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EVALUATION REPORT

On

**The Centrally-Sponsored Programme for
Improvement of Secondary Education—
Strengthening of Science Laboratories
& Special Training of Science Teachers**

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PLANNING COMMISSION, GOVERNMENT OF INDIA

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GOVERNMENT OF INDIA
PLANNING COMMISSION

THE CENTRALLY SPONSORED PROGRAMME
FOR THE
IMPROVEMENT OF SECONDARY EDUCATION
STRENGTHENING OF SCIENCE LABORATORIES
AND
SPECIAL TRAINING OF SCIENCE TEACHERS.
(CRASH PROGRAMME)

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A N E V A L U A T I O N R E P O R T

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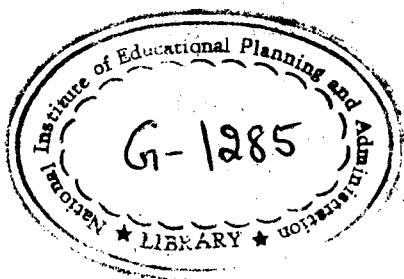
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INTRODUCTION

1.1 At a meeting held in Yojana Bhavan, New Delhi, on the 14th December, 1966, under the chairmanship of the Secretary, Planning Commission, and attended by representatives of Union Ministries of Education and Finance and the University Grants Commission, it was decided to request the Programme Evaluation Organisation of the Planning Commission to make a quick evaluation of the progress of the centrally sponsored schemes relating to the strengthening of science teaching in schools (Crash Programme). Since the Programme Evaluation Organisation was unable to take up this assignment owing to its preoccupation with other enquiries, it was decided to entrust the job to an Evaluation Team consisting of Shri A.H. Hemrajani, Director (Education), Planning Commission and Dr. M. C. Pant, Professor of Science Education in the Department of Science Education, National Council of Educational Research and Training.

1.2 Owing to the limited time at their disposal, the members of the Evaluation Team could visit only six States, viz. Punjab, West Bengal, Madhya Pradesh, Andhra Pradesh, Maharashtra and Uttar Pradesh. In the course of their visits, the members held consultations with the officers of the State Departments of Education and the State Institutes of Science Education. They visited a few schools in each of the States - both in rural and urban areas, inspected their science laboratories and discussed with headmasters and science teachers arrangements for the teaching of science in their schools. The total number of schools visited was 35. The details of the Team's itinerary are given in Appendix I.

1.3 The Union Ministry of Education and the Education Departments of all State Governments (except Nagaland) were requested to supply detailed information in regard to the implementation of the Programme. Although they were reminded, the Governments of Assam, Bihar, Jammu & Kashmir, Madras, Orissa and Rajasthan failed to furnish the information. In the absence of full information concerning the progress of the Programme in all the States, this report remains incomplete. However, the members of the Team feel that delay in the submission of the report for an indefinite period would defeat the very object for which the Team was set up. Accordingly this report has been prepared on the basis of the available data and is submitted in the belief that although incomplete, it will be found useful in putting to more effective use the funds which may be sanctioned under this programme and other Programmes of science education during the Fourth Plan period.

1.4 Finally, the members of Team wish to express their gratitude to all those officials, headmasters and teachers who assisted the Team in its work, often at considerable personal inconvenience.

2. The Crash Programmes - a brief account

2.1 Like the two earlier Plans, the Third Plan laid great stress on the teaching of science in secondary schools. The object was two-fold - to introduce the teaching of general science in all secondary schools as a compulsory subject and to provide facilities for teaching science of an elective standard in 9,500 out of about 21,800 secondary schools. A number of supporting measures were envisaged including the revision of science syllabi, the preparation of suitable text-books and supplementary reading materials and the provision of in-service training programmes for science teachers both in content and methodology. The programme was placed entirely in the State sector. The Union Government had no direct responsibility, financial or otherwise, for the success of the programme.

2.2 In June 1963, a Conference of State Education Secretaries was convened in New Delhi to review the progress of important educational programmes included in the Third Plan. Naturally science education in schools received much attention at the Conference. While the State representatives were agreed on the need for fulfilling the Third Plan targets in respect of science education at the secondary stage, they pleaded for additional funds from the Union Government over and above the ceiling of financial assistance promised to the States under the Plan. This led to the formulation of a 'Special Centrally Sponsored Programme for the Improvement of Secondary Education'. The details of the Programme were communicated to the State Governments by the Union Education Secretary in his letter No. F.11-2/64-SEI, dated 30th June, 1964. Under the programme, assistance was provided to the States for the following three schemes:-

- a) Strengthening of science laboratories.
- b) Special training of science teachers.
- c) Improvement of school libraries.

The present evaluation report is confined to the schemes in parts (a) and (b) of the Programme. The full text of the two schemes is given in Appendix II.

2.3 The decision of the Union Government to participate actively in the planned development of science education in schools was in keeping with its earlier decision to set up the Department

of Science Education under the National Council of Educational Research & Training. The Department has responsibility for revision of science and mathematics curricula in schools and preparation of text-books and other instructional materials in science and mathematics for school pupils. The Department also organises science talent search and collaborates with the University Grants Commission in arranging Summer Institutes for mathematics and science teachers working in secondary schools. The Central Science Workshop of N.C.E.R.T. is engaged in fabricating prototypes of science apparatus used in school laboratories. An important objective of the Crash Programme was to create an agency at the State level with functions more or less analogous to those assigned to the Department of Science Education, N.C.E.R.T., at the national level. The Programme emphasised the need for close association of the Department of Science Education in all efforts at the State level for raising the standards of science education in schools. It was envisaged that the State Institutes of Science Education would provide the necessary links for such close association.

Scheme for strengthening of science laboratories

2.4 The objective of the scheme is to strengthen the science laboratory equipment in secondary schools to the prescribed norms so that students at this crucial stage of education receive better and more practical instruction in basic science subjects, viz. physics, chemistry and biology.

