7/13	Allahabad
CAMIOLO, Sarah M. D'Youville Coll., Buffalo, N.Y.	Chemistry/School	4/14-6/10	Ernakulam
CAMPBELL, Wallace G. Ateneo De Manila Univ., Manila, Phil. I.	Mathematics/School	4/23-6/13	Trivandrum
CAROTENUTO, Albert N. Morristown H.S., Morristown, N.J.	Chemistry/School	5/8-7/1	Varanasi
CHOGUILL, Harold S. Fort Haya Kansas St. Coll.	Chemistry/College	5/7-6/27	Kurukshetra
CHURCH, Austin H. New York Univ.	Mechanical Engg.	5/1-7/13	Madras
CLARK, Dayle M. Arlington State Coll., Arlington, Texas	Civil Engg. (Polytech)	5/29-8/5	Chandigarh
COBB, Emerson G. Univ. of the Pacific, Stockton, Cal.	Chemistry/College	5/10-6/28	Poona
CRAFT, Thomas J. Central State Univ., Wilberforce, Ohio	Biology/College	5/7-6/29	Ahmedabad
CRENSHAW, John W. Univ. of Maryland	Biology/College	7/9-8/25	Srinagar
CRNKOVICH, Joseph G. Wauwatosa H.S., Wauwatosa, Wis.	Physics/School	5/15-7/11	Allahabad
CRUM, James D. California State Coll., San Bernardino, Cal.	Chemistry/College	5/7-7/1	Cuttach

Name	Field/Level	Dates	Place Assigned
DENNY, Wayne B. Grinnell Coll., Grinnell, Iowa	Physics/School	5/7-6/29	Gauhati
DIAZ Granados, F.A. Flintridge Prep. School, Pasadena, Cal.	Physics/School	5/7-6/28	Varanasi
DOLLARD, Peter M. State Univ. of N.Y., Stonybrook, N.Y.	Electrical Engg. (Polytech)	5/22-7/27	Gauhati
DOOTHITT, Clair D. Chief Sealth H.S., Seattle, Wash.	Chemistry/School	5/28-7/18	Patna
DREXLER, Henry E. Pious XI H.S., Milwaukee, Wis.	Biology/School	4/23-6/13	Chandigarh
DUDLEY, Frank M. Univ. of South Florida	Chemistry/School	4/23-6/17	Chandigarh
DUFF, James W. Arlington State Coll., Arlington, Texas	Polytechnic	5/29-8/12	Various Places
DUNN, Donald J. Phillips Univ., Enid, Ok.	Biology/College	5/7-7/22	Patna
ELICH, Joe Utah State Univ.	Mathematics/School	4/23-6/13	Bhopal
EVERT, Carl F., Jr. Univ. of Cincinnati	Electrical Engg.	5/15-6/20	Madras
FAIRBANKS, Alan E. Alfred State Coll., Alfred, N.Y.	Mechanical Engg. (Polytech)	5/7-7/11	Allahabad
FARREN, Joseph M. Univ. of Dayton, Dayton, Ohio	Electrical Engg. (Polytech)	4/24-7/1	Ahmedabad
FERGUSON, Harold W. Harriton H.S., Rosemont, Pa.	Chemistry/School	5/15-7/6	Jodhpur
FLANAGAN, James C. Del Mar Coll., Corpus Christi, Texas	Mechanical Engg. (Polytech)	5/28-8/19	Chandigarh
FLETCHER, William H. Broad Ripple H.S., Indianapolis, Ind.	Chemistry/School	4/16-6/10	Annamalainagar

Name	Field/Level	Dates	Place Assigned
FONTANA, Peter R. Univ. of Michigan	Physics/College	4/24-6/15	Baroda
FOWLER, Edgar T. Southern Tech. Inst., Marietta, Ga.	Civil Engg. (Polytech)	5/1-7/1	Bhopal
FRANK, Andrew J. W. Washington St. Coll., Bellingham, Wash.	Chemistry/College	5/7-6/29	Jaipur
GARDNER, Robert Educational Services Inc., Newton, Mass.	Physics/School	5/7-6/27	Ajmer
GIBBONS, James F. Stanford Univ.	Electrical Engg.	4/30-5/22	Baroda
GIPSON, Jeffery St. Augustine's Coll., Raleigh, N.C.	Chemistry/School	4/21-6/13	Bangalore
GIST, Lewis A. NSF/Washington	Chemistry	4/3-5/12	Various Places
GOODNER, Dwight B. Florida State Univ.	Mathematics/College	4/21-6/9	Madurai
GORSHE, Frank B. Bettendorf Comm. S., Bettendorf, Iowa	Chemistry/School	5/8-7/1	Ujjain
GURFINKEL, German R. Univ. of Illinois	Civil Engg. (Polytech)	5/29-8/2	Madras
GUSTAFSON, Robert D. Purdue Univ.	Electrical Engg.	5/29-6/29	Pilani
HADEMENOS, James Stephen F. Austin Coll., Nacogdoches, Texas	Physics/School	4/28-6/13	Waltair
HARRIS, Reece T. Univ. of Maryland	Mathematics/College	5/7-6/28	Lucknow
HAUPT, Robert E. Iowa State Univ.	Biology/College	4/12-6/16	Mysore
HAYGOOD, Neal T. Wakefield H.S., Arlington, Va.	Chemistry/School	5/14-7/6	Kolhapur
HEADLEE, Elmer W. Kirkwood H.S., Kirkwood, Mo.	Chemistry/School	4/23-6/17	Calcutta

Name	Field/Level	Dates	Place Assigned
HEIKKINEN, Henry W. Richfield H.S., Richfield, Minn.	Chemistry/School	5/22-7/14	Lucknow
HERZOG, John O. Idaho State Univ.	Mathematics/School	5/7-6/29	Kanpur
HIGGERSON, Charles A. Mohawk Valley Comm. Coll., Utica, N.Y.	Mechanical Engg. (Polytech)	4/23-6/29	Bhopal
HILL, Philip G. Mass. Inst. of Tech.	Engineering	5/14-6/24	Howrah
HOFFMAN, Richard Phoenix Union H.S., Phoenix, Ariz.	Biology/School	5/7-6/29	Gorakhpur
HOHL, Sister Mary C. Marygrove Coll., Detroit, Mich.	Chemistry/School	4/23-6/15	Bhopal
HORWITZ, Henry E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Mechanical Engg. (Polytech)	5/29-9/1	Madras
HUGDAHL, Wallace I. Homestead H.S., Mequon, Wis.	Chemistry/School	5/24-7/18	Patna
HUTTON, Wilbert Bowling Green St. Univ., Bowling Green, Ohio	Chemistry/College	5/7-6/29	Gorakhpur
JENSEN, Berlin C. Roy H.S., Roy, Utah	Biology/School	5/7-6/29	Aurangabad
JENSEN, James LaMont Roy H.S., Ogden, Utah	Biology/School	5/7-6/29	Ranchi
KAPLAN, Harvey Syracuse Univ.	Physics/College	5/8-6/27	Delhi
KARPLOS, Walter J. Univ. of Cal., Los Angeles	Engineering	5/29-6/17	Various Places
KASTRINOS, William Educational Testing Service, Princeton, N.J.	Biology/School	5/1-6/17	Bhubaneswar
KELLER, Henry P. The Peddie School, Hightstown, N.J.	Physics/School	5/15-7/4	Allahabad
KENNEDY, Manert H. Univ. of Colorado	Biology/School	4/23-6/13	Madurai

Name	Field/Level	Dates	Place Assigned
KEITZERER, Frederick D. Univ. of Pennsylvania	Engineering	5/14-6/24	Calcutta
KOONS, Lawrence F. Tuskegee Inst.	Chemistry/School	5/24-7/12	Lucknow
KOWALSKI, Stephen W. Montclair State Coll.	Chemistry	4/10-7/15	Various Places
KULLER, Robert G. Wayne State Univ.	Mathematics/College	4/16-6/8	Poona
KOMLER, Marion L. Southern Illinois Univ.	Biology/School	4/23-6/13	Chandigarh
KURTH, Rodolf Georgia Inst. of Tech.	Mathematics/College	4/23-6/17	Dharwar
LAMBERT, Francis L. Union Coll., Schenectady, N.Y.	Biology/College	4/16-6/8	Trivandrum
LAMPERT, Henry A., Jr. Lamar State Coll. of Tech., Beaumont, Texas	Mechanical Engg. (Polytech)	5/29-7/29	Gauhati
LAWRENCE, Willard E. Marquette Univ., Milwaukee, Wis.	Mathematics/School	5/15-7/8	Gwalior
LEACH, James L. Univ. of Illinois	Engineering	5/14-8/5	Coimbatore
LEE, Malph Hewitt Alabama Ag. & Mech. Coll., Normal, Al.	Chemistry/School	4/16-6/8	Ernakulam
LEEDS, Clarence W. III Berkshire School, Sheffield, Mass.	Mathematics/School	5/7-6/27	Kurukshetra
LEFF, Edward Queens Borough Comm. Coll., Bayside, N.Y.	Electrical Engg. (Polytech)	5/8-7/13	Bangalore
LEVY, Norton Brookline H.S., Brookline, Mass.	Mathematics/School	5/29-7/13	Bhagalpur
LEWIN, Ruth L. Hunter Coll., N.Y., N.Y.	Chemistry/College	5/8-6/29	Waltair
LIEBHERR, Hal Nicolet H.S., Milwaukee, Wis.	Biology/School	5/7-6/29	Hyderabad

Name	Field/Level	Dates	Place Assigned
LIGHTHALL, Harry, Jr. Univ. of Vermont	Mathematics/College	4/14-6/12	Nagpur
LITTLE, Clifford Hill School, Pottstown, Pa.	Physics/School	6/2-7/18	Lucknow
LITTLE, Richard A. Culver, Mil. Acad., Culver, Ind.	Mathematics/School	5/8-7/1	Kanpur
LUCE, Ernest S. Univ. of Houston	Electrical Engg.(Polytech)	5/29-8/2	Madras
MADSEN, Arthur P. Teaneck H.S., Teaneck, N.J.	Physics/School	4/16-6/8	Alwaye
MAJOR, John K. NSF/Washington	Physics/College	4/16-6/9	Mysore
MALONE, James V. Univ. of Houston	Electrical Engg.(Polytech)	5/28-8/12	Chandigarh
MANN, Nathaniel III Public School of W. & M., Conn.	Mathematics/School	4/23-6/15	Bhopal
MASON, Lyale C. Phillips Univ., Enid, Ok.	Mathematics/School	5/24-7/18	Bhagalpur
MCCARTHY, David F. Mohawk Valley Comm. Coll., Utica, N.Y.	Engineering	5/8-7/12	Various Places
MCNEIL, Edward B. Univ. of Illinois, Rome	Physics	4/23-7/18	Various Places
METZNER, Kenneth A.W. Brookhaven National Lab.	Physics/School	4/29-6/19	Bangalore
MILLER, Bruce L. Flint Comm. Coll., Flint, Mich.	Industrial Electronics (Polytech)	5/8-8/26	Bombay
MILLER, Donald E. Mercer Island School, Mercer Island, Wash.	Physics/School	5/3-6/20	Bhubaneswar
MEILLER, Roy D. Forest View H.S., Arlington Hts., Ill.	Chemistry/School	5/14-7/6	Kolhapur
MILSTEAD, William W. Univ. of Missouri	Biology/School	5/7-7/1	Hyderabad

Name	Field/Level	Dates	Place Assigned
MITCHELL, Henry A. Univ. of Missouri	Biology/School	5/7-6/29	Ranchi
MORTON, Richard F. Worcester Polytechnic Inst.	Physics/School	4/17-6/1	Alwaye
MOSLEY, Albert J. Keene State Coll., Keene, N.H.	Mathematics/School	7/7-9/2	Srinagar
MURPHY, Donald J., Jr. State Univ. of N.Y., Farmingdale, N.Y.	Civil Engg. (Polytech)	5/8-7/13	Bangalore
MYERS, Donald E. Univ. of Arizona	Mathematics/School	7/9-9/2	Srinagar
NEWMAN, Elaine B. Western Reserve Univ.	Biology/School	5/7-7/21	Aurangabad
NYCE, John D. Goshen Coll., Goshen, Ind.	Mathematics/School	5/12-7/5	Jabalpur
OSTERBERG, Jorj O. Northwestern Univ.	Civil Engg.	5/15-6/17	Delhi
OWEN, H. Malcolm Univ. of the South	Biology/College	4/16-6/6	Annamalainagar
PADDOCK, Elton F. Ohio State Univ.	Biology/College	4/23-6/10	Jaipur
PEACOCK, Ben N. Wauwatosa Board of Educ., Wauwatosa, Wis.	Physics/School	5/1-6/22	Annamalainagar
RAMSEUR, George S. Univ. of North Carolina	Biology/College	5/10-7/1	Varanasi
REID, Theodore L. Univ. of South Dakota	Chemistry/School	5/7-7/1	Ujjain
REYNOLDS, Thomas Duke Univ.	Mathematics/College	4/16-6/8	Madurai
RIGGS, Charles L. Texas Tech. Coll.	Mathematics/School	5/7-6/29	Jaipur
RIO, Sheldon T. Southern Oregon Coll.	Mathematics/College	5/7-6/24	Delhi