2.5 The salient features of the scheme are:-

i) All recognized and aided schools, under any management, teaching science subjects in secondary classes (class VIII/IX and above), will be eligible for assistance under the scheme. For the present, the scheme will cover only the schools established upto the end of the Second Plan.

ii) State Governments will lay down standard lists of laboratory equipment to serve as norms for different types of secondary schools depending on the nature of science course taught in them. In the case of higher secondary schools, the minimum essential equipment indicated in COPP Team's Report on Science Laboratories in Higher Secondary Schools will, with suitable modifications, be generally taken as the norm.

iii) 5% of the grant under the scheme could be spent on laboratory furniture. Another 2% of the grant could be utilized, if considered necessary, on the purchase of consumable science material.

iv) Central assistance to States will be calculated on the assumption that the average cost of bringing different types of secondary schools to the prescribed norms would be as follows:-

- a) Higher secondary school or Intermediate college with facilities for teaching physics, chemistry and biology Rs. 12,000
- b) Higher secondary school or Intermediate college with facilities for teaching physics and chemistry Rs. 8,000
- c) High school with facilities for teaching elective science Rs. 4,000
- d) High or higher secondary school with facilities for teaching general science Rs. 2,000

The actual assistance to an individual school will, however, depend upon the gap between its existing equipment and the prescribed norm. The items to be purchased will be those which are actually needed by each institution for attaining the prescribed norms.

v) The State Government and/or private managements will make up the deficiency in respect of laboratory rooms and furniture. The State Government will also ensure that properly qualified science teachers are appointed in the schools covered under the scheme.

vi) It will be ensured that: (a) the Central assistance is used fully and properly, (b) the quality of apparatus purchased is good and prices are reasonable, (c) for Government and local body schools the purchases are made in bulk, wherever feasible, and preference is given to firms willing and able to supply material according to ISI standards, and (d) all laboratory equipment and apparatus will be properly maintained and kept in good repair.

vii) No new school will be given recognition unless it is provided with laboratory equipment according to the prescribed norm.

viii) A committee consisting of officials of the Union Government and the State Governments will be set up to review the progress of the Programme from time to time.

Scheme for Special Training of Science Teachers

2.6 The objectives of the scheme are: (a) to meet the deficiency of post-graduate teachers in higher secondary schools by arranging special condensed courses for existing graduate science teachers, (b) to organise short training courses for science teachers to improve their competence, and (c) to set up State Units of Science Education (to be converted in the Fourth Plan into State Institutes of Science Education) to undertake quick surveys of the position of science teaching in their States, to organise various training programmes and also to undertake other activities for strengthening of science education, viz. revision of curriculum, preparation of text-books, improvement of teaching methods, laying down norms of laboratory equipment, etc.

2.7 The salient features of the scheme are:-

i) States, which have adopted the higher secondary pattern, will, organise 9-month course mainly in subject content for existing graduate science teachers in science faculties of selected universities or post-graduate colleges.

ii) 10-week courses will be organised in the science departments of universities or post-graduate colleges.

iii) State Units of Science Education will be staffed by a director, two technical assistants and a small office establishment.

Cost patterns have been indicated in the scheme for the training courses and the Unit of Science Education.

State Institute of Science Education

2.8 (a) The State Unit of Science Education will be expanded in the Fourth Plan into a full-fledged State Institute of Science Education with the following functions:-

i) To reconstruct the science curriculum at school stage on the basis of continuous studies and experimentation;

ii) To prepare text-books and other reading material on science for students and teachers;

iii) To devise measures for improved experimental and laboratory work in science;

iv) To design and organise in-service training courses for teachers of science;

v) To organise post-graduate condensed courses for science teachers at the school level;

vi) To design improved methods of pre-service training of science teachers;

vii) To organise training programmes for science teachers in co-curricular activities;

viii) To prepare instructional materials, including teaching aids, for science education for the guidance of schools;

ix) To collaborate with other organizations in promoting experimental work in improved science teaching; and

x) To undertake all other work directed to improve teaching of science in the State.

(b) The Institute will function as the technical arm of the Directorate of Education and/as the State level counterpart /also of the Department of Science Education, N.C.E.R.T. The Institute will adopt to local conditions the results achieved by the Department of Science Education, N.C.E.R.T. and reach them to schools within the State.

(c) The State Institute of Science Education should be integrated with the State Institute of Education.

(d) A fully equipped practising school should be attached to the State Institute of Science Education in order to provide facilities for training and research.

(e) The Institute will be located in a university so that it may receive guidance and assistance in its work for university teachers and also derive benefit from the laboratory, library and other facilities available in the university. Further, an advisory committee consisting of representatives of state department of education, training colleges, heads of secondary schools and state association of science teachers will be set up to guide the working of the Institute.

The staffing pattern of the Institute as well as ^{of} the practising school is indicated in the scheme.

3. Crash Programme - its implementation

3.1 As explained in the preceding chapter, the Crash Programme consists of two inter-related schemes, viz. supply of laboratory equipment to schools and the training of science

teachers. In the present chapter, an attempt has been made to explain briefly how the two schemes have been implemented in different States. It will be observed that States have adopted different procedures for the purchase and supply of laboratory equipment to schools. There are also wide variations in the organisation of training programmes and setting up of the State Units/Institutes of Education. These have been described in somewhat greater detail in the tour reports of the Team (Appendix III).

Supply of Laboratory Equipment and Apparatus

3.2 Andhra Pradesh

i) In 1964-65, the Special Inspector in Science in the office of the D.P.I., sent standard lists of science apparatus to schools, ascertained their requirements and calculated the grants separately for each school on the basis of information received from schools. In some cases, grants were sanctioned on an ad-hoc basis and the amount sanctioned in such cases was Rs. 2,000. Since the earlier experience of making purchases through the Central Stores Purchases Department of the Andhra Pradesh Government was not encouraging, it was decided to permit the headmasters of government schools, to make purchases direct after calling for tenders. In the case of the aided, municipal and zilla parishad schools, grants were made to the managements who made the purchases direct from suppliers. A list of eight firms dealing in science apparatus was suggested to the managements. Sanction for grants were issued on 17.11.1964 and on 6.3.1965. While the grants were to be disbursed before the end of the financial year, the managements were required to utilise the grants within a 'reasonable period'. The District Education Officers were instructed to arrange the physical verification of the articles. The sanction letter also laid down that the cost of articles purchased from the grant should not exceed by 10% the cost indicated in the standard lists prepared by the Department.

ii) In 1965-66, the procedure of the previous year was followed. In many cases, grants were sanctioned on an ad-hoc basis at the rate of Rs. 2,000 per school. Some of the grants were released in March, 1966.

iii) In 1966-67, the grants were released on a purely ad-hoc basis. The rates of grants were: Rs. 12,000, Rs. 8,000, Rs. 4,000 and Rs. 2,000, the averages suggested in the centrally sponsored schemes. This was due to the fact that the post of Special Science Inspector in the D.P.I.'s office was withdrawn in that year.

3.3 Assam

No information was received from the State Government.

3.4 Bihar

No information was received from the State Government.

3.5 Gujarat

i) The assistance is limited to Rs. 4,000 in the case of high schools teaching elective science and to Rs. 2,000 in the case of high schools teaching general science. Varying amounts were sanctioned to different schools.

ii) Every school was required to work out its requirements after referring to the standard list sent to all schools, keeping in view the equipment the schools already possessed.

iii) While purchasing equipment, schools were advised to give priority to equipment and apparatus required for class demonstration and experiments to be performed by the pupils as laid down in the syllabus. Funds left over could be utilized for purchase of film-strip projectors, film-strips, compound microscopes, epidiascopes, and 16 m.m. film projectors. Purchase of tape-recorders and amplifiers was banned.