Name	Field/Level	Dates	Place Assigned
ROONEY, Victor M. Univ. of Dayton	Electrical Engg. (Polytech)	4/29-7/1	Bhopal
ROUSE, Arthur G. St. Louis Univ., St. Louis, Mo.	Physics/School	4/21-6/13	Chandigarh
RYAN, Donald E. Bowling Green St. Coll., Bowling Green, Ohio	Mathematics/College	5/7-6/29	Baroda
SALYER, Darnell Eastern Kentucky Coll., Richmond, Ky.	Chemistry/School	5/19-7/6	Jodhpur
SCHLUETER, Donald J. Purdue Univ.	Physics/College	5/8-6/29	Calcutta
SCHNEIDER, Hubert H. Univ. of Nebraska	Mathematics/School	6/11-8/5	Gauhati
SCHROT, Robert Yuba City H.S., Yuba City, Cal.	Biology/School	5/28-7/13	Delhi
SCHWENGEL, James D. Wm. Henry Harrison H.S., Evansville, Ind.	Biology/School	5/15-7/8	Ahmedabad
SEVERIN, Charles F. St. Mary's Coll., Winona, Minn.	Biology/School	4/14-6/10	Calicut
SHARRAH, Paul C. Univ. of Arkansas	Physics/School	4/23-6/15	Vallabh Vidyanagar
SHERMAN, Noah Univ. of Michigan	Physics/College	4/23-6/22	Chandigarh
SHUTTS, C. Francis Cal. State Coll., San Bernardino, Cal.	Biology/College	5/7-8/26	Bombay
SIMPSON, James E. Univ. of Kentucky	Mathematics/College	5/7-6/29	Jaipur
SLABY, Harold T. Wayne State Univ.	Mathematics/College	4/16-6/7	Chandigarh
SPENCER, James A. Choate School, Wallingford, Conn.	Chemistry/School	5/7-6/29	Waltair
SPINDLE, Jackson F. Cypress Jr. Coll., Cypress, Cal.	Chemistry/School	5/7-7/1	Hyderabad

Name	Field/Level	Dates	Place Assigned
STARKE, Emory P. Bloomfield Coll.	Mathematics	3/27-7/27	Various Places
STARR, Donald Alex. Ham. Found., Plymouth, Mich.	Chemistry/College	4/17-7/10	Vallabh Vidyanagar
STEELE, Stephen G. Broome Tech. Comm. Coll.	Polytechnic	5/29-8/12	Various Places
STERN, Jacob Michigan State Univ.	Mfg. Processes(Polytech)	5/7-7/11	Coimbatore
STRICKLER, Thomas Berea Coll., Berea, Ky.	Physics/College	5/10-6/27	Gauhati
SUMMERLIN, Lee R. Florida State Univ.	Chemistry/College	4/23-6/17	Nagpur
SUNDERWIRTH, S.G. Kansas State Coll.	Chemistry/College	4/16-6/6	Annamalainagar
SUTMAN, Frank X. Temple Univ.	Chemistry/School	4/19-6/13	Bangalore
SWARD, Paul L. U.S. Department of Interior	Biology/School	4/14-6/10	Calicut
TAYLOR, Marie G. Howard Univ.	Biology/School	5/14-7/7	Poona
TELFAIR, David Earlham Coll.	Physics/College	5/21-7/8	Bombay
THORO, Dmitri E. San Jose State Coll., San Jose, Cal.	Mathematics/School	5/7-6/29	Jaipur
THRON, Wolfgang J. Univ. of Colorado	Mathematics/College	5/9-6/29	Jodhpur
THURSTON, Charles W. Columbia Univ.	Civil Engg.	6/4-7/15	Sindri
TOALSON, Wilmont Fort Hays Kansas St. Coll.	Mathematics/College	4/23-6/17	Bangalore
TOMPSON, Robert N. Univ. of Nevada	Mathematics/School	5/15-7/6	Gwalior
TROLAN, J. Kenneth Univ. of Redlands, Redlands, Cal.	Physics/College	5/7-6/30	Varanasi

Name	Field/Level	Dates	Place Assigned
TULECKE, Waltair R. Boyce Thomson Inst., Yonkers, N.Y.	Biology/College	4/21-7/10	Hyderabad
VANCE, J. David Gaston Coll., Gastonia, N.C.	Civil Engg. (Polytech)	4/25-6/29	Ahmedabad
VAUGHN, Charles M. Miami Univ.	Biology/College	4/23-6/15	Jaipur
VOGELI, Barry D. Mount Union Coll., Alliance, Ohio	Mathematics/School	4/23-7/1	Hyderabad
WAGGONER, Wm. H., Jr. Univ. of Georgia	Chemistry/College	4/16-6/6	Mysore
WARREN, Edgar Denver Pub. School	Biology/School	5/15-7/6	Ahmedabad
WATSON, Joseph T. (Rev.) Brooklyn Prep. School, Brooklyn, N.Y.	Physics/School	5/7-6/29	Udaipur
WAITERS, James I. Ohio State Univ.	Chemistry/College	5/15-7/1	Ujjain
WEBBER, Frederick A. Wayne State Coll.	Mathematics/School	6/11-8/3	Gauhati
WEHN, Donald State Univ. of N.Y., Stonybrook, N.Y.	Mathematics/College	4/23-6/17	Jadavpur
WHITE, Paul A. Univ. of South California	Mathematics	5/22-6/23	Various Places
WILCOX, Harold E. Cal. Inst. of Tech.	Chemistry/College	5/8-6/29	Varanasi
WILSON, Dale G. Purdue Univ.	Mechanical Engg. (Polytech)	5/8-7/13	Bangalore
WOODS, Roger D. San Bernardino Valley Coll., San Bernardino, Cal.	Physics/School	4/24-6/16	Aurangabad
YOUNGBLOOD, Ralph P. Georgia Inst. of Tech.	Electrical Engg. (Polytech)	5/12-7/15	Allahabad

## Short Term Consultants (187) CY-1968

Name	Field/Level	Dates	Place Assigned
ALLENSTEIN, Richard V. Univ. of Wisconsin, Waukesha, Wis.	Chemistry/School	5/6-7/5	Varanasi
ANDERSON, Jack M. Iowa State Univ.	Mathematics/College	5/5-7/3	Calcutta
ASHBY, Ebert A. Univ. of Texas	Biology/College	4/5-5/31	Trivandrum
ASIMOW, Robert M. Univ. of Maryland	Design Processes & Materials (Engineering)	5/6-6/15	Coimbatore
AUCLAIR, Walter Rensselaer Polytechnic Inst.	Biology/College	4/29-6/16	Poona
BARTLE, Robert G. Univ. of Illinois	Mathematics/College	5/5-7/3	Jodhpur
BARTON, Jay II West Virginia Univ.	Biology/College	4/8-6/5	Mysore
BECKER, Jerry P. Rutgers Univ.	Mathematics/School	5/6-6/28	Kanpur
BERRY, Jewel E. Prairie View A. & M. Coll., Praire View, Texas	Biology/School	5/26-7/19	Delhi
BIRDWHISTELL, Ralph K. Univ. of West Florida	Chemistry/College	5/1-6/19	Vallabh Vidyanagar
BLANPIED, William A. Case Inst. of Tech.	Physics	6/1-7/1	Various Places
BLANTON, Mathew S., Jr. Univ. of Texas, Arlington, Texas	Industrial Electronics (Polytech)	5/17-7/3	Bhopal
BLISS, Laura Randolf-Macon Women's Coll., Va.	Chemistry/School	4/28-6/19	Ahmedabad
BOAL, Jan List Univ. of South Carolina	Mathematics/College	5/5-7/1	Dibrugarh

Name	Field/Level	Dates	Place Assigned
BORER, Gerald J. (Rev.) Rockhurst H.S., Kansas City, Mo.	Physics/School	5/19-7/12	Gauhati
BOYAJIAN, Richard J. Univ. of Chicago Lab. School	Biology/School	4/28-7/7	Bhubaneswar & Vizag
BRASTED, Robert C. Univ. of Minnesota	Chemistry	4/26-5/31	Various Places
BRENNAN, John W. George Washington H.S., Denver, Col.	Biology/School	4/28-6/21	Madras
BRICKER, Clark E. Univ. of Kansas	Chemistry/College	5/22-7/11	Poona
BROWN, Fayette J. Chico State Coll., Chico, Cal.	Industrial Engg. (Polytech)	5/26-7/21	Chandigarh
BROWN, Frederick C. Univ. of Illinois	Physics	12/30/68 - 1/18/69	Various Places
BROWN, Robert T. Mich. Tech. Univ., Houghton, Mich.	Biology/School	4/21-6/24	Gorakhpur
BRUMBERGER, Harry Syracuse Univ.	Chemistry/College	5/10-7/3	Waltair
BRYAN, John H.D. Univ. of Georgia	Biology/College	4/28-6/19	Bombay
EUCY, David A. Univ. of Washington	Physical Metallurgy (Polytech)	6/9-7/28	Hyderabad
BURKE, Jack D. Medical Coll. of Virginia, Richmond, Va.	Biology/College	4/28-6/14	Jaipur
CAMILOLO, Sarah M. (Miss) American Univ., Wash, D.C.	Chemistry/School	5/5-6/30	Annamalainagar
CAROTENUTO, Albert M. Morristown H.S., Morristown, N.J.	Chemistry/School	4/22-6/18	Jaipur
CHOGUILL, Harold B. Fort Hays Kansas State Coll.	Chemistry/College	5/5-6/29	Annamalainagar
CHURCH, Austin H. New York Univ.	Vibration Control (Engg.)	5/29-7/11	Kharagpur

Name	Field/Level	Dates	Place Assigned
CLAPP, Leallyn B. Brown Univ.	Chemistry/School	5/10-6/27	Patna
CLARK, Doyle M. Univ. of Texas, Arlington, Va.	Asphalt Tech. (Polytech)	5/27-6/21	Chandigarh
CLEM, I. Williams Univ. of Florida	Biology/College	4/21-6/19	Ahmedabad
COLEMAN, Robert M. Boston Coll.	Biology/College	5/5-6/28	Gorakhpur
COMSTOCK, Dale R. Central Wash. State Coll., Ellensburg, Wash.	Mathematics/School	4/17-6/14	Aurangabad
COSTOPOULOS, James E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Architecture (Polytech)	5/27-7/19	Madras
COWAN, Clifford W. Southern Tech. Inst., Marietta, Ga.	Basic Electronics (Polytech)	5/27-7/28	Hyderabad
CRAFT, Thomas J. Central State Univ., Wilberforce, Ohio	Biology/College	4/20-6/14	Hyderabad
CREIGHT, Harriet B. Wellesley Coll.	Biology/College	5/5-7/17	Hyderabad
CRNKOVICH, Joseph G. Wauwatosa H.S., Wauwatosa, Wis.	Physics/School	5/6-7/5	Varanasi
CRUM, James D. California State Coll., San Bernardino, Cal.	Chemistry/College	5/5-7/5	Varanasi
CRUZ, Jose B. Univ. of Illinois	Electrical Engg.	5/5-6/26	Kharagpur
CUNNINGHAM, William E. Redlands Sr. H.S., Redlands, Cal.	Physics/School	4/22-6/18	Mysore
DART, S. Leonard Claremont Coll.	Physics/College	4/22-6/30	Alwaye
DAVIS, Joseph E., Jr. Univ. of Cal., Berkeley, Cal.	Chemistry/School	4/28-6/21	Ahmedabad
DeBAGGAGIS, Henry F. Fordham Univ.	Mathematics/School	5/5-6/27	Hyderabad

Name	Field/Level	Dates	Place Assigned
DENNY, Wayne B. Grinnell Coll.	Physics/School	5/19-7/11	Gauhati
DESNOYERS, Harold B. Westchester Comm. Coll., Valhalla, N.Y.	Industrial Electronics (Polytech)	5/5-6/28	Ahmedabad
DeVILLAFRANCA, George W. Smith Coll.	Biology/College	5/19-7/12	Chandigarh
DIEFENDERFER, A. James Lehigh Univ.	Chemistry/College	4/21-6/12	Jaipur
DILL, Normal H. Del. State Coll., Dover, Del.	Biology/School	5/19-7/21	Ranchi
DILLON, Thomas J. Concord-Carlisle H.S., Concord, Mass.	Physics/School	5/5-6/26	Udaipur
DUFF, James W. Arlington State Coll., Arlington, Texas	Hydraulics Irrigation & Public Health (Polytech)	5/26-7/21	Bangalore
DUNN, Donald J. Oklahoma Christian Coll., Oklahoma City, Ok.	Biology/School	4/21-6/30	Various Places
EBELING, Water Univ. of Cal., Los Angeles	Biology/College	4/28-6/28	Poona
EISNER, Leonard Barnes Engg. Co., Stamford, Conn.	Physics/School	4/28-6/20	Sagar
EUSTIS, Robert H. Stanford Univ.	Mechanical Engg.	5/15-7/1	Madras
EVERT, Carl F., Jr. Univ. of Cincinnati	Numerical Analysis(Engg.)	5/6-6/14	Madras
FAITH, Carl C. Rutgers Univ.	Mathematics/College	4/21-8/16	Delhi
FAN, H.Y. Purdue Univ.	Physics	12/30/68- 1/18/69	Various Places
FAST, Kenneth V. Webster Coll., St. Louis, Mo.	Chemistry/School	5/12-7/3	Lucknow
FLANAGAN, James C. Del Mar Coll., Corpus Christi, Texas	Automobile Engg. (Polytech)	5/26-7/20	Chandigarh