3.6 Haryana

i) The State came into being in 1966-67. During that year the State sanctioned grants to schools on the basis of their requirements. The amount of grant was assessed in each case on the basis of enrolment of science students, the equipment already available in the schools and the equipment needed by the schools in accordance with the norms prepared by the State Science Education Unit. Purchases of equipment were restricted to items included in the standard list.

ii) A Purchase Committee was set up to fix specifications, approve firms and rates of all such articles that were not already on rate contract. Heads of institutions were required to purchase their requirements only from firms that were approved by the Purchase Committee or were on rate contract.

3.7 Jammu & Kashmir

No information was received from the State Government.

3.8 Kerala

i) A list of essential equipment for teaching general science in high schools was prepared and circulated to all schools. The requirements of each school were ascertained in relation to the norms laid down. After consolidating the requirements of selected schools, equipment was purchased centrally and then distributed to schools.

ii) In 1964-65, tenders were invited for the supply of equipment and the firms were required to submit samples. As the number of samples received was small, only a limited number of items could be purchased and distributed. Only 150 schools were supplied with equipment, of which 90 schools got equipment worth Rs. 756.80 each and the remaining 60 schools worth Rs. 390.50 each.

iii) During 1965-66, a more elaborate procedure was followed. Tenders were invited by the D.P.I. and firms were required to furnish samples to the three Regional Deputy Directors. The Regional Deputy Directors appointed Committees for examination of samples and selection of equipment on the basis of price and quality. Orders were placed with the firms after obtaining Government's approval. The supplies to schools were made through the 24 District Educational Officers. Equipment worth Rs. 5,40,936.64 was distributed.

iv) During 1966-67, the same procedure was followed but the samples were examined by a committee set up in the State Institute of Science Education. Besides, as many as 33 items of the value of Rs. 3 lakhs were entrusted for manufacture to the Government Small Scale Industries Units. The State Institute of Science Education furnished detailed specifications regarding each item and approved the prototypes before the manufacture was actually started. This procedure was adopted to ensure supply of good quality equipment at reasonable price.

3.9 Madhya Pradesh

i) An inventory of science equipment was prepared by the Education Department. The printed copies of the inventory were supplied to higher secondary schools. Their requirements were called in the inventory itself.

ii) In 1964-65, no grant was given to individual higher secondary schools for the purchase of science equipment. However, science equipment was centrally purchased at Bhopal and the equipment was then distributed to 426 higher secondary schools in Madhya Pradesh.

Supplies of science equipment were calculated as follows:-

- a) Schools teaching physics and chemistry and biology @ Rs. 2,475
- b) Schools teaching physics and chemistry @ Rs. 1,500
- c) Schools teaching general science only @ Rs. 500

Actual requirements of individual schools were collected through printed proformae, consolidated and taken into consideration while distributing science equipment.

iii) In 1965-66, the general basis of selection of schools for strengthening of science laboratories was the same as in 1964-65. Supplies to individual schools were calculated as follows:-

- a) Schools with physics, chemistry and biology @ Rs. 5,110
- b) Schools with physics and chemistry @ Rs. 3,000
- c) Schools with general science only @ Rs. 2,000

Actual requirements of the individual schools were taken into consideration while distributing science equipment. Science equipment was supplied to schools in three ways:-

- a) Some costly and precision equipment was purchased centrally at Bhopal and then distributed to schools through the respective Divisional Superintendents of Education.
- b) Rest of the material was supplied to schools directly by the firms.
- c) Science equipment was supplied at divisional head quarters and then supplied to schools.

iv) In 1966-67, the general basis of selection of schools for strengthening of science laboratories was the same as adopted during 1964-65 and 1965-66. Supplies to schools were calculated as follows:-

- a) Schools teaching physics, chemistry and biology @ Rs. 4,480
- b) Schools teaching physics and chemistry @ Rs. 2,000
- c) Schools teaching general science @ Rs. 1,500

Actual requirements of each school were taken into consideration while distributing science equipment. Some equipment is being supplied to schools directly by the firms while the rest is purchased centrally and then distributed to schools through the respective Divisional Superintendents of Education. Also, some amount is placed at the disposal of the schools to make direct purchase of glassware and chemicals from dealers and at prices, approved by the D.P.I.

Procedure for the purchase of science equipment

The following procedure was adopted in the purchase of science equipment.

- a) Tenders were called for the purchase of science equipment on an all-India basis.
- b) Comparative charts were prepared, on the basis of which samples were called, inspected and selected.
- c) Rates were approved by the Inter-Departmental Purchase Committee consisting of the following:
 - 1. Education Secretary to the Government.
 - 2. Deputy Secretary, Finance Department.
 - 3. Director of Education.
 - 4. Joint Director, Collegiate Education.
 - 5. Director, Institute of Science Education.

3.10 Madras

No information was received from the State Government.

3.11 Maharashtra

i) The State Government decided to allocate to every higher secondary school a sum of Rs. 8,000 and to every high school a sum of Rs. 2,000 for purchase of science equipment from the funds provided under the Crash Programme. A standard list of equipment was sent to all schools. The schools were required to make purchase of equipment, according to their needs, from the items included in the list.

ii) Since most of the schools established prior to 1960-61 were given grants in the first two years, i.e. in 1964-65 and 1965-66, it was possible to utilise in 1966-67, only a sum of Rs. 2.62 lakh out of the grant of Rs. 24.65 lakh placed at the disposal of the State by the Central Government. Further, the sanction for grants for 1966-67 was issued only on 31.3.1967 and it is, therefore, not known what part of the funds could be actually spent by the grantee institutions.

3.12 Mysore

i) In 1964-65, the D.P.I. circulated a standard list of minimum essential equipment for high and higher secondary schools to all schools. The heads of schools were required to submit their actual requirements in the light of the norm, in the prescribed proformae. Purchases were to be made only from the firms approved by the Stores Purchase Committee of the Mysore Government. The Committee was to issue a rate contract. Grants were sanctioned to 38 class XI schools at rates varying from Rs. 3,500 to Rs. 8,700. Other high schools, 184 in number, received grants at two rates, viz. Rs. 2,400 and Rs. 2,100.

ii) During 1965-66, managements of non-government institutions were asked to share 25% of the expenditure on purchase of equipment. Items for which rate contract had been issued were to be purchased only from firms approved by the States Purchase Committee. For other items, the schools were advised to make direct purchases after calling for at least three quotations. Grants were given upto Rs. 12,000 to higher secondary schools with facilities for teaching physics, chemistry and biology and upto Rs. 8,000 to higher secondary schools with facilities for teaching physics and chemistry. In the case of high schools, the ceiling was Rs. 4,000. The actual amount was calculated on the basis of requirement of each school. Schools which received grants in 1964-65 were given additional grants upto the ceilings indicated above, if that was considered necessary.

iii) In 1966-67, the procedure followed was the same as in the preceding year. However, in the case of 250-non-government schools, 'which existed in the Second Plan and which started elective science', grant was limited to Rs. 2,800 only. Instructions were also issued that in case of items outside the rate contract list, final approval for purchase of items should be sought from the Deputy Directors. The schools were asked not to accept any sub-standard article.

iv) According to the Rate Contract List issued on 19.10.1965, rate contracts were laid down for the following items:-

Student microscopes - two models (Rs. 720 & Rs. 475), spectrometer (Rs. 350), analytical balances - two models (Rs. 250 & Rs. 248), gas plant (Rs. 2,590), Fortin's barometer (Rs. 215) epidiascope (Rs. 725), telescope (Rs. 208). Specifications have been given in the case of each item.