Name	Field/Level	Dates	Place Assigned
FLETCHER, William H. Broad Ripple H.S., Indianapolis, Ind.	Chemistry/School	5/12-7/4	Waltair
FONTANA, Peter R. Oregon State Univ.	Physics/College	5/5-7/3	Pilani
FOREMAN, Seymour B. New York City Comm. Coll., Brooklyn, N.Y.	Construction Tech. (Polytech)	5/29-7/26	Hyderabad
FRY, Wayne L. NSF/Washington	General Supervisor	4/14-5/29	Various Places
FULLER, John L. The Jackson Lab., Bar Harbor, Me.	Biology	4/21-6/7	Various Places
GARDNER, Marjorie H. Univ. of Maryland	Chemistry/School	5/10-6/14	Bhubaneswar
GERSTLE, Kurt H. Univ. of Colorado	Structural Engg.	5/13-6/19	Coimbatore
GORSHE, Frank B. Bettendorf Comm. School, Bettendorf, Iowa	Chemistry/School	5/8-6/30	Ajmer
GREEN, Morris Hunter Coll. of City Univ. of N.Y.	Biology/College	4/28-7/12	Jaipur
GULRUD, Orville J. Brookfield Central H.S., Brookfield, Wis.	Biology/School	5/13-7/10	Agra
GUNTER, Roy C., Jr. Coll. of the Holy Cross, Worcester, Mass.	Physics/School	4/28-6/19	Annamalainagar
GURFINKEL, German R. Univ. of Illinois	Structure Tech. (Polytech)	5/27-7/17	Bangalore
HAGGIS, Alex J. Reed Coll., Portland, Ore.	Biology/College	5/19-7/12	Chandigarh
HALL, Lyle C. Wis. State Univ., River Falls, Wis.	Chemistry/College	4/22-6/15	Nagpur
HARR, Milton E. Purdue Univ.	Soil Mechanics (Engg.)	5/4-6/9	Roorkee
HARRISON, Anna J. Mount Holyoke Coll.	Chemistry/College	5/5-7/3	Varanasi
HAYASHI, Teru Illinois Inst. of Tech.	Biology	5/5-6/12	Various Places

Name	Field/Level	Dates	Place Assigned
HEADLEE, Elmer W. Kirkwood H.S., Kirkwood, Mo.	Chemistry/School	5/31-7/21	Chandigarh
HEMPLING, Harold G. Cornell Univ. Medical Coll.	Biology/College	5/5-6/28	Kolhapur
HEUER, Gerald A. Concordia Coll., Moorhead, Minn.	Mathematics/School	4/24-6/21	Poona & Allahabad
HIGGERSON, Charles A. Mohawk Valley Comm. Coll., Utica, N.Y.	Machine Shop Tech. (Polytech)	5/19-7/15	Bhopal
HILDEBRAND, James L. W. Wash. State Coll., Bellingham, Wash.	Mathematics/School	4/19-6/14	Bangalore
HOLTON, Gerald J. Harvard Univ.	Physics	6/7-6/17	Udaipur
HOOGSTOEL, Robert E. Broome Tech. Comm. Coll., Binghamton, N.Y.	A.C. & Refrigeration (Polytech)	5/20-7/10	Allahabad
HOPKINS, Harold H. St. Cloud State Coll., St. Cloud, Minn.	Biology/School	5/5-6/26	Hyderabad
HORWITZ, Henry E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Mechanical Engg. (Polytech)	5/27-8/9	Madras
HUBBARD, John C. F.J. Reitz H.S., Evansville, Ind.	Chemistry/School	5/5-6/28	Annamalainagar
HUGDAHL, Wally I. Homestead H.S., Mequon, Wis.	Chemistry/School	5/6-6/26	Hyderabad
HUNTINGTON, Hillard H. Rensselaer Polytechnic Inst.	Physics	12/30/68- 1/18/69	Various Places
HUTTON, Wilbert Jr. Bowling Green State Univ.	Chemistry/School	5/5-6/28	Indore
ILLINGER, Karl H. Tufts Univ.	Chemistry/College	5/8-6/26	Cuttack
IVASH, Eugene V. Univ. of Texas	Physics/College	4/26-6/19	Baroda
JASTRAM, Phillip S. Ohio State Univ.	Physics	4/22-7/11	Various Places

Name	Field/Level	Dates	Place Assigned
JENSEN, Berlin C. Roy H.S., Roy, Utah	Biology/School	5/5-6/28	Hyderabad
JENSEN, James LaMont Roy H.S., Roy, Utah	Biology/School	4/14-6/26	Annamalainagar
JOHNSON, Ellis L. Yale Univ.	Mathematics/College (Polytech)	4/24-7/6	Delhi & Bhopal
JOHNSON, Gregory F. Ulster County Comm. Coll., Stone Ridge, N.Y.	Industrial Electronics (Polytech)	5/27-7/19	Madras
JONES, F. Burton Univ. of Cal., Riverside	Mathematics	10/3-10/21	Various Places
KAUFMAN, Ernest D. St. Mary's Coll., Winona, Minn.	Chemistry/College	5/5-6/26	Chandigarh
KEESEE, John W. Univ. of Arkansas	Mathematics/College	5/5-6/30	Meerut
KELLER, Henry P. The Peddie School, Hightstown, N.J.	Physics/School	5/24-7/10	Chandigarh
KILMER, Henry J. Rex Putnam H.S., Milwaukie, Ore.	Biology/School	5/19-7/19	Ranchi
KING, L. Carroll Northwestern Univ.	Chemistry	5/19-6/14	Various Places
KNUDSEN, John R. New York Univ.	Mathematics/School	4/21-6/14	Bangalore
KURTH, Rudolf Georgia Inst. of Tech.	Mathematics/College	4/21-6/14	Baroda
KUSIC, George L., Jr. Univ. of Pittsburg	Electrical Engg.	4/22-6/16	Baroda
LAMBERT, Francis L. Union Coll., Schenectady, N.Y.	Biology/College	5/5-6/28	Kolhapur
LAMPERT, Henry A., Jr. Lamar State Coll. of Tech., Beaumont, Texas	Polytechnic	5/19-7/31	Various Places
LARSEN, Max D. Univ. of Nebraska	Mathematics/School	5/6-7/1	Kurukshetra

Name	Field/Level	Dates	Place Assigned
LARSON, Maurice A. Iowa State Univ.	Chemical Engg.	4/24-7/3	Kharagpur
LAWRENCE, Willard E. Marquette Univ.	Mathematics/College	5/13-7/5	Tirupati
LEARNARD, Everett F. Milton Acad., Milton, Mass.	Physics/School	4/28-6/19	Annamalainagar
LILLIS, James C. Lowell Tech. Inst., Lowell, Mass.	Industrial Engg. (Polytech)	5/19-7/10	Allahabad
LINDBLAD, James G. Lowell H.S., Whittier, Cal.	Physics	6/7-7/12	Udaipur
MAJOR, John K. Univ. of Cincinnati	Physics/School	4/24-6/12	Vallabh Vidyanagar
MARKHAM, Mary J. St. Joseph Coll., W. Hartford, Conn.	Mathematics/School	5/15-7/4	Delhi
MAURER, Robert J. Univ. of Illinois	Physics/College	5/15-7/5	Delhi
MCCARTHY, David F. Mohawk Valley Comm. Coll., Utica, N.Y.	Construction Tech. (Polytech)	5/12-7/10	Bhopal
MCKIE, James K., Jr. Iowa State Univ.	Construction Engg. (Polytech)	5/26-7/21	Chandigarh
MEWBORN, Ancel C. Univ. of North Carolina	Mathematics/School	5/5-7/3	Calcutta
MILLER, Bruce L. Flint Comm. Coll., Flint, Mich.	Industrial Electronics	5/27-7/17	Chandigarh
MITCHELL, Robert I. Univ. of Dayton	Industrial Engg.	4/28-7/7	Bhopal & Ahmedabad
MORRIS, Joseph B. Howard Univ.	Chemistry/School	5/12-7/5	Lucknow
MOSLEY, John A. Keene State Coll., Keene, N.H.	Mathematics/School	5/20-7/3	Kanpur
MULLINS, Robert E. Marquette Univ.	Mathematics/School	5/13-7/3	Jaipur

Name	Field/Level	Dates	Place Assigned
NARENDRA, Kumpati S. Yale Univ.	Digital Computation & Control (Engg.)	5/20-7/14	Hyderabad
NELSON, Rex R. Occidental Coll., Los Angeles, Cal.	Physics/College	6/9-8/1	Gauhati
NIELSON, Carl E. Ohio State Univ.	Physics/College	5/12-7/28	Nagpur
O'CONNOR, Paul R. Univ. of Minnesota	Chemistry	3/29-6/14	Various Places
OINES, Ole P.J. Glenbrook N. H.S., Northbrook, Ill.	Physics/School	4/28-6/19	Ahmedabad
OSMAN, Elizabeth M. Univ. of Iowa	Chemistry/College	4/21-6/7	Delhi
OVERMIRE, Thomas G. CUEBS	Biology/School	4/28-6/22	Madras
PACKER, Lester Univ. of Cal., Berkeley	Biology/College	5/26-7/15	Sagar
PASIENCIER, Samuel New York Univ.	Mathematics/College	5/20-7/12	Lucknow
PEACOCK, Ben N. Wauwatosa Public School, Wauwatosa, Wis.	Physics/School	5/6-6/27	Kolhapur
PERESSINI, Anthony L. Univ. of Illinois	Mathematics/College	5/12-7/3	Jaipur
PETERSON, Gary D. Pacific Lutheran Univ.	Mathematics	10/13/68- 1/25/69	Various Places
PINNICK, Harry T. Univ. of Akron	Physics/College	4/27-6/21	Sagar
POTTER, Loren D. Univ. of New Medico	Biology/College	5/5-6/26	Varanasi
PRATT, Charles Savannah State Coll., Savannah, Ga.	Chemistry/School	4/21-6/12	Bangalore

Name	Field/Level	Dates	Place Assigned
PRAUSA, William J. Brookfield Central H.S., Brookfield, Wis.	Chemistry/School	4/21-6/12	Indore
PREUL, Herbert C. Univ. of Cincinnati	Civil Engg.	4/29-7/4	Roorkee
RABB, Donald D. Bloomsburg State Coll., Bloomsburg, Pa.	Biology/School	5/26-7/19	Delhi
RANDOLPH, John F. Univ. of Rochester	Mathematics/College	5/5-6/30	Meerut
RAW, Isias Univ. of Sao Paulo, Brazil	Physics	9/15-10/6	Various Places
REINHARDT, Howard E. Univ. of Montana	Mathematics/College	4/28-6/23	Lucknow
RENO, Martin A. Heidelberg Coll.	Physics/School	4/22-6/16	Mysore
RIGDEN, John S. Middlebury Coll.	Physics/School	5/6-7/10	Varanasi & Udaipur
RIGGS, Charles L. Texas Tech. Coll.	Mathematics/School	5/5-7/5	Calcutta
ROONEY, Victor M. Univ. of Dayton	Industrial Electronics	5/6-6/12	Allahabad
ROTHMAN, Neal J. Univ. of Illinois	Mathematics/College	5/4-7/1	Madurai
ROUSE, Arthur G. St. Louis Univ.	Physics/School	5/5-6/26	Calcutta
RUSSELL, Milton E. Hewlett Packard Co.	Physics	10/28-11/23	Delhi
SACHER, David Bronx Comm. Coll., Bronx, N.Y.	Physics/School	4/26-6/21	Bangalore
SCHLEICHER, Jeanne d'Arc (Sister) Antioch Coll.	Biology/School	4/7-6/17	Aurangabad

Name	Field/Level	Dates	Place Assigned
SCHNEIDER, Hubert H. Univ. of Nebraska	Mathematics	5/5-7/7	Various Places
SCOTT, James J. Interlake H.S., Bellevue, Wash.	Physics/School	5/5-6/28	Kolhapur
SPANDORF, Adolf A. Cazenovia Coll.	Biology/School	4/17-6/12	Bangalore
SPINDLE, Jackson F. Cypress Jr. Coll., Cypress, Cal.	Chemistry/School	4/21-6/14	Bangalore
STEPHENS, Grover C. Univ. of California, Irvine	Biology/College	4/21-6/26	Ahmedabad
STERLING, Daniel J. Bowdoin Coll.	Mathematics/College	5/6-6/30	Jabalpur
STERN, Kurt H. National Bureau of Standards	Chemistry/College	4/21-6/12	Nagpur
STONE, Marshall Univ. of Massachusetts	Mathematics	12/8/68- 2/10/69	Various Places
STRICKLER, Thomas D. Berea Coll., Berea, Ky.	Physics/College	5/6-6/26	Calcutta
STURDIVANT, Harwell P. Western Maryland Coll.	Biology/School	4/28-7/3	Bhubaneswar
SWARTZ, Charles D. Union Coll.	Physics/School	4/14-6/10	Alwaye
TAMRES, Milton Univ. of Michigan	Chemistry/College	4/26-6/12	Mysore
TAYLOR, Moddie D. Howard Univ.	Chemistry/College	5/6-6/26	Chandigarh
TOMBES, Averett S. Clemson Univ.	Biology/College	4/12-6/5	Mysore
TOMPSON, Robert N. Univ. of Nevada	Mathematics/College	5/6-6/29	Jodhpur