3.13 Orissa

No information was received from the State Government.

3.14 Punjab

i) Although the Union Ministry of Education allocated funds in June or July of each financial year, the sanctions from the State Government were received in the D.P.I.'s office towards the end of the financial year. Thus the sanction for 1964-65 was received on 19.1.1965, for 1965-66 on 27.1.1966 and for 1966-67 on 28.2.1967.

ii) Standard lists of minimum science apparatus were prepared by the D.P.I. separately for high and higher secondary schools. The Controller of Stores, Punjab Government invited tenders for the supply of the various items. The goods offered by the firms were inspected and approved by a Special Purchase Committee appointed by the Government. Prices were approved and a copy of the rate contract was supplied to all schools. Purchases for government schools were mainly arranged through the Education Department. In the case of non-government schools, purchases in the first year were made through the Department but in the subsequent years the schools were asked to deal with the approved firms direct. In the case of articles not covered by the rate contract, the schools were authorized to make purchases in accordance with the normal rules. Schools were asked not to purchase costly items like film projectors, Epidiascopes, tape-recorders etc. All purchases in government and non-government schools had to be completed by the end of the financial year.

iii) In 1964-65, 58 government schools were given a grant of Rs. 1,500 each. 80 higher secondary schools (40 government and 40 non-government) received grants at the rate of Rs. 4,625 each.

iv) In 1965-66, the grants in the case of high schools varied from Rs. 1,000 to Rs. 4,000 while in the case of higher secondary schools, grants upto Rs. 11,000 were sanctioned. In 1966-67 also, grants were paid at different rates.

3.15 Rajasthan

Information was not received from the State Government.

3.16 Uttar Pradesh

i) During the first year of the scheme, i.e. in 1964-65 a standard list of science equipment for high schools and Intermediate colleges was circulated and the requirements for individual institutions were assessed. Grants were sanctioned upto Rs. 20,000 in the case of Intermediate colleges and Rs. 6,000 in the case of high schools. In the subsequent two years, grants were sanctioned more or less on ad-hoc basis: Rs. 12,000 to Intermediate colleges teaching physics, chemistry and biology, Rs. 8,000 to Intermediate colleges teaching physics and chemistry and Rs. 4,000 to high schools teaching optional science. In all cases, institutions were selected on the recommendations of the District Inspectors of Schools.

ii) In most cases, grants were released towards the close of the financial year. The grantee institutions are required to credit the grants into a separate Saving Bank account. The Pass Book for the account is deposited with the District Inspectors of Schools and funds are authorised to be drawn from the Pass Book only when the payments for purchases have to be made. Grantee institutions are required to furnish utilization certificates by the end of June following the year in which the grants are released. A large number of utilisation certificates are, however, still due even from those institutions which received grants in 1964-65.

3.17 West Bengal

i) The Government of West Bengal has constituted a board consisting of the D.P.I. and three other senior officials of the Education Department to select schools for financial assistance under the scheme.

ii) Grants are sanctioned on a uniform basis at the following rates:

'A' Higher Secondary Schools (Class XI)

- | | |
|--|------------|
| 1. With physics, chemistry and biology | Rs. 12,000 |
| 2. With physics and chemistry | Rs. 8,000 |
| 3. With general science | Rs. 2,000 |

'B' High Schools (Class X)

- | | |
|--------------------------|-----------|
| 1. With elective science | Rs. 4,000 |
| 2. With general science | Rs. 2,000 |

The grant of Rs. 12,000 or Rs. 8,000 is sanctioned to a class XI school which has been upgraded with science course and was imparting science education at the end of Second Plan.

The grantee institutions are advised to purchase articles of good quality for strengthening the science laboratory and replenishing the stock of articles according to their requirements. A copy of the list of equipment, as prepared by the Committee on Plan Projects, Government of India, is supplied to each school for guidance. The schools are also required to complete the purchase within a month from the date of receipt of the grant. In actual practice, the schools take a much longer time to utilise the grants.

iv) The State Government's sanction for release of funds under the scheme is received in the Directorate usually towards the end of the financial year. In turn, the Directorate draws the entire grant before the close of the financial year and distributes it to the schools by the end of June, in the next financial year.

Science Education Units/Institutes - training and other programmes

3.18 Andhra Pradesh

i) The Science Unit was set up in the State in November, 1964. Besides the Director, the staff now consists of 5 lecturers (1 has since left), a librarian and clerical and class IV staff. The Unit's office is located in rented premises. Accommodation has been secured in the Methodist School to house the library and to conduct the 10-week training courses. The laboratories and the workshop of the school are also available to the Unit for use by the trainees.

This arrangement is likely to be discontinued as the school authorities have expressed their inability to provide this facility any more owing to their own expanding needs. For administrative purpose, the Unit is under the Director of Higher Education, Andhra Pradesh.

ii) The Osmania University has agreed to run the 9-month condensed course for the Science Unit. Trainees completing this course are awarded a post-graduate diploma and are eligible for the salary scale for M.Sc. teachers in higher secondary schools. The first course commenced in November, 1964 and the second in July, 1965. The third course was started in January, 1967. Each batch consists of about 30 trainees. Every trainee has to take two subjects. At present, courses are organised only in physical sciences. Each course costs about Rs. 1.6 lakh which includes salaries of substitute teachers.

iii) The Science Education Unit organises 10-week training courses for B.Sc. teachers. The course consists of lectures, discussions and practical work. In addition, the Unit organises about 40 extension lectures in physics, chemistry, botany and zoology by the staff of the Osmania University. These lectures deal with latest development in the respective subject areas. The trainees are also given workshop practice, training in handling audio-visual aids etc. Two courses were organised in 1964-65 and three in 1965-66. Owing to late receipt of financial sanction only two courses could be organised in 1966-67. 30 teachers are admitted to each course.

iv) The Science Unit has evolved a draft syllabus for classes VIII to X. It has prepared a kit for teaching chemistry in class VIII. The Unit has also helped the Education Directorate in compiling lists of science equipments and of library books. The Unit is now engaged on preparation of guide-books for teaching science in classes VI & VII. The Unit urgently needs permanent accommodation for its laboratories, workshop, library, lecture rooms and a hostel. The Unit also needs additional staff for training courses and for follow-up work.

v) In addition to the 9-month and 10-week courses organised respectively by the Osmania University and the State Science Education Unit, the State Government is running with the assistance of the American Peace Corps Volunteers 10-day courses for science teachers. These courses are organised in 7 training centres at a cost of Rs. 23,000 per annum per centre.