Name	Field/Level	Dates	Place Assigned
TRIPP, Arley L. City Coll. of San Francisco	Industrial Electronics (Polytech)	5/31-7/21	Bangalore
TULECKE, Walter R. Antioch Coll.	Biology	4/13-6/16	Various Places
UMBREIT, Wayne W. Rutgers Univ.	Biology	5/19-7/17	Various Places
VANCE, John D. Gaston Coll., Gastonia, N.C.	Construction Tech. (Polytech)	5/5-7/3	Ahmedabad
VAN ENGEN, Henry Univ. of Wisconsin	Mathematics	6/8-7/1	Various Places
VAN NORMAN, Richard W. Univ. of Utah	Biology/School	4/21-6/19	Ahmedabad
VOGEL, Barry D. Mount Union Coll., Alliance, Ohio	Mathematics/School	4/12-6/23	Madras
WATSON, Joseph T. (Rev.) Brooklyn Prep. School, Brooklyn, N.Y.	Physics/School	5/6-6/28	Waltair
WAYNICK, Arthur H. Penn. State Univ.	Physics/College	5/5-6/19	Waltair
WHEELER, Charles M. Univ. of New Hampshire	Chemistry/School	5/26-7/18	Chandigarh
WHITE, Edward P. Univ. of Cincinnati	Engineering	5/5-7/7	Various Places
WHITNEY, Richard M. Roxbury Latin School, Boston, Mass.	Chemistry/School	5/12-7/10	Patna
WILSON, Dale G. Purdue Univ.	Industrial Engg. (Polytech)	5/31-7/19	Bangalore
YOUNG, Frederick H. Oregon State Univ.	Mathematics/College	4/14-6/5	Trivandrum
YOUNGBLOOD, Ralph P. Georgia Inst. of Tech.	Polytechnic	6/7-8/14	Various Places

## Short Term Consultants (130) CY-1969

Name	Field/Level	Dates	Place Assigned
ALYEA, Hubert N. Princeton Univ.	Chemistry	11/30/69- 1/9/70	Various Places
ANDERSON, Jack M. Univ. of Iowa	Mathematics/School	5/5-7/4	Cuttack
ANDERSON, Paul M. Iowa State Univ.	Engineering	5/25-7/1	Kharagpur
ASCHER, Samuel Henry Ford H.S., Detroit, Mich.	Chemistry/School	5/4-6/25	Indore
ASIMOW, Morris Univ. of Cal., Los Angeles	Engineering	11/15-12/25	Delhi
BECKER, Jerry P. Rutgers Univ.	Mathematics	1/22-7/6	Various Places
BENADE, Arthur H. Case Western Reserve Univ.	Physics/School	5/21-7/14	Allahabad
BILANIUK, Olexa-Myron Swarthmore Coll.	Physics/School	4/27-5/30	Kolhapur
BOEKELHEIDE, Irving F. Chico State Coll., Chico, Cal.	Physics/College	5/11-7/2	Gorakhpur
BOYAJIAN, Richard J. Univ. of Chicago, Lab. H.S.	Biology/School	4/6-7/9	Alwaye
BRANSON, Lane K. Montana Coll. of Mineral Sci. & Tech.	Physics/School	4/23-6/15	Mysore
BRENNAN, John W. George Washington H.S., Denver, Col.	Biology/School	4/20-6/11	Poona
BRICKERHOFF, Richard F. Phillips Exeter Acad., Exeter, N.H.	Physics/College	4/23-6/15	Mysore
BRODSKY, Stanley M. New York City Comm. Coll., Brooklyn, N.Y.	Polytechnic	5/28-7/15	Bhopal
BROWN, Fayette J. Chico State Coll., Chico, Cal.	Polytechnic	5/25-7/2	Calcutta

Name	Field/Level	Dates	Place Assigned
BROWN, Frederick C. Univ. of Illinois	Physics	12/30/68- 1/18/69	Various Places
CASSIDY, Harold G. Yale Univ.	Chemistry/College	4/29-6/19	Madurai
CHESLEY, Robert E. The Thacher School, Ojai, Cal.	Physics/College	5/4-6/25	Delhi
CHOATE, David C. Ohio Coll. of Applied Sci., Cincinnati, Ohio	Polytechnic	5/25-7/16	Jadavpur
COBURN, Hoarce H. New Mexico State Univ., Las Cruces, N.M.	Physics/School	4/14-6/6	Trichinapally
COHEN, Haskell Univ. of Mass.	Mathematics/College	5/14-7/2	Kanpur
COMSTOCK, Dale R. Central Washington State Coll.	Mathematics/College	5/5-6/25	Tirupati
COSTLOW, John D., Jr. Duke Univ. Marine Lab.	Biology/College	4/26-5/21	Ernakulam
COWAN, Clifford W. Southern Tech. Inst., Marietta, Ga.	Polytechnic	5/25-7/16	
CREIGHTON, Harriet B. Wellesley Coll.	Biology/College	6/8-8/3	Allahabad
DAENZER, Gilbert H. Concordia Teachers Coll., Seward, Neb.	Physics/School	5/4-6/27	Jodhpur
DALPHIN, Richard J. Univ. of Hartford	Polytechnic	5/16-7/16	Allahabad
DART, S. Leonard Claremont Coll.	Physics	4/18-7/13	Various Places
DAVIDSON, Bruce M. Washington State Univ.	Engineering	4/28-7/4	Roorkee
DAW, Harold A. New Mexico State Univ.	Physics	5/23-6/14	Various Places
DAYTON, Irving E. Montana State Univ.	Physics/College	5/11-7/2	Madurai
DeBAGGIS, Henry F. Fordham Univ.	Mathematics/School	5/4-6/30	Gwalior

Name	Field/Level	Dates	Place Assigned
DeROSE, James V. Marple Newtown Schools, Newton Square, Pa.	Physics/School	5/30-6/28	Delhi
DIEFENDERFER, A. James Lehigh Univ.	Chemistry	4/19-7/9	Various Places
DILL, Norman H. Delaware State Coll., Dover, Del.	Biology/School	5/5-6/27	Muzaffarnagar
DIZER, John T., Jr. Mohawk Valley Comm. Coll., Utica, N.Y.	Polytechnic	6/4-7/18	Madras
DUBISCH, Roy Univ. of Washington	Mathematics/School	4/20-6/13	Alibagh
EDMISTER, Wayne C. Oklahoma State Univ.	Engineering	5/11-6/17	Madras
EINSTEIN, Hans Albert Univ. of Cal.	Engineering	5/12-6/1	Roorkee
EL-WAKIL, Mohamed M. Univ. of Wisconsin	Engineering	5/18-7/2	Howrah
ENGELBRECHT, Richard S. Univ. of Illinois	Engineering	4/27-6/8	Kanpur
EVERT, Carl P., Jr. Univ. of Cincinnati	Engineering	6/9-7/15	New Delhi
FAN, H.Y. Purdue Univ.	Physics	12/30/68- 1/18/69	Various Places
FARREN, Joseph M. Univ. of Dayton	Polytechnic	5/4-7/11	Ahmedabad
FEHR, Howard F. Teachers Coll., Columbia Univ.	Mathematics/School	4/20-6/4	Madras
FEIEREISEN, William J. Univ. of Wisconsin	Engineering	4/27-7/2	Madras
FOREMAN, Seymour B. New York City Comm. Coll., Brooklyn, N.Y.	Polytechnic	5/28-7/27	Chandigarh
FREEMAN, Sheldon Euclid H.S., Euclid, Ohio	Biology/School	4/23-6/15	Bombay

Name	Field/Level	Dates	Place Assigned
GARDNER, Marjorie H. Univ. of Maryland	Earth Science/School	4/27-6/18	Bangalore
GEAR, Charles W. Univ. of Illinois	Engineering	5/11-6/15	New Delhi
GERSTLE, Kurt H. Univ. of Colorado	Engineering	5/21-6/25	Coimbatore
GLOVER, Israel E. Albany State Coll.	Mathematics/School	4/28-6/20	Ahmedabad
GOLDNER, Ronald B. Tufts Univ.	Engineering	5/4-6/10	Baroda
GURFINKEL, German R. Univ. of Illinois	Polytechnic	5/26-7/15	Jadavpur
GUSTAFSON, Robert D. Purdue Univ.	Engineering	5/25-6/27	Coimbatore
HAIRSTONE, Marcus A. U.S. Commission for Cultural Exchange with Iran	Biology/College	5/3-7/2	Cuttack
HANCOCK, John C. Purdue Univ.	Engineering	5/4-6/30	New Delhi
HEARD, B. Frank Southern Tech. Inst., Marietta, Ga.	Polytechnic	6/1-7/16	Chandigarh
HEUER, Gerald A. Concordia Coll., Moorhead, Minn.	Mathematics/College	5/4-7/2	Gorakhpur
HIGGERSON, Charles A. Mohawk Valley Comm. Coll., Utica, N.Y.	Polytechnic	5/25-7/20	Bhopal
HIRSCH, Lester M. California State Coll., Los Angeles, Cal.	Physics/School	5/4-6/25	Raipur
HORWITZ, Henry E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Polytechnic	5/26-7/15	Madras
HUNTINGTON, Hillard B. Rensselaer Polytechnic Inst.	Physics	12/30/68- 1/18/69	Various Places
JACOBSON, Willard J. Teachers Coll., Columbia Univ.	Chemistry/School	4/28-6/15	Ajmer
JOHNSON, Gregory F. Ulster County Comm. Coll., Stone Ridge, N.Y.	Polytechnic	5/26-7/15	Bangalore

Name	Field/Level	Dates	Place Assigned
JONES, Burton W. Univ. of Colorado	Mathematics/School	6/4-7/23	Jammu
JONES, Charles E. Univ. of Arkansas	Physics/College	4/28-6/20	Ahmedabad
KAMEMOTO, Fred I. Univ. of Hawaii	Biology	6/18-7/4	Various Places
KENNEDY, Manert H. BSCS, Boulder, Col.	Biology	12/29/69- 1/24/70	Madurai
KERDIEJUS, John B. Xavier H.S., Concord, Mass.	Physics/School	4/23-6/27	Ahmednagar
KILMER, Henry J., Jr. Rex Putnam H.S., Milwaukee	Biology/School	5/11-7/30	Guntur
LEACH, James L. Univ. of Illinois	Polytechnic	5/9-6/25	Ahmedabad
LeCROISSETTE, Dennis H. Cal. Inst. of Tech.	Engineering	6/20-7/25	Kanpur & Pilani
LEWIS, Robert B.	Biology	11/10-12/10	Madras
MAC NAB, William K. Sir F. Drake H.S., San Rafael, Cal.	Chemistry/School	5/14-7/18	Agra
MANGELSDORF, Paul C. Swarthmore Coll.	Physics/College	5/11-7/4	Kanpur
MARTIN, John R. Univ. of Houston	Polytechnic	6/3-7/17	Bangalore
McCLUND, Leland S. Indiana Univ.	Biology	5/12-6/13	Various Places
McCUSKER, Patrick A. Univ. of Notre Dame	Chemistry/College	5/18-6/13	Bombay
McNEIL, Edward B. Univ. of Illinois	Physics/College	4/27-6/18	Bombay
MILLER, Jack C. Pomona Coll.	Physics/College	5/4-6/25	Delhi

Name	Field/Level	Dates	Place Assigned
MOLITOR, Theodore E. Alexander Ramsey Sr. H.S., St. Paul, Minn.	Chemistry/School	4/27-7/2	Jodhpur
MORRIS, Joseph B. Howard Univ.	Chemistry/College	5/4-6/25	Udaiyur
NELSON, L. Warren Highland Park Board of Ed., Detroit, Mich.	Ele. Science	11/30/69- 1/2/70	Bombay
ORTON, William R. Univ. of Arkansas	Mathematics	5/5-6/27	Various Places
PEACOCK, Ben N. Wauwatosa Public Schools, Wauwatosa, Wis.	Physics/School	4/28-6/27	Udaipur
PETERSEN, Quentin R. Simmons Coll., Boston, Mass.	Chemistry/College	5/11-7/2	Dharwar
PETERSON, Gray D. Pacific Lutheran Univ.	Mathematics	10/13/68- 1/25/69	Various Places
PRAMER, David Rutgers Univ.	Biology/College	4/27-6/8	Bombay
REESE, Lymon C. Univ. of Texas	Engineering	5/18-7/1	Bombay
REID, Karl Nevelle, Jr. Oklahoma State Univ.	Engineering	5/26-7/4	Coimbatore
RIDD, Merrill K. Univ. of Utah	Earth Science/School	4/27-6/14	Bangalore
RIGDEN, John S. Univ. of Missouri	Physics/School	5/19-7/8	Kanpur
RIO, Sheldon T. Southern Oregon Coll.	Mathematics/School	4/9-6/1	Trivandrum
RITCHIE, Myles H. Florida State Univ.	Polytechnic	6/4-8/6	Various Places
ROMBERG, Thomas A. Univ. of Wisconsin	Mathematics/School	5/21-6/20	Delhi
ROUSE, Hunter Univ. of Iowa	Engineering	1/22-2/8	Various Places
SAN PIETRO, Anthony Indiana Univ.	Biology	5/4-6/1	Various Places

Name	Field/Level	Dates	Place Assigned
SCROGGS, James E. Univ. of Arkansas	Mathematics/College	5/5-6/25	Calcutta
SHELLABARGER, Claire J. Brookhaven National Lab.	Biology/College	5/1-6/11	Madurai
SINGER, Ferdinand L. New York Univ.	Engineering	11/23-12/19	Delhi
SKELTON, John Fabric Research Lab., Inc., Dedham, Mass.	Engineering	5/18-6/15	Delhi
STEELE, Stephen G. Broome Technical Comm. Coll., Binghamton, N.Y.	Polytechnic	6/15-7/29	Various Places
STERN, Jacob Univ. of Illinois	Polytechnic	5/18-7/19	Coimbatore & Allahabad
STONE, Marshall Univ. of Mass.	Mathematics	12/8/68- 2/10/69	Various Places
STEWART, Albert B. Antioch Coll.	Physics/College	4/25-6/15	Mysore
STOLLBERG, Robert J. San Francisco State Coll.	Physics/School	5/30-6/28	Delhi
STRASSENBERG, Arnold A. St. Univ. of New York	Physics	10/20-10/26	Delhi
SUNDERWIRTH, Stanley G. Kansas State Coll.	Chemistry/School	4/20-6/7	Amravati
TAYLOR, Charles E. Univ. of Illinois	Engineering	5/21-7/2	Kanpur
TEMMER, Harry A. Metropolitan State Coll., Denver, Col.	Polytechnic	6/1-7/23	Jadavpur
THRON, Wolfgang J. Univ. of Colorado	Mathematics/College	5/12-7/2	Aligarh
THORNTON, Susan F. Montgomery Jr. Coll., Rockville, Md.	Chemistry/School	5/14-7/2	Allahabad
TOEBES, Gerrit H. Purdue Univ.	Engineering	5/26-7/2	Bombay

Name	Field/Level	Dates	Place Assigned
TOMBES, Averett S. Clemson Univ.	Biology/College	4/27-6/20	Ahmedabad & Sagar
TROLAN, J. Kenneth Univ. of Redlands	Physics/School	5/5-6/25	Bhagalpur
TULECKE, Walter Antioch Coll.	Biology	4/9-6/25	Various Places
VANCE, J. David Gaston Coll., Gastonia, N.C.	Polytechnic	4/28-6/17	Pccna
VAN NORMAN, Richard W. Univ. of Utah	Biology/School	5/4-6/27	Raipur
VAN VLACK, Lawrence H. Univ. of Michigan	Engineering	5/4-6/4	Kanpur
VELETSOS, Anestis S. Rice Univ.	Engineering	5/12-7/1	Bombay
WARNER, Raymond M., Jr. ITT, Corp., West Palm Beach, Fla.	Engineering	4/26-5/28	Pilani
WHEELER, Charles M., Jr. Univ. of New Hampshire	Chemistry/School	4/11-6/6	Ernakulam
WHITE, Edward F. Univ. of Cincinnati	Engineering	3/31-7/30	Various Places
WIRSZUP, Izaak Univ. of Chicago	Mathematics/School	4/20-6/25	Bangalore & Delhi
YANDL, Andre L. Seattle Univ.	Mathematics/College	4/28-6/18	Aurangabad
YOUNG, Frederick H. Oregon State Univ.	Mathematics/School	4/20-6/11	Poona
YOUNG, Jay A. King's College	Chemistry/School	4/27-6/25	Jabalpur
YOUNGBLOOD, Ralph P. Southern Tech. Inst., Marietta, Ga.	Polytechnic	5/7-7/20	Various Places
YOUNGER, Philip G. St. Cloud State Coll., St. Cloud, Minn.	Physics/School	4/9-5/30	Alwaye

## Short Term Consultants (90) CY-1970

Name	Field/Level	Dates	Place Assigned
ALIN, John S. Univ. of Utah	Mathematics/School	4/27-6/17	Udipi
ALYEA, Hubert N. Princeton Univ.	Chemistry	11/30/69- 1/9/70 & 12/21/70 - 1/14/71	Various Places
ASHFORD, Theodore A. Univ. of South Florida	Chemistry	7/12-8/4	Hyderabad
AVNER, Sidney H. New York Comm. Coll., Brooklyn, N.Y.	Polytechnic	6/21-10/25	Hyderabad
BARTLE, Robert G. Univ. of Illinois	Mathematics/College	5/24-7/25	Ranchi
BARTON, Jay II West Virginia Univ.	Biology/College	5/24-7/15	Ujjain
BEACHY, John A. Goshen Coll., Goshen, Ind.	Mathematics/School	5/4-7/24	Sambalpur
BECKER, Jerry P. Rutgers Univ.	Mathematics	5/4-6/20	Various Places
BEDIENT, Phillip E. Franklin & Marshall Coll.	Mathematics/School	6/1-7/24	Gauhati
BENDER, Phillip R. Marquette Univ.	Mathematics/School	5/24-7/17	Amritsar
BORER, Gerald J. Rockhurst H.S.	Physics/School	5/6-6/26	Indore
BRANSON, Lane K. Montana Coll. of Min. Sci. & Tech.	Physics/School	4/24-6/20	Mysore
BURR, Arthur H. Cornell Univ.	Engineering	4/19-7/12	Coimbatore & Bombay
CARMICHAEL, Robert G. Highland Park H.S., Highland Park, Ill.	Chemistry/School	4/27-6/17	Madras
CHAFFEE, David E. Hewlett-Packard Co.	Physics	7/27-9/13	Delhi

Name	Field/Level	Dates	Place Assigned
CHAMPE, Sewell P. Rutgers Univ.	Biology	6/15-7/28	Bangalore
CORRELL, Malcolm Univ. of Colorado	Physics/College	5/15-6/19	Raipur
COURT, Joel Queens Borough Comm. Coll., Queens, N.Y.	Polytechnic	5/18-7/17	Bombay
CRESWELL, Clifford James Hamline Univ., St. Paul, Minn.	Chemistry/College	5/3-7/8	Roorkee & Aurangabad
CUNNINGHAM, John F. Mansfield City School	Ele. Science	6/17-9/16	Bombay
DART, S. Leonard Pitzer Coll. and Scripps Coll., Claremont, Cal.	Physics/College	5/6-7/1	Dibrugarh
DIBLE, Isabel W. Unified School Dist. Beverly Hills, Cal.	Ele. Science	4/8-7/5	Bombay
DIEFENDERFER, A. James Lehigh Univ.	Chemistry	5/31-7/24	Various Places
DOMHOLDT, Lowell C. Cleveland State Univ., Cleveland, Ohio	Engineering	5/24-7/3	Madras
DUNN, Donald J. Oklahoma Christian Coll., Oklahoma City, Ok.	Biology/School	4/12-7/5	Poona & Ajmer
EBERT, Ian O. Michigan State Univ.	Engineering	4/12-7/25	Various Places
ELLER, Herbert Southern Tech. Inst., Marietta, Ga.	Polytechnic	3/29-7/26	Various Places
FABIAN, Richard V., Jr. Tilton School, Tilton, N.H.	Physics/School	4/27-7/1	Vellore
FAIRHURST, Charles Univ. of Minnesota	Engineering	5/13-6/11	Kurukshetra
FONTANA, Peter R. Oregon State Univ.	Physics	5/3-7/3	Various Places

Name	Field/Level	Dates	Place Assigned
FRANK, Andrew J. Western Washington State Coll.	Chemistry/College	6/1-7/9	Jammu & Sagar
FRANKEL, Jacob Harvey Mudd Coll.	COSIP	6/12-8/2	Various Places
FOWLER, Edgar T. Southern Tech. Inst.	Polytechnic	4/6-7/2	Various Places
GILKESON, Murray Mack Harvey Mudd Coll.	Engineering	5/11-7/1	Delhi
GORGES, Robert C. North H.S., Sheboygan, Wis.	Chemistry/School	5/17-7/8	Gauhati
HAGGARD, J.D. Kansas State Coll.	Mathematics/School	5/5-6/23	Raipur
HEARD, B. Frank Southern Tech. Inst.	Polytechnic	3/29-7/15	Ranchi & Poona
HEINZ, Winfield B. Univ. of Cal.	Engineering	5/11-7/2	Delhi
HIGGERSON, Charles A. Mohawk Valley Comm. Coll., Utica, N.Y.	Polytechnic	5/10-8/2 & 12/20-12/31	Bhopal
HENNINGER, G. Ross Oregon Tech. Inst.	Polytechnic	5/4-7/24	Various Places
HORWITZ, Henry E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Polytechnic	6/7-8/26	Madras
JOHNSON, Gregory F. Ulster County Comm. Coll., Stone Ridge, N.Y.	Polytechnic	5/25-7/15	Madurai & Patna
KECK, Russell A., Jr. Gaston Coll., Gastonia, N.C.	Polytechnic	5/10-7/2	Trivandrum
KEEFE, Thomas E. George Washington H.S., Denver, Col.	Physics/School	4/26-6/18	Poona
KEESEE, John W. Univ. of Arkansas	Mathematics/School	5/17-7/6	Allahabad

Name	Field/Level	Dates	Place Assigned
KENNEDY, Manert BSCS, Boulder, Col.	Biology	12/29/69- 1/24/70	Madurai
KILMER, Henry J., Jr. Rex Putnam H.S., Milwaukie, Ore.	Biology	4/12-6/19	Various Places
KROGER, Ferdinand A. Univ. of South. Cal.	Engineering	6/7-7/19	Kanpur
KRYGOWSKI, Eugene E. Cincinnati Tech. Inst.	Polytechnic	4/26-6/28	Bombay
LAGNESE, John E. Georgetown Univ.	Mathematics/School	5/4-6/24	Delhi
LAGOWSKI, J.J. Univ. of Texas	Chemistry/College	5/7-6/15	Patna & Sagar
LARSON, Miss Jane Northpark Sr. & Jr. H.S.	Ele. Science	6/17-10/16	Bombay
LASCOE, Orville D. Purdue Univ.	Polytechnic	6/1-7/8	Allahabad & Kanpur
LAWSON, Robert D. Argonne National Lab.	Physics/College	4/26-5/28	Chandigarh
LEVINE, Myron Univ. of Michigan	Biology	7/6-8/8	Bangalore
LOWERY, Buck L. Southern Colorado State Coll.	Polytechnic	5/24-7/5	Bangalore
MAYHEW, Wilbur W. Univ. of Cal., Riverside	Biology/College	5/3-7/5	Rajkot
McCLUNG, Leland S. Indiana Univ.	Biology	5/11-6/13	Various Places
McMILLAN, Robert D. Oklahoma Christian Coll., Oklahoma City, Ok.	Mathematics/School	4/15-6/7	Bombay
MEINERS, Harry F. Rensselaer Polytechnic Inst.	Physics	6/12-8/26	Delhi & Srinagar

Name	Field/Level	Dates	Place Assigned
MENDENHALL, Robert V. Ohio Wesleyan Univ.	Mathematics/College	5/31-7/15	Roorkee
MERGEN, Francis C. Bradley Univ.	Engineering	5/15-6/28	Delhi
MILLER, Bruce L. Flint Comm. Coll.	Polytechnic	4/22-7/12	Patiala & Nagpur
MINEHART, Ralph C. Univ. of Virginia	Physics/College	5/3-6/24	Jammu
MITCHELL, Robert I. Univ. of Dayton	Polytechnic	5/11-7/10	Bhopal
MORGAN, Henry W. Oak Ridge National Lab.	Chemistry/College	5/18-7/3	Chandigarh
NELSON, Bernard A. Wheaton Coll.	Chemistry/College	5/15-6/21	Calcutta
NELSON, L. Warren Highland Park Board of Ed., Detroit, Mich.	Ele. Science	11/30/69 - 1/2/70 & 7/27-8/21	Bombay
NETZEL, Richard G. Wisconsin State Univ., Oshkosh, Wis.	Ele. Science	6/1-7/30	Delhi
O'BRIEN, Robert J. Southwest Minnesota State Coll.	Polytechnic	5/25-7/9	Chandigarh
PACKER, Lester Univ. of Cal.	Biology/College	5/3-6/15 & 9/15-9/23	Madurai & Meerut
PALDY, Lester G. State Univ. of New York, Stony Brook, N.Y.	Physics/School	4/26-6/17	Bombay
PETERSON, Gordon E. Lawrence Hall of Science	Ele. Science	6/1-8/5	Delhi
PREUL, Herbert C. Univ. of Cincinnati	Engineering	5/29-7/3	Madras
RAMDAS, A.K. Purdue Univ.	Physics/College	4/24-6/13	Mysore

Name	Field/Level	Dates	Place Assigned
REID, K.N., Jr. Oklahoma State Univ.	Engineering	5/4-6/5	Coimbatore
RILEY, William F. Iowa State Univ.	Engineering	5/28-7/1	Kanpur
SHELTON, John S. Claremont, Cal.	Earth Science/College	5/3-6/12	Bangalore
SCOTT, William R. Univ. of Utah	Mathematics/College	5/11-7/1	Sagar
STOLL, Robert R. Oberlin Coll.	Mathematics/School	5/18-7/8	Bareilly
SULLENBERGER, Robert A. Metropolitan State Coll., Denver, Col.	Polytechnic	5/22-7/19	Delhi
SULLIVAN, M. Helen Mount St. Scholastica Coll., Atchinson, Ka.	Mathematics/School	4/26-6/19	Aurangabad
SUSSMAN, Martin V. Tufts Univ.	Engineering	5/23-7/9	Kharagpur
THROOP, James W. General Motors Inst., Flint, Mich.	Polytechnic	5/18-6/28	Coimbatore
TUBMAN, Vincent D. Brooklyn Center H.S., Brooklyn Center, Minn.	Chemistry/School	4/27-6/16	Bhopal
VANDER VEN, Ned S. Carnegie Melon Univ.	Physics/College	4/26-7/12	Roorkee & Mysore
WALES, Charles E. West Virginia Univ.	Engineering	7/2-8/12	Kanpur
WATSON, Joseph T. Brooklyn Prep. School, Brooklyn, N.Y.	Physics/School	5/10-7/2	Guntur
WOODSON, Thomas T. Harvey Mudd Coll.	Engineering	5/11-7/1	Delhi
YENTSCH, Charles S. Nova Univ. Phys. Ocean. Center, Ft. Lauderdale, Fla.	Biology/College	4/29-6/8	Ernakulam