About 15 teachers attend one course. The course consists of lectures on basic scientific principles and methods of teaching, but the major emphasis is on the imparting of skills to trainees so that they could improvise simple items of equipment. Every trainee learns the use of hand tools and is expected to improvise 11 pieces of apparatus during the period of training. Training is also provided in the organisation of the science clubs in schools. At the end of the course, each trainee is presented with a copy of the UNESCO Source Book on the Teaching of Science and a set of hand tools costing Rs. 50. The Peace Corps volunteers are sending a newsletter to all past trainees. The Newsletter contains useful material on improvisation of new apparatus etc.

3.19 Assam

No information was received from the State Government.

3.20. Bihar- No information was received from the State Government.

3.21 Gujarat

i) Science Education Unit was set up in 1965-66. The staff of the Unit consists of a Director (Class I officer), two Technical Assistants (class II officers), one junior clerk, one steno-typist and one peon. The Unit organised 3 courses, each of 8 weeks' duration, both during 1965-66 and during 1966-67. 81 and 57 graduate science teachers attended these courses.

ii) Other activities of the Unit were:

- a) Preparation of teachers' hand-book in science for standards I to III (under preparation).
- b) Preparation of teachers' hand-book in mathematics for standards I to III (manuscript is ready).
- c) Preparation of syllabi in mathematics and science for standards I to III. (The syllabi have been approved by the State Government and will be introduced from June, 1967).
- d) Preparation of standard list of equipment for teaching science in primary schools.

A proposal to prepare text-books is under consideration.

3.22 Haryana

The Institute of Science Education has not been set up in this State. The State Government, has, however, established a Science Education Unit which consists of one Technical Officer, one steno-typist, one clerk and one peon. The Science Education Unit is now under a Director, who is, also in charge of the State Bureau of Educational and Vocational Guidance and the State Evaluation Unit. The three Units are housed in a rented building. The Haryana Government proposes to start the 9-month condensed course and also short-term courses for the science teachers of high and higher secondary schools during 1967-68 immediately on the reopening of the colleges after the summer vacation, i.e. from July, 1967.

3.23 Jammu & Kashmir

No information was received from the State Government.

3.24 Kerala

i) The State Institute of Science Education was established in October 1964 as a wing of the State Institute of Education. The staff appointed for the Institute of Science Education consists of three Science Instructors, one Junior Science Consultant, three Research Assistants, clerical and class IV staff. The institute is housed in rented premises.

ii) In-service training courses were planned for science teachers: (a) to equip them to teach science as an integrated subject, (b) to give them sufficient practice in the use of tools and in the improvisation of apparatus, and (c) to keep them abreast of the modern developments in science and new approaches to science teaching. The duration of each course is 28 days. Special training in the use of audio-visual aids is also given to enable the teachers to handle audio-visual equipments. The duration of the course is 10 days. The number of trainees, year-wise is given below.

Number of teachers who participated in the
Inservice training course for 28 days

1964-65	427
1965-66	352
1966-67	254

Number of teachers who participated in
the audio-visual training course

1965-66	81
1966-67	28

iii) The Science Institute organises every year a workshop of five weeks' duration for the production of supplementary reading material in science in the Malayalam language. 25 books were prepared and printed in 1964-65. During 1965-66, nineteen more books were prepared, out of which 4 books were printed during the year itself. The remaining 15 books were printed in 1966-67. A set of another 10 books prepared in 1966-67 will be printed in 1967-68. 1,500 copies of each of the books have been printed as a trial edition and distributed to all high schools and training schools in the State. After ascertaining the reactions of the students and teachers, more copies of these books will be printed and sold to school libraries and to students.

iv) The Institute has prepared a guide for the teachers of science in teacher training schools. The Institute is also preparing a new syllabus for use in schools in the State.

v) The Institute has furnished detailed specifications of science equipment to the Government Instruments Workshop, which has undertaken to manufacture 33 items of equipment.

3.25 Madhya Pradesh

i) The State Institute of Science Education was set up in October, 1966. The Institute is located in a large and newly constructed school building. From July this year, a Demonstration Higher Secondary School (classes VI-XI) will also start functioning in the building. The Science Education Institute will then have facilities for trying out its ideas concerning the teaching of science in the middle and secondary sections of the school. The Audio-visual Unit of the State, which is also located in the school building, will be a great help to the Institute in its training programme. The staff of the Institute consists of one Director, a Vice-Principal, six Assistant Professors, a Workshop Superintendent, an Office Superintendent, clerical staff, laboratory staff etc. The Institute proposes to undertake the following activities: training courses, curriculum research and publications, supply of science equipment to school laboratories and extension work with schools.

ii) Under the Crash Programme, the State organised in 1964-65 and 1965-66, 9-month condensed courses for existing B.Sc. teachers in the Motilal Vigyan Mahavidyalaya, Bhopal. The syllabus for the course is approved by the Vikram University which awards a post-graduate certificate to successful trainees. Each year a batch of 30 teachers is selected. The trainees are required to take two subjects for their course and the combinations offered are: (i) physics and chemistry, (ii) physics and mathematics, (iii) chemistry and zoology, (iv) chemistry and botany and (v) zoology and botany. In addition, 10-week courses were organised in 1964-65 (two batches) and in 1965-66 (two batches). These courses consist of content, methodology of teaching and workshop practice and there are 25 to 30 teachers in each batch. Following its establishment, the State Institute of Science Education has taken over the responsibility for running both types of courses. The Institute organised in 1966-67 one 9-month condensed course and 2 ten-week courses. The Institute has no hostel for its trainees. The Institute has started equipping its own laboratories in the new building. It has a small library. It has also recently set up a workshop, which is used for training teachers in improvising and maintenance of science equipment. In addition, the Institute has started a repair service. Schools have been advised to send their damaged apparatus to the workshop.

3.26 Madras

No information was received from the State Government.