## Short Term Consultants (50) CY-1971

Name	Field/Level	Dates	Place Assigned
ALYEA, Hubert N. Princeton Univ.	Chemistry	12/21/70- 1/14/71	Bombay
AVNER, Sidney H. N.Y. City Comm. Coll., Brooklyn, N.Y.	Polytechnic	6/21-8/18	Hyderabad
BALCH, Patrick E. BSCS, Boulder, Col.	Biology	5/3-6/17	Secunderabad, Bangalore
BASS, Hyman Columbia Univ.	Mathematics	6/19-8/16	Madurai
BASSLER, Gerald C. Stanford Research Institute	Chemistry	12/3-12/31	Various Places
BEACH, Nancy A. Cal. Inst. of Tech.	Chemistry	7/17-12/31	Bombay, Poona
BRANSON, Lane K. Montana Coll. of Min. Sci. & Tech.	Physics	1/1-7/28 & 8/27-12/31	Mysore
BRAUNSTEIN, Jerry Oak Ridge National Lab.	Chemistry	9/26-10/9	Delhi
BURKHART, Sarah M. Tulsa Public Schools, Tulsa, Ok.	Mathematics	2/15-3/28	Bombay
CHANDRASEKHAR, B.S. Case Western Reserve Univ.	Physics	5/23-7/10	Mysore, Waltair
CLAPP, Leallyn B. Brown Univ.	Chemistry	7/9-8/30	Various Places
CLARK, George B. Univ. of Missouri	Engineering	5/16-6/12	Kurukshetra, Mysore
COLTHUP, Norman D. Am. Cyanamid Co., Stamford, Conn.	Chemistry	9/19-10/17	Various Places
CRAM, Stuart P. Univ. of Florida	Chemistry	3/15-3/31	Various Places
DeJONG, Don C. Wayne State Univ.	Chemistry	6/13-7/5	Poona, Madras
DIEFENDERFER, A. James Lehigh Univ.	Chemistry	5/16-6/25	Kanpur

Name	Field/Level	Dates	Place Assigned
FOREMAN, Seymour B. N.Y. City Comm. Coll., Brooklyn, N.Y.	Polytechnic	5/31-8/19	Hyderabad
FRANKLIN, Stanley P. Carnegie Inst. of Tech.	Mathematics	5/19-8/22	Various Places
FRENCH, J. Bruce Univ. of Rochester	Physics	5/2-6/1	Chandigarh
GILKESON, Murray M. Harvey Mudd Coll.	Engineering	8/16-12/11	Delhi
HIGGERSON, Charles A. Mohawk Valley Comm. Coll., Utica, N.Y.	Polytechnic	5/23-7/29	Bhopal
HORN, Axel Board Cooperative Educational Services, Yorktown Hts., N.Y.	Audio-Visual	9/26-12/31	Ahmedabad
HORWITZ, Henry E. Dutchess Comm. Coll., Poughkeepsie, N.Y.	Polytechnic	6/11-11/26	Madras
JONES, Burton W. Univ. of Colorado	Mathematics	5/30-7/25	Various Places
KING, L. Carroll Northwestern Univ.	Chemistry	5/9-7/7	Various Places
KISSINGER, Peter T. Univ. of Kansas	Chemistry	5/16-6/27	Kanpur
KNIGHT, Walter D. Univ. of California	Physics	5/23-6/11	Nagpur
LARSON, Miss Jane North Park Jr. & Sr. H.S., Walden, Col.	Ele. Science	3/8-6/7	Bombay
LAWSON, Tom E. Univ. of Illinois	Polytechnic	9/9-12/31	Bhopal
MAC NAB, William K. Sir F. Drake H.S., San Rafael, Cal.	Chemistry	5/5-7/4	Poona
McNAIR, Harold M. Virginia Poly. Inst.	Chemistry	3/15-3/31	Poona, Chandigarh
MEINERS, Harry F. Rensselaer Polytechnic Institute	Physics	8/20-10/1	Delhi
MORRISON, George H. Cornell Univ.	Chemistry/College	5/14-5/30	Bombay

Name	Field/Level	Dates	Place Assigned
PACKER, Lester Univ. of California	Biology	6/21-7/19	Various Places
PEDRICK, George Calif. State Coll.	Mathematics	10/31-12/17	Various Places
PETERSON, Gordon E. Lawrence Hall of Science	Ele. Science	6/6-9/1	Bombay
RIDGWAY, David Univ. of California	Chemistry	10/6-12/11	Madras
ROCHE, Ruth L. San Fernando Valley St. Coll., Cal.	Ele. Science	1/17-2/17 & 6/6-8/6	Bombay
ROGERS, William W. Wentworth Inst., Boston, Mass.	Polytechnic	9/17-11/19	Madras
ROSS, Kenneth A. Univ. of Oregon	Mathematics	5/16-6/16	Delhi
RYNACK, William M. N.Y. City Comm. Coll., Brooklyn, N.Y.	Polytechnic	5/19-7/13	Coimbatore
SHANNON, Thomas G. Rensselaer Polytechnic Institute	Polytechnic	1/22-9/11	Hyderabad
SILVERSTEIN, Robert M. Stanford Res. Inst.	Chemistry	12/3-12/31	Various Places
SINGWI, Kundan S. Northwestern Univ.	Physics	5/2-6/8	Various Places
STERN, Jacob Univ. of Illinois	Polytechnic	5/16-10/13	Bhopal
UHL, Vincent W. Univ. of Virginia	Engineering	5/12-6/15	Kanpur
VAN ENGEN, Henry Univ. of Wisconsin	Mathematics	5/18-6/20	Meerut
WALES, Charles E. West Virginia Univ.	Engineering	2/28-3/12	Madras
WHITE, Harvey E. Univ. of California	Physics	2/22-4/2	Various Places
ZILKA, Thomas J. San Francisco St. Coll.	Engineering	1/27-6/4	Delhi

Short Term Consultants (7) CY-1972

Name	Field/Level	Dates	Place Assigned
BEACH, Nancy Cal. Inst. of Tech.	Chemistry	1/1-1/31 & 4/15-6/24	Various Places
BRANSON, Lane K. Montana Coll. of Min. Sci. & Tech.	Physics	4/1-6/8	Mysore
FINN, Robert K. Cornell Univ.	Engineering	5/8-5/28	Delhi
HORN, Axel Board Coop. Educ. Services, Yorktown Hts., N.Y.	Audio-Visual	1/1-3/3	Ahmedabad
KASTRINOS, William, Jr. Educational Testing Service	Biology	2/18-3/17	Madurai
LAWSON, Tom E. Univ. of Illinois	Polytechnic	1/1-2/2	Bhopal
PRICE, Richard M. M.I.T.	Physics	1/17-2/20	Kanpur

Invited Visitors (7) CY 1967

Name	Dates of Visit
ROE, Arthur NSF/Washington	3/29-7/10
WILSON, John T. NSF/Washington	7/10-7/16
SHAFFER, Paul NSF/Washington	7/17-7/21
KELSON, Keith R. NSF/Washington	7/17-7/21
PHILLIPS, Lyle W. NSF/Washington	7/17-7/21
WHITMER, Charles A. NSF/Washington	7/17-7/21
LANZA, Anthony R. Chief Education Officer Bureau for NESA	7/17-7/21

Invited Visitors (2) CY-1968

Name	Field	Dates of Visit	Places Visited
DICKINSON, David Univ. of Massachusetts	Mathematics	12/5-12/29	Various Places
DICKINSON, Alice B. (Mrs.) Univ. of Massachusetts	Mathematics	12/5-12/29	Various Places

Name	Field	Dates of Visit	Places Visited
JACOBSON, Nathan Yale Univ.	Mathematics	1/10-3/29	Various Places
JACOBSON, F.D. (Mrs.) Yale Univ.	Mathematics	1/10-3/29	Various Places
KING, L. Carroll Northwestern Univ.	Chemistry	6/8-7/9	Various Places
LIPPINCOTT, William T. Ohio State Univ.	Chemistry	6/15-7/6	Various Places
MORGAN, Robert	Engineering	11/18-11/25	
NASH, Leonard K. Harvard Univ.	Chemistry	6/15-7/7	Various Places
ROE, Arthur NSF/Washington	Chemistry	6/13-6/29	Various Places
TAMRES, Milton Univ. of Michigan	Chemistry	5/23-7/8	Various Places
TAUBE, Harry Stanford Univ.	Chemistry	6/15-7/6	Various Places
VOGELI, Barry D. Mount Union Coll.	Mathematics	5/23-6/21	Bombay
WILSON, Mathew K. NSF/Washington	Chemistry	6/16-6/29	Various Places

## Invited Visitors (21) CY-1969

Name	Field	Dates of Visit	Places Visited
BURKMAN, Ernest Florida State Univ.	Physics	6/15-6/26	Various Places
CAMPBELL, James A. Harvey Mudd Coll.	Chemistry	6/15-7/6	Various Places
COLES, James S. Research Corp., New York, N.Y.	Chemistry	6/13-7/6	Various Places
COOK, William B. Colorado State Univ.	Chemistry	6/9-7/9	Various Places
(CRAWFORD, Bryce L., Jr. Univ. of Minnesota	Chemistry	6/13-6/27	Various Places
DELAHAY, Paul J. New York Univ.	Chemistry	6/15-7/6	Various Places
GRAY, Harry B. Cal. Inst. of Tech.	Chemistry	6/15-7/6	Various Places
HAMMOND, George S. Cal. Inst. of Tech.	Chemistry	6/17-7/8	Various Places
HORNIG, Donald F. Eastman Kodak Co., Rochester, N.Y.	Chemistry	6/15-6/27	Various Places
HIEBERT, Gordon L. NSF/Washington	Chemistry	5/25-7/18	Various Places

## Invited Visitors (23) CY1970

Name	Field	Dates of Visit	Places Visited
BERN, Howard A. Univ. of California	Biology	11/5-11/30	Various Places
BRANSON, Herman Central Ohio St. Coll., Wilberforce, Ohio	Physics	6/21-7/3	Various Places
BREGMAN, Judith Polytechnical Inst., Brooklyn, N.Y.	Physics	6/19-7/22	Various Places
CHANDRASEKHAR, B.S. Case Western Reserve Univ.	Physics	6/16-7/15	Various Places
DIBLE, Earl W. Santa Monica Unified School Dist., Cal.	Ele. Science	4/8-7/5	Bombay
FOWLER, John M. Maryland Univ.	Physics	6/19-7/13	Various Places
FRENCH, Anthony P. Mass. Inst. of Tech.	Physics	6/21-6/28	Various Places
HARDIN, Garrett I. Univ. of Cal., Santa Barbara	Biology	11/15-12/16	Various Places
HOLTON, Gerald Harvard Univ.	Physics	6/7-6/28	Various Places
JOSSEM, E. Leonard Ohio State Univ.	Physics	6/19-7/17	Various Places
KNIGHT, Walter D. Univ. of California, Berkeley	Physics	6/17-7/7	Various Places

Name	Field	Dates of Visit	Places Visited
KOLCHIN, Ellis R. Columbia Univ.	Mathematics	1/31-4/2	Various Places
NEHER, Victor Calif. Inst. of Tech.	Physics	6/19-7/3	Various Places
NIXON, Richard M. Hobert & Eilliam Smith Coll.	Physics	4/17-5/12	Thiruchirapalli
PHILLIPS, Melba Univ. of Chicago	Physics	6/18-7/8	Various Places
PORTIS, Alan M. Univ. of Cal., Berkeley	Physics	6/15-7/1	Various Places
RAMSEY, Norman F. Harvard Univ.	Physics	6/21-7/10	Various Places
ROGERS, Eric Princeton Univ., Princeton, N.J.	Physics	6/7-7/17	Various Places
SANDS, Mathew Univ. of California, Santa Cruz	Physics	6/18 /10	Various Places
SCHWARZ, Guenter Florida State Univ.	Physics	6/17-7/22	Various Places
STRASSENBURG, Arnold A. St. Univ. of N.Y., Stony Brook, N.Y.	Physics	6/19-7/10	Various Places
TOLL, John St. Univ. of N.Y., Stony Brook, N.Y.	Physics	6/20-7/10	Various Places
WASAN, Darshanlal T. Illinois Inst. of Tech.	Engineering	12/23-12/31	Madras

## Invited Visitors (29) CY-1971

Name	Field	Dates of Visit	Places Visited
BARTON, Jay II West Virginia Univ.	Biology	6/15-7/6	Various Places
BRINDLEY, G.W. Pennsylvania State Univ.	Engineering	9/5-9/17	Various Places
BRODY, Marcia Hunter College	Biology	6/19-7/12	Various Places
BRONK, Detlev W. Rockefeller Inst.	Biology	6/23-7/11	Various Places
BULLOCK, Theodore H. Univ. of Cal., San Diego	Biology	6/12-7/18	Various Places
COSTLOW, John D. Duke Univ. Marine Lab.	Biology	6/22-7/7	Various Places
CREUTZ, Edward C. NSF/Washington		1/1-1/8	Bangalore
DAUBENMIRE, Rexford Washington State Univ.	Biology	6/19-7/7	Various Places
EYRING, LeRoy Arizona State Univ.	Chemistry	11/30-12/19	Various Places
GLASS, H. Bentley State Univ. of N.Y., Stony Brook, N.Y.	Biology	6/24-7/4	Bangalore
GODDARD, David R. Univ. of Penn.	Biology	6/22-7/9	Various Places