3.27 Maharashtra

i) The State Unit of Science Education was set up in June, 1965 and consists of a Director (Class I officer) two Technical Assistants (Class II officers), two junior clerks and one peon. The Unit is a part of the State Directorate of Education. At present, the Unit is housed at Poona in the building of the Government Training College for women primary teachers. The Unit has no laboratories, library or lecture rooms of its own. It is assisting the Director of Education in the administration of the Crash Programme and schemes of Science Talent Search, Summer Institutes, Vigyan Mandirs and Science Clubs and Fairs. The Unit has also rendered assistance in the preparation of new syllabi in mathematics and science in primary schools, preparation of lists of apparatus and equipment for different types of educational institutions, surveys of science teaching etc. Proposals for setting up a State Institute of Science Education have not materialised so far and, therefore, the training programmes and

other important activities relating to curriculum, textbooks etc. have not received sufficient attention.

ii) The State Government is keen on organising nine-month condensed course in subject content for existing B.Sc. teachers so as to upgrade their knowledge in science subjects. Unfortunately, it has not been possible so far to persuade the universities in the State to run such courses.

iii) The State authorities are of the view that while short courses are necessary for B.Sc. teachers, as provided in the centrally sponsored scheme, in the circumstances now obtaining in the State, it is also necessary to organise suitable courses for the under-graduate science teachers. No training course could be organised in 1964-65, under the Crash Programme. In 1965-66, 5 training courses of 10-week duration were arranged for graduate science teachers, one each in Bombay, Poona, Aurangabad, Jalgaon and Kolhapur. These courses were run by the authorities of local colleges, who were paid on an average a sum of about Rs. 17,000 per course. This amount included stipends to trainees, which were paid at rates varying from Rs. 45 to Rs. 100 per month. In all about 126 teachers attended the five courses. Generally speaking, managements of schools are unwilling to depute teachers for training during the period when the schools are open because they are unable to arrange for substitute teachers. No training course for graduate science teachers could be arranged in 1966-67. Courses for under-graduate science teachers could not be organised from the funds provided under the Crash Programme. The State Unit of Science Education, therefore, persuaded 4 zilla parishads to provide the necessary funds. Thus in 1966-67, about 200 under-graduate science teachers were trained in courses whose duration varied from one to three weeks.

3.28 Mysore

i) The State Institute of Science Education is located in a rented building at Bangalore. The staff consists of one director, one lecturer, one stenographer, one typist and one peon.

ii) No training course was organised in 1964-65. A nine-month training course for 20 B.Sc. teachers was arranged in 1965-66 in the Central College, Bangalore, with the approval of the Bangalore University. A similar course has been arranged in 1966-67 for the second batch of 21 science teachers in physics, chemistry and biology. One short course of 10-weeks' duration

was arranged during 1965-66 at the Regional College of Education, Mysore and was attended by 11 teachers. In 1966-67, two such courses were arranged, one each at the University College of Education, Dharwar and the National College, Bangalore. Each course was attended by 15 teachers. The short courses have not been popular because (a) the stipend of Rs. 30 per trainee is inadequate and (b) the management are unwilling to depute teachers since no substitute teachers are provided. L.P.M.

iii) Seminars of primary schools teachers teaching science in classes V, VI and VII were conducted at the Taluk level in all the 20 districts of the State. These seminars were of one week's duration. The syllabi for classes V, VI and VII were discussed and science experiments were arranged.

iv) The Institute proposes to carry out a survey to study the position of science laboratories and teaching staff in secondary schools. The questionnaire is ready and will be sent to all schools shortly. Also the work relating to the preparation of revised science syllabi for standards I to X is in progress.

3.29 Orissa

No information was received from the State Government.

3.30 Punjab

i) The Science Education Unit was set up in 1964-65. The staff consisted of one director, two senior lecturers, one stenographer and one clerk. The Unit has, however, ceased to exist after the reorganisation of the State in 1966-67.

ii) In 1965-66, nine-month condensed courses were organised for science teachers in chemistry and biology at the Government College, Chandigarh and in physics at the Punjab University. 27 teachers attended the courses. As regards short term 10-week courses, only one course was organised in 1965-66. 30 teachers were selected, but only 13 attended. This was mainly due to the difficulty of finding substitute teachers.

3.31 Rajasthan

i) The State Institute of Science Education was established in Udaipur, in October, 1965, with a director, two technical assistants and office staff. In 1966-67, the staff consisted

of a director, an assistant director, four technical lecturers, three research assistants, a librarian and office staff. The Institute has at present rented accommodation consisting of a large hall and four small back rooms. In addition, the University of Udaipur has placed at the disposal of the Institute, the first floor of a university hostel. The library and laboratories of the Institute are accommodated in the hall.

ii) In 1965-66, the Institute arranged a 12-day seminar to train 50 senior teachers in science and mathematics for conducting summer schools for middle school teachers during the summer of 1966. The programme consisted of lectures and laboratory work. The summer schools of 6-weeks' duration were held at 11 different places in the State, with an average participation of 50 teachers in each summer school. The Institute planned complete lesson notes which were made available to all resource personal.

iii) The Institute also organised, in October, 1966, an Advanced Post-degree Diploma Course in Physics to meet the shortage of teachers in that subject. The duration of the course was ten-months. Trainees who pass the course successfully are eligible for teaching physics in class XI. They are also entitled to the senior scale of pay. Active support of the University of Udaipur was sought in organising the course.

iv) The Science Institute has taken up reorientation courses in elementary science with trainees in two primary teachers training schools. Every week, one lecture is given dealing with topics such as: living things, the earth, atoms and molecules, notion, energy in waves and space. About 150 trainees are taking advantage of the course.

v) A three-week refresher course was arranged for 28 science lecturers of the primary teachers training schools. New approaches in science and mathematics were discussed. Provision was also made for laboratory work.

vi) 16 participants under the Advanced Post-Degree Diploma Course in Physics also attended an eight-day workshop devoted to analytical and critical examination of some of the precision instruments leading to a deeper insight into their mechanism.

vii) The Institute has evolved a draft syllabus in general science for classes I to V. The preparation of syllabus in mathematics is also in progress. Teachers' guides are under preparation.

viii) The Institute has set up a Science Study Circle which arranges popular lectures, demonstrations, film shows etc.

ix) The Institute brings out a monthly bulletin dealing with school science.

x) The Institute has set up a servicing station which renders free servicing and repairing of defective instruments received from schools. About 30 instruments were received from two schools. These were repaired and returned to the institutions.