Name	Field	Dates of Visit	Places Visited
GORBMAN, Aubrey Univ. of Washington	Biology	6/21-7/4	Bangalore
HANSON, Earl D. Wesleyan Univ.	Biology	6/14-7/5	Various Places
HOPKINS, Johns W. Washington Univ.	Biology	6/14-7/8	Various Places
KASTRINOS, William Educational Testing Service	Biology	6/16-7/7	Various Places
LAETSCH, Watson M. Univ. of California	Biology	6/16-7/18	Various Places
MACKEY, George W. Harvard Univ.	Mathematics	1/3-5 & 2/3-8	Madurai & Chandigarh
MAYHEW, Wilbur W. Univ. of Cal., Riverside	Biology	6/10-7/7	Various Places
McCLUNG, Leland S. Indiana Univ.	Biology	6/14-7/3	Various Places
McMILLAN, Calvin Univ. of Texas	Biology	6/13-7/3	Various Places
NOBEL, Park S. Univ. of Cal., Los Angeles	Biology	6/20-7/11	Various Places
OWEN, Thomas B. NSF/Washington		6/27-6/30	Bangalore & Delhi

Name	Field	Dates of Visit	Places Visited
POLLACK, Henry O. Bell Telephone Lab.	Mathematics	4/15-4/20	Delhi & Jaipur
RAVIN, Arnold W. Univ. of Chicago	Biology	6/16-7/4	Various Places
RONKIN, R.R. NSF/Washington	Biology	6/18-7/11	Various Places
SAN PIETRO, Anthony Indiana Univ.	Biology	12/2-12/8	Bangalore
SCHEIN, Martin W. West Virginia Univ.	Biology	6/6-7/7	Various Places
STSSMAN, Alfred S. Univ. of Michigan	Biology	6/21-7/15	Various Places
TRIBE, M.A. Univ. of Sussex ,U.K.	Biology	6/25-7/2	Bangalore

## Invited Visitors (3) CY-1972

Name	Field	Dates of Visit	Places Visited
DOCTOR, B.P. Walter Reed Army Research Centre	Biology	1/2-1/5	Madurai
FODOR, Gabor B. West Virginia Univ.	Chemistry	2/6-2/24	Various Places
KELLEY, John Univ. of California, Berkeley	Mathematics	9/22-9/27	Delhi

Materials Produced as a Direct Consequence of SEIFBIOLOGY

1. "Biological Sciences: An Inquiry into Life." BSCS curriculum project. Reprinted in India through NCERT.
2. Indian adaptation of the Yellow Version BSCS prepared at Madurai University under leadership of Prof. S. Krishnaswamy. Published by NCERT in four volumes. Republished in two volume form by Tata-McGraw Hill. Awarded 1st award for best book produced in 1971-72 in category of "Reprints."
3. "Laboratory Experiments in Microbiology and Molecular Biology." Manual developed at the University of Madurai, under the University Leadership Project of COSIP.
4. "Experiments in Genetics." Manual developed at the University of Madurai, under the University Leadership Project of COSIP.
5. "Biological Sciences and National Development: Strategy for Progress." Proceedings of the conference on Education and Research in Life Sciences. Bangalore, 1971. Sponsored by NCSE, UGC, NSF and USAID.
6. New equipment

Densitometer, Van Slyke apparatus, water quality kit, genetics kit, microbiology kit, thin layer chromatography kit, electrophoresis kit, pH meter, oxygen meter, colorimeter, thermistor, developed at Universal Biochemicals, Madurai with guidance from Department of Life Sciences, University of Madurai.

CHEMISTRY

1. "Chemistry An Experimental Science." CHEMS curriculum project, reprinted in India through NCERT.
2. "Chemistry: An Experimental Science." Translated into Gujarati by SSI staff at Sardar Patel University. Hindi and Punjabi translations authorized.
3. "Chemistry: Experiments and Principles." One of the three authorized CHEMS revisions, reprinted in India through NCERT for use in SSIs. Permission has been granted for translation into Telugu through Telugu Akademi, Hyderabad.
4. "Experiments in General Chemistry." C.N.R. Rao and V. C. Agarwala. East-West Press 1967.
5. "Basic Physical and Chemical Data." L. S. Kothari and C.N.R. Rao. East-West Press, 1970.
6. "A Handbook of Chemistry and Physics." C.N.R. Rao, M. V. George, J. Mahanty and P. T. Narasimhan. East-West Press, 1967.
7. "General Chemistry, First Degree Course." N. V. Subba Rao and Staff of SSIs, Osmania University, S. Chand & Co., 1970.
8. "Chemistry, An Introductory Course." For the first year of Intermediate Course. (By staff of Andhra, Sri Venkateswara and Osmania Universities). Sri Saraswati Book Depot, Hyderabad-2.
9. Journal of Chemistry Teacher. Published by Sardar Patel University SSI Staff, Drs. R. P. Patel, R. D. Patel, Editors.
10. Indian Journal of Chemical Education. Sponsored by NCSE. Dr. V. Ramakrishna, IIT Delhi, Editor.

11. "Chemistry: Design for Innovation." Proceedings of the Conference on Chemical Education and Research held at Srinagar and Bangalore, June 1969. Sponsored by NCSE, UGC and NSF.
12. Instructional Material in Chemistry, for VIII and IX Standard. Prepared by the Department of Public Instruction in Mysore, State Institute of Science Education, Kumara Park West, Bangalore-20, with the assistance of NSF consultant.
13. "Refresher Course in Chemistry, Parts I and II." Dr. C.J. Sanchorawala. Community Science Center, Ahmedabad. These books draw directly from references 1 and 3 in large measure.
14. "Chemistry - Booklist." Prepared by the Chemistry Panel, NCSE 1969.
15. "Petroleum and Petrochemicals." Prof. R.D. Patel, Sardar Patel University. First of the Chemistry monograph series sponsored by the NCSE.
16. "The Blowup of the Chemistry Syllabus for TDC Part I." Prepared by the ULP in Chemistry, Panjab University, Chandigarh. This syllabus has been adopted by the four universities in the Punjab, Haryana and Himachal Pradesh. It represents a general chemistry approach, with direct derivation from references 1 and 3. A Teachers Guide has also been published for this Blowup. The second year Blowups are soon to be published.

#### Teaching Aids

1. Thermocole spheres. Initially produced by BASF Ltd., Bombay, with support from USAID. Now being produced by Guli Plastics, Bangalore.

## 2. Molecular models

- a. Ball and stick models
- b. Molecular framework models including kits for diamond, graphite, NaCl, Zn S.
- c. Molecular orbital models

a and b are manufactured by Dynam Engineering Corporation, Bangalore. NSF Staff Scientists and consultants have assisted Dynam in the development of these models. c are available through Dr. Sagi, Andhra University Chemistry Department. These models resulted from SSIs at Andhra.

## 3. Charts

Through COSIP a number of charts useful in teaching chemistry are now available in India. These include periodic charts, molecular orbitals, electronic energy levels, acid-base strengths, redox potentials, e/m experiment. All are derived from CHEMS and were initially introduced through SSIs.

PHYSICS

1. PSSC Physics, reprinted in India through NCERT. Telegu translation in preparation.
2. COSIP Curriculum development by ULP, Physics, Mysore University, derives from PSSC.
3. Instructional material in Hindi, prepared by State Board of Secondary Education, Rajasthan, derives from PSSC. Used in SSIs run by State Board, Rajasthan.
4. Syllabi for Secondary and Higher Secondary Examinations, 1972, onwards, based on PSSC, CHEMS, BSCS, and SMSG and SSI experience, State Board of Secondary Education, Rajasthan.
5. "Physics, Check-list of Books for College Libraries" prepared by Prof. J. Mahanty, IIT Kanpur, 1972. Recommended by Physics Binational Conference and published by NCSE.
6. "Journal of Physics Education." Sponsored by NCSE; Dr. V.G. Bhide, National Physical Laboratory, and Prof. L.S. Kothari, Delhi University, Editorial Committee.
7. Instructional Material in Physics for VIII Standard. Prepared by the Department of Public Instruction in Mysore, State Institute of Science Education, Kumara Park West, Bangalore-20.
8. "Physics in India: Challenge and Opportunities." Proceedings of the Conference on Physics Education and Research, Srinagar, 1970. Sponsored by the UGC, NCSE, NSF and USAID.
9. Physics Resource Material for Secondary School Teachers. Prepared by the Physics Staff, RCE Mysore.
10. "Physics News." Bulletin of the Indian Physics Association. The Association was organized as a consequence of the 1970 Conference on Physics Education and Research.

11. COSIP New Letter published monthly by the Andhra University Physics Dept.
12. COSIP Bulletin published by the Mysore Univ. Physics Dept.
13. "Creativity" a report by the Aligarh University Physics Dept.

#### Teaching Aids

1. PSSC Kits manufactured by Dynam Corporation, Bangalore. Widely used in SSIs, COSIP colleges.
2. Paper slide rules made by Nalanda Industries, Delhi. Widely used in SSIs. The SISE in Rajasthan developed a Guide to Slide-Rule in Hindi.
3. Cathode Ray tube developed at National Physical Laboratory
4. Super-8 film loop projector manufactured by Cinema Workshop, New Delhi
5. Overhead Projectors. Although Fresnel lenses are still imported, NSF Staff and consultants have encouraged manufacture in India. Now available from several companies. Used in COSIP Colleges.
6. Prototype science kit for middle school physics courses, Andhra Pradesh. Developed and field tested with assistance of NSF consultant.
7. College Physics Laboratory and Demonstration Equipment developed at IIT/Kanpur.

POLYTECHNIC

1. Flat Rolling Mill, fabricated at S. V. Govt. Polytechnic. Advanced Summer School in Material Technology.
2. Micro-Specimen Mounting Press, fabricated at S. V. Govt. Polytechnic. Advanced Summer School in Material Technology.
3. Curriculum materials for sandwich type Post Diploma Course in Production Metallurgy, prepared by Directorate of Technical Education, Government of Tamil Nadu, Madras.
4. The Effective Teaching - Learning Process. Four booklets prepared at the Curriculum Development Centre, College of Engineering, Guindy, Madras.
5. Curriculum development and workshops in evaluation techniques and methodology in educational research in technical education Curriculum Development Centre, T. T. T. I. Bhopal.

Teaching Aids

1. 1600 slides, 90 charts prepared for Metallurgy Curriculum Development work at Director of Technical Education, Madras.

MATHEMATICS

1. 8 volumes, College Mathematics developed by ULP staff, Bangalore University
2. 5 volumes, College Mathematics, developed by ULP staff, Panjab University.

ELEMENTARY SCIENCE and MATHEMATICS

(Bombay Municipal Corporation)

1. "Look and Discover" series. (Teachers' Guide) Standards I, II, III and IV. English, Hindi, Marathi, Gujarati and Urdu editions.
2. "Let's Find Out" series. (Pupils book). Standards I, II, III and IV. English, Hindi, Marathi, Gujarati and Urdu editions.
3. "Modern School Mathematics series Introductory book, Standards I, II, III and IV English edition (Teachers' guides and Marathi and Gujarati editions are to be published for each level)
4. Geoboards. Teaching aid for elementary mathematics. Lesson plans, teachers guides developed at Municipal Corporation, Bombay. Manufactured in India by P. S. Plastics Industries, Bombay and Dynam Engineering Corporation, Bangalore.

GENERAL

Science Resource Letter. Sponsored by NCSE 1967-73.