3.32 Uttar Pradesh

i) The State Institute of Science Education is located at Allahabad. The staff consists of a director, three professors, one stenographer and two peons. The Institute has at its disposal four large rooms in the building of the State Institute of Education. In addition, it shares with S.I.E. a lecture theatre, a hall and ample hostel accommodation.

ii) As M.Sc. teachers are in short supply, the State Government has, on its own, started ten 9-month condensed courses in different universities and colleges in various science subjects for the benefit of existing B.Sc. teachers. From the funds made available to the State Government under the Crash Programme, two more condensed courses have been started in the Gorakhpur University. Teachers passing out of these courses are entitled to salary scales admissible to M.Sc. teachers.

iii) B.Sc. teachers are also in short supply, particularly in the rural areas. The State authorities have organised 10-week courses for B.Sc. teachers working in high schools in order to improve their competence. Hitherto, these courses were organised in the Government Constructive Training College, Lucknow and the Government Central Pedagogical Institute, Allahabad. But from June, 1967, it is proposed to organise the courses in the State Institute of Science Education. There is reluctance on the part of teachers to join the courses because

they do not stand to benefit monetarily from attendance at such course. Also the managements are unwilling to relieve teachers, because they find it difficult to carry on work in the absence of the science teachers.

iv) The Institute of Science Education has arranged two short courses for biology teachers to enable them to teach the revised high school syllabus more effectively. In collaboration with S.I.E., the Science Institute has also conducted a week-end course for 26 teachers of mathematics drawn from junior high schools. The staff of the Science Institute has actively participated in the preparation of departmental textbooks in mathematics for classes VI and VII, helped in the revision of science syllabi for the high school and Intermediate classes, prepared inventories of science apparatus and equipment for teaching of science subjects at the high school and Intermediate levels and compiled lists of suitable science books and magazines for primary and middle schools pupils. A few brochures have been brought out by the Science Institute. While it has not been possible for the Institute to set up its laboratories or a workshop, a good library has been set up.

3.33 West Bengal

i) The State Institute of Science Education has been set up in collaboration with the University of Burdwan in the campus of the University. The Institute has an independent Board of Governors with the Education Minister, West Bengal as President, Vice-Chancellor of Burdwan University as Vice-President and eminent science professors and principals of training colleges as members of the Board. Pending construction of its buildings, the Institute has rented from the Burdwan University a building known as 'Dilaram' which houses the library, the reading room and the demonstration gallery. The Institute has also rented some rooms on the ground floor of the 'Mahtab Manzil', where the Institute has its offices, class-rooms, laboratories etc. The staff of the Institute consists of one full-time reader, one full-time lecturer and four part-time lecturers in physics and one full-time lecturer and six part-time lecturers in chemistry. The part-time lecturers are drawn from the staff of the University. In addition to the teaching staff, the Institute employs laboratory assistants, office staff and class IV staff.

ii) The Institute conducted in 1965-66 nine-month condensed courses in physics for 29 science teachers and in chemistry for 27 science teachers. In 1966-67, the number of teachers in the two courses were 29 and 26 respectively. The course in physics is conducted in the Institute's premises in Mahtab Manzil, whereas the course in chemistry is conducted in the Chemistry Department of the University. The teachers admitted to the course are drawn from all districts of the State. On successful completion of the course, they are entitled to the grade admissible to B.Sc. (Hons.) teachers.

iii) The Institute has decided to set up an experimental school which will house model laboratories in all science subjects, a workshop, science museum and a library. The idea is to develop a kind of science education centre to which students and teachers from neighbouring schools can be brought from time to time. The building of the experimental school is under construction.

iv) The Institute would shortly undertake publication of general literature on scientific topics. It was also proposed to select about 20 schools for intensive work so that the new ideas developed in the Institute could be tested in actual class-room conditions. It is also proposed to build up a circulating library for science teachers.

4. Suggestions and Recommendations

Supply of Science Teachers:

4.1 It has been explained in Chapter II of this Report that the General aim of the Crash Programme is to strengthen science education in secondary schools, the immediate objective being the improvement of teaching of science in schools established upto the end of the Second Plan. Since the standard of instruction cannot be improved unless the schools are staffed with qualified and trained teachers, the Crash Programme enjoins upon the State Governments to ensure the appointment of properly qualified science teachers in schools covered under the Programme. Although the Evaluation Team is not directly concerned with this aspect, a few observations have been made here in view of the importance of the subject

4.2 During the course of its visits to different States, the Team was informed that science teachers of the requisite qualifications were not forthcoming in sufficient numbers to serve in schools. The shortage is most acutely experienced in the case of B.Sc. (Hons) or M.Sc. teachers required to teach in higher secondary schools and in the Intermediate Colleges of U.P. In regard to the supply of B.Sc. teachers for teaching in high schools, the position appears to be comparatively easy in the southern States and in West Bengal. But in the other States the schools in rural areas are finding it particularly difficult to obtain services of qualified B.Sc. teachers.

4.3 The Team is of the opinion that for many years to come, teachers with B.Sc. (Hons) or M.Sc. qualification will not be available in sufficient numbers for employment in higher secondary schools and in Intermediate Colleges. It will, therefore, be necessary to make long-term arrangements for the 9-month condensed course as envisaged under the Crash Programme. The need for such course will further increase if the State Government decide to make higher secondary classes (classes XI and XII) part of the school system as recommended by the Kothari Commission.

4.4 In the States which are experiencing shortage of graduate science teachers, the problem can be solved in the long run by increasing facilities for science courses in colleges and universities. The supply of science teachers could also be augmented by increasing the number of 4-year content-cum-pedagogy courses of the type now provided in the Regional Colleges of Education established by the National Council of Educational Research and Training. These long-term measures will take time to fructify. Meanwhile, some steps have to be taken to increase the supply of B.Sc. teachers in the immediate future. The States have in some cases, offered monetary incentives in the shape of advance increments to attract more science graduates to the teaching profession. In some States, the age of superannuation of science teachers has been raised. These measures may have helped in easing the situation to some extent, but since the shortage continues, the whole question needs very careful consideration at the hands of the State Governments. Both long-term and short-term measures should be devised to augment supply in accordance with the needs of the States. One aspect of this question which was

brought to the notice of the Team during its visit to Maharashtra is the need for organising suitable training courses for under-graduate teachers teaching science subjects in the secondary classes.

9-month condensed course

4.5 The Crash Programme provides for the organisation of the 9-month condensed course to meet the deficiency of post-graduate teachers in higher secondary schools. This deficiency, as stated earlier, is likely to last for a long time and for States which have adopted the higher secondary pattern, there is no other way out of the difficulty but to organise the special condensed course to equip the present graduate science teachers for teaching in the higher secondary classes. This idea was explored even before the institution of the Crash Programme. The Governments of Punjab, West Bengal and Uttar Pradesh had, on their own, organised condensed courses with the cooperation of the universities and colleges in their areas. With the funds provided under the Crash Programme, the Governments of Andhra Pradesh, Madhya Pradesh, Mysore, Rajasthan, West Bengal and Uttar Pradesh are running the condensed course and although the arrangements are from ideal, the course has met a felt demand and is, in the opinion of the Team, working on the whole satisfactorily. The Government of Maharashtra is keen on starting the course but it has not been able so far to persuade any university in the State to undertake the responsibility. There have been some difficulties in Punjab, but following the reorganisation of the State, both Punjab and Haryana are anxious to restart the course on a more sound and permanent basis. Kerala and Gujarat do not have the higher secondary pattern and, therefore, do not have need for the condensed course at present. As stated earlier, if the recommendations of the Kothari Commission in regard to higher secondary education is accepted, it will be necessary for other States as well to organise a similar course.