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\* This information was taken from the "Information Brochure, 1970" published by Amar Printing Press, E-24/3 Hauz Khas, New Delhi-16

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Indian Institute of Technology, Kanpur
3. Prof. U.N. Singh, Head  
Department of Mathematics  
Delhi University, Delhi
4. Prof. P.C. Vaidya, Head  
Department of Mathematics  
Gujarat University, Ahmedabad
5. Prof. M. Venkataraman, Head  
Department of Mathematics  
Madurai University, Madurai
6. Prof. R.S. Verma, Head  
Department of Mathematics  
Delhi University, Delhi

Convener



PHYSICS

1. Dr. V.G. Bhide, Deputy Director  
National Physical Laboratory  
New Delhi Convener
2. Prof. J. Bhimasenachar, Head  
Department of Physics  
Sri Venkateswara University, Tirupati
3. Prof. S. Chandrasekhar, Head  
Department of Physics  
Mysore University, Mysore
4. Prof. L.S. Kothari  
Department of Physics  
Delhi University, Delhi
5. Prof. B.D. Nag Chaudhury  
Member (Education)  
Planning Commission New Delhi
6. Prof. D.D. Pant, Head  
Department of Physics  
The D.S.B. College, Mainital
7. Prof. G.N. Ramachandran, Head  
Department of Physics  
Madras University, Madras
8. Prof. B. Ramachandra Rao, Head  
Department of Physics  
Andhra University, Waltair
9. Dr. K.B. Shah  
Director  
Community Science Centre, Ahmedabad

MEDICINE

1. Dr. B.K. Anand  
Professor of Physiology & Vice-Dean  
All India Institute of Medical Sciences, New Delhi
  2. Dr. B.K. Bachawat  
Professor of Biochemistry  
Christian Medical College & Hospital, Vellore
  3. Dr. J.B. Chatterjea, Director  
School of Tropical Medicine  
Calcutta
  4. Lt. Gen. S.N. Chatterjee, MC, PHS,  
Director of Medical Services  
Army Headquarters, New Delhi
  5. Dr. P.N. Chuttani  
Dean & Director-Professor of Medicine  
Postgraduate Institute of Medical Education & Research  
Chandigarh
  6. Col. S.K. Mazumdar, Director  
Institute of Nuclear Medicine & Allied Sciences  
Delhi
  7. Dr. V. Ramalingaswami  
Professor of Pathology  
All India Institute of Medical Sciences, New Delhi
  8. Dr. Ramji Das  
Professor & Head of the Department of Anatomy & Principal  
Medical College, Patiala
  9. Dr. U.K. Sheth, Head  
Department of Pharmacology  
Seth G.S. Medical College, Bombay
  10. Dr. A. Venugopal, Hony. Surgeon  
Govt. General Hospital & Kensington Nursing Home  
Madras
  11. Dr. K.L. Wig  
Formerly Director  
All India Institute of Medical Sciences, New Delhi
- ..... Convener

POLYTECHNIC

1. Dr. S.K. Barua  
Director of Technical Education Assam  
Shillong
2. Prof. S.K. Das, Principal  
Technical Teachers Training Institute  
Madras
3. Shri S.P. Datta, Director  
Technical Education  
Government of Rajasthan, Jodhpur
4. Shri M.K. Ganesan, Principal  
Central Polytechnic  
Madras
5. Prof. A.A. Jambulingam, Principal  
Technical Teachers Training Institute  
Madras
6. Shri R.N. Kapoor, Principal  
Allahabad Polytechnic  
Allahabad
7. Prof. P.S. Kalwachwala  
Director of Technical Education  
Government of Gujarat, Ahmedabad
8. Prof. A.A. Kulkarni, Head  
Physics Department  
Victoria Jubilee Technical Institute, Bombay
9. Shri G.Y. Mangulkar ..... Convener  
Staff Training Officer  
Tata Iron & Steel Company Ltd., Jamshedpur
10. Dr. T. Muthian  
Director of Technical Education  
Madras
11. Shri R. Murthuswami  
Superintendent of Training  
Bhilai Technical Institute, Bhilai Steel Plant, Bhilai
12. Col. S.G. Pendse  
Director of Employment & Training  
Directorate-General of Employment & Training, New Delhi
13. Shri Y. Saran, Principal  
S.V. Government Polytechnic  
Bhopal
14. Shri N.N. Sen Gupta, Principal  
Calcutta Technical School  
Calcutta

ENGINEERING

1. Dr. G.N. Acharya, Head  
Electronic Instrumentation  
Central Electronics Engg. Res. Inst., Pilani
2. Dr. Braham Prakash, Director  
Metallurgy Group  
Atomic Energy Establishment, Bombay
3. Shri G.R. Damodaran, Principal  
P.S.G. College of Technology  
Coimbatore
4. Prof. R.N. Dogra, Director Convener  
Indian Institute of Technology  
New Delhi
5. Dr. Jagdish Narain  
Department of Civil Engineering  
University of Roorkee, Roorkee
6. Dr. C.S. Jha, Head  
Department of Electrical Engineering  
Indian Institute of Technology, New Delhi
7. Prof. N. Keshav Murthy  
Department of Electrical Engineering  
Indian Institute of Technology, Kharagpur
8. Prof. R.C. Narayanamurthy, Head  
Department of Mechanical Engineering  
Indian Institute of Technology, Madras
9. Prof. Ramaswamy, Director  
Structural Engineering Research Centre  
Roorkee
10. Dr. L.S. Srinath  
Professor of Electrical Engineering  
Indian Institute of Technology, Kanpur
11. Dr. N.M. Swani, Head  
Department of Textile Technology  
Indian Institute of Technology, New Delhi
12. Dr. D. Venkatesvalu, Head  
Department of Chemical Engineering  
Indian Institute of Technology, Madras

BIOMEDICAL ENGINEERING

1. Shri L.S. Chandrakant  
**Jt. Educational Advisor**  
Ministry of Education & Youth Services, New Delhi
2. Surgeon Comdr. A.K. Deb  
Defence Electronics & Research Establishment  
Bangalore
3. Prof. R.N. Dogra, Director  
Indian Institute of Technology  
New Delhi
4. Prof. S.K. Guha  
Department of Electrical Engineering  
Harcourt Butler Technological Institute, Kanpur
5. Col. S.K. Majumdar, Director  
Institute of Nuclear Medicine & Allied Sciences  
Delhi
6. Dr. A.S. Paintal, Director  
V.P. Chest Institute  
University of Delhi, Delhi
7. Prof. A. Shankaran  
Professor of Orthopaedic Surgery  
Maulana Azad Medical College, New Delhi
8. Dr. K.L. Wig Convener  
Formerly Director  
All India Institute of Medical Sciences, New Delhi

## Participants Trained (7) CY-1967

Name	Present Position	Dates of Study Tour
KOTHARI, L.S. Delhi University	Professor of Physics	6/21-8/5
KRISHNASWAMY, S. Madurai University	Head Department of Biological Sciences	8/2-10/4
NAG CHAUDHURI, B.D. Ministry of Defence	Scientific Advisor to the Minister of Defence	6/8-8/10
PAUL, R.C. Panjab University	Head Department of Chemistry	6/14-9/25
SINGH, U.N. Delhi University	Head Department of Mathematics	8/2-9/29
SUBBA RAO, N.V. Osmania University	Head Department of Chemistry	8/14-10/5
SWANI, N.M. Indian Institute of Technology, Delhi	Head Department of Textile Technology	6/8-7/29

Participants Trained (18) CY-1968

Name	Present Position	Dates of Study Tour
BHIDE, V.G. National Physical Laboratory	Deputy Director	9/28-12/27
DESHPANDE, R.D. University Grants Commission	Joint Secretary	8/14-10/8
JHA, C.S. IIT New Delhi	Professor & Head Dept. of Electrical Engineering	8/1-10/1
KAPOOR, R.N. Allahabad Polytechnic	Principal	8/7-11/10
KATTI, R.K. IIT Bombay	Professor & Head Dept. of Civil Engineering	8/3-10/27
MOHAMAD, Jan Jammy & Kashmir University	Professor & Head Dept. of Mathematics	11/2/68-2/7/69
NARAYANAMURTHI, R.G. IIT Madras	Professor & Head Dept. of Mechanical Engineering	8/3-11/21
NIGAM, A.N. University of Rajasthan	Reader Dept. of Physics	9/28-12/27
PANT, D.D. D.S.B. Government College, Nainital	Principal	9/28-12/27
PATEL, R.P. Sardar Patel University	Reader Dept. of Chemistry	9/11-12/6

Name	Present Position	Dates of Study Tour
RAJAMANNAR, P.V. Delhi University	Reader Dept. of Zoology	10/7/68-1/3/69
RAO, B. Ramachandra Andhra University	Professor & Head Dept. of Physics	9/28-12/31
REDDI, O.S. Osmania University	Professor & Head Dept. of Genetics	9/18-12/12
ROHATGI-MUKHERJEE, K.K. Jadavpur University	Reader Dept. of Chemistry	8/6-11/18
SARAN, Y. Technical Teachers Trg. Inst., Bhopal	Principal	9/8-12/9
SRINATH, L.S. Indian Institute of Science	Professor Dept. of Mechanical Engineering	9/6-12/5
VAIDYANATHAN, T.K. Technical Teachers Trg. Inst., Chandigarh	Principal	9/23-12/27
WANCHOO, V.N. Directorate of Education, Delhi	Additional Director of Education	9/4-11/16

Participants Trained (15) CY-1969

Name	Present Position	Dates of Study Tour
ARNIKAR, H.J. Poona University	Senior Professor & Head Dept. of Chemistry	9/20/69-1/6/70
AJLUCK, F.C. Delhi University	Head Physics & Astro-Physics Dept.	9/30-12/30
BANERJEE, D. Bengal Engineering College, Calcutta	Principal	9/24-12/27
BHATT, K.J. L.D. College of Engineering, Ahmedabad	Professor & Head	9/1-12/9
DOSS, T.R. Directorate of Technical Education Government of Andhra Pradesh	Director	9/3-12/12
DUBALE, M.S. Gujarat University	Reader & Head Dept. of Zoology	9/3-12/6
GANESAN, M.K. College of Engineering, Madras	Head Curriculum Development Cell	9/1-12/9
IYENGAR, S. State Council of Educational Research and Training, Hyderabad	Lecturer	9/3-12/12
KULKARNI, A.A. V.J. Technical Institute, Bombay	Professor & Head	8/27-12/9

Name	Present Position	Dates of Study Tour
MANDE, C. Nagpur University	Professor & Head Dept. of Physics	9/25/69-1/5/70
MEHROTRA, R.C. Rajasthan University	Professor & Head Dept. of Chemistry	10/11/69-1/4/70
NAGARAJAN, A. Univ. Botany Laboratory, Madras	Zoologist	9/14/69-1/1/70
PITRE, B.G. The Doon School, Dehra Dun	Senior Physics Master	8/26-12/4
PRASAD, Rajender NCERT (R.C.E.) Bhopal	Field Advisor	9/14/69-1/1/70
SHENOI, K.V. Directorate of Public Instruction, Mysore	Jt. Director of Public Instruction	9/3-12/4

Participants Trained (19) CY-1970

Name	Present Position	Dates of Study Tour
BEEDKAR, S.R. Directorate of Technical Education Government of Madhya Pradesh	Director	1/29-5/23
BHIMASENACHAR, J. Sri Venkateswara University	Professor & Head Dept. of Physics	10/3-12/29
BISWAS, M.M. Technical Teachers Trg. Inst., Calcutta	Professor & Head Dept. of Science	10/3/70-1/4/71
IOSE, A.N. National Council for Educational Research & Training, New Delhi	Head Dept. of Science	9/26-12/16
COPINATH, N. All India Institute of Medical Sciences	Professor of Thoracic Surgery	10/2-12/24
CUHA, S.K. Harcourt Butler Tech. Inst., Kanpur	Professor & Head Dept. of Electrical Engineering	9/5-11/14
KUTTY, M.N. Madurai University	Reader Dept. of Biological Sciences	9/5-11/29
LAKHANPAL, M.L. Panjab University	Professor Dept. of Chemistry	10/3-12/16
MENON, K.B. IIT Kharagpur	Head Dept. of Electrical Engineering	9/26-12/17
PATHAK, P.D. Gujarat University	Head Dept. of Physics	9/5-12/6

Name	Present Position	Dates of Study Tour
PURI, M.R. University of Jammu	Professor Dept. of Mathematics	9/26-12/22
ROW, L. Ramachandra Andhra University, Waltair	Professor & Head Dept. of Chemistry	9/26-12/13
SARAF, B.L. Rajasthan University	Professor & Head Dept. of Physics	9/26-12/21
SEN, S.N. M.S. University of Baroda	Head Dept. of Electrical Engineering	9/5-12/15
SHAH, (Mrs.) Madhuri R. Bombay Municipal Corporation	Education Officer	5/8-8/15
SHARMA, A.K. Panjab University	Reader Dept. of Chemistry	1/30-5/2
SINHA, D.K. Jadavpur University	Reader Dept. of Mathematics	9/26-12/7
SIVALINGAM, T.P. Directorate of Technical Education Government of Tamil Nadu	Director	9/5-12/19
SUXENA, M.R. Osmania University	Professor & Head Department of Botany	10/3-12/29

Participants Trained (18) CY-1971

Name	Present Position	Dates of Study Tour
ABROL, M.L. P.G. D.A.V. College, New Delhi	Head Dept. of Mathematics	6/20-9/6
DAS GUPTA, S.M. Indore University	Director, G.S.I.T.S. Indore & Professor of Electronics	7/11-10/1
DEO, B.B. Utkal University	Professor Dept. of Physics	2/14-6/26
DUBE, Y.M. State Institute of Science Education Poona	Director	6/20-9/12
GEORGE, M.V. IIT Kanpur	Professor Dept. of Chemistry	9/18-12/14
GOEL, S.N. Jodhpur Polytechnic	Principal	7/18-10/11
JAIN, A.C. Jammu University	Professor & Head Dept. of Chemistry	7/18-10/1
KAR, Subir IIT Bombay	Professor & Head Dept. of Mechanical Engineering	7/18-9/17
NARAYAN, D. Shankar University Grants Commission	Additional Secretary	8/15-10/15

Name	Present Position	Dates of Study Tour
RAJAN, J.M.T. State Institute of Science Education Bangalore	Director	6/19-9/17
RAMACHANDRAN, A. Dept. of Science and Technology	Secretary	9/19-11/20
RAMAKRISHNA, V. Defence Res. & Dev. Organization	Chief Scientist	1/10-4/5
RAO, P. Venkata IIT Madras	Professor & Head Dept. of Electrical Engineering	7/10-9/20
RAO, Rajamadhav Regional College of Education, Mysore	Head Dept. of Science (Physics)	6/12-9/17
RAO, T.S. Poona University	Reader Dept. of Nuclear & Rad. Chem.	9/5-11/8
SINGH, C.P. Agra College	Professor & Head Dept. of Zoology	7/14-9/24
TANDON, H.D. All India Institute of Medical Sciences	Professor & Chairman Dept. of Pathology	9/26-12/7
VARMA, J. Udaipur University	Professor & Head Dept. of Physics	8/1-9/19