4.6 It was suggested in the Crash Programme that the condensed course should be organised in the science faculties of universities or in post-graduate colleges. The advantages are obvious. Apart from the library and laboratory facilities available in the universities, it will be possible to obtain the services of qualified staff to conduct the condensed course in the universities or in post-graduate institutions. In actual practice, the States have made different arrangements according to their own convenience. The condensed course in Andhra Pradesh,

U.P. and Mysore is organised in the Osmania, Gorakhpur and Bangalore Universities respectively and the Institutes of Science Education in these States have no direct responsibility in the matter. In West Bengal, the State Institute of Science Education and the Burdwan University jointly share the responsibility for running the course. The West Bengal Institute proposes to set up its own laboratories, but will still continue to obtain the services of some of the university teachers on a part-time basis. In Rajasthan, although the responsibility for running the 9-month advanced course in physics rests primarily with the State Institute of Science Education, the Udaipur University is rendering all assistance sought from it. Only in Madhya Pradesh, the State Institute of Science Education is organising the condensed course entirely on its own. In all cases, the universities lay down the syllabi for the course, conduct the final examination and award the diploma to the successful trainees. The Team is of the view that the different arrangements should be given a fair trial. The Team is not in favour of insisting on any uniformity in this matter, but desires to emphasise the need for a close cooperation between the universities and the Institutes of Science Education in this field. Where a university has taken the responsibility for running the course, the Institute may be asked to arrange special lectures for trainees on the organisation of school laboratories and the new approach to the teaching of science in schools so that while learning their special subject in depth, the trainees may also be helped to understand how the new ideas can be taken to the class room. In case, where the Institute is organising the course, it will always be desirable to request university teachers to lecture on those branches of the subject in which they have specialised knowledge. Also, where the Institute may have set up its laboratories, it may still be necessary to make arrangements with the university for such practical work for which the Institute's laboratories may not have adequate facilities. Also the facilities of the university library should be available to the trainees and to the staff of the Institute. The team is also of the view that the trainees should be given full opportunities to partake in the intellectual and social life of the university.

4.7 As the intention of the condensed course is to provide subject competency to a science teacher to handle the higher class in a higher secondary school, it is suggested that the training in this course should be restricted to one subject only as is done for post-graduate courses. The scope and depth of the course should be such that it will provide training at the B.Sc.(Hons) level in one major subject of Science. As the course is meant for teachers, the new

methodology of teaching science should also be presented in this course by using the new curriculum materials which have been developed in some of the advanced countries. The materials that are being used in Summer Institutes conducted by NCERT, UGC and the U.S. AID can be used with profit. The duration of the course may be retained at 9 months for such teachers who would take this course at one stretch. However, the possibility of conducting this full course in three sequential periods of three months each during the summer vacations may also be explored.

4.8 It has been stated in an earlier paragraph that the response to the 9-month condensed course has been fairly satisfactory although the numbers trained are small compared to the needs. The number of graduate science teachers who have taken advantage of this course in different States is given in Appendix IV. In all the States (except in Punjab), trainees who are successful at the examination held at the end of the course, are eligible for the scale of pay admissible to post-graduate teachers. The Team hopes that the Punjab Government will also fall in line and make the condensed course more attractive for the science teachers in that State. The Team has a few other suggestions to offer in this regard. In the first place, the stipend of Rs.30/- p.m. provided under the Crash Programme for trainees in the condensed course is too low and should be raised immediately to about Rs.100/- p.m. in view of the rising cost of living. Secondly, the trainees should be provided suitable hostel accommodation. Lastly, the Team suggests that merit should be the only consideration in selecting the trainees. Normal the trainees should be below the age of 40 years. Preference should be given to candidates who have kept up interest in their subject and have shown a marked aptitude for teaching. It is suggested that before admission to the course, all candidates should be interviewed by a small committee consisting of the representatives of the Directorate of Education, the State Institute of Science Education and the university conducting the course. This will ensure the entry of only such candidates who can profit from this advanced level course and will thus result in maximum utilization of the limited resources available for this programme.

4.9 Short in-service courses

The Crash Programme provides for a short-in-service course of 10 weeks' duration for graduate science teachers. The main objectives of the course are: (a) acquainting the teacher with the new developments in his subject, (b) bringing his ideas up to date on subjects which he is teaching, (c) introducing him to new techniques of teaching science, and (d) helping him to organise properly the practical work in the school laboratory. Stress is to be laid on the

Rs. 10/- maintenance and repairs of laboratory equipment and on the improvisation of simple equipment out of locally available material. West Bengal and Rajasthan have not organised this refresher course so far, while Kerala has done a good job by training over 1,000 teachers over a period of three years. In other States the number of teachers who have taken advantage of this course is comparatively small (please, see Appendix V). The Team was given to understand that the teachers are not keen on joining the course because: (a) the stipend of Rs. 30/- p.m. sanctioned under the programme is insufficient to meet the expenses of lodging and boarding, specially when compared with the daily allowance of Rs. 8/- paid to each trainee in the Summer Institutes for secondary school science teachers organised by the U.G.C., (b) there is no monetary benefit to be derived from attending the course, and (c) there is, at present, no requirement of undergoing an in-service training to earn normal annual increments or to cross the efficiency bars. The managements of schools, specially in the rural areas, are reluctant to relieve teachers because there is no arrangement to carry on the teaching work in classes while the science teacher is away to attend the refresher course. In view of the rapid growth in scientific knowledge, the team attaches great importance to a continuous inservice as a means of introducing better teaching practices and suggests that every science teacher should be given a refresher course, at least once in five years. After carefully considering the difficulties experienced in organising the course, the Team makes the following suggestions:

a) The duration of the course should be from six to eight weeks and not ten weeks as suggested in the Crash Programme. Suggestions for the syllabus are given in a subsequent paragraph.

b) The course may be taken either (i) in one stretch during the long summer holidays, or (ii) in two or three years in periods of training varying from two to three weeks at a time, or (iii) in the case of local teachers in the form of a week-end course continued throughout one full school session.

c) The stipend for the training period be increased from Rs. 30 to about Rs. 100/- p.m. In the case of local trainees, suitable allowance may be given to cover the cost of transport and lunch.

d) On the completion of the course, the trainees should be given a test. Those qualifying in the test may be given a cash award or one advance increment in salary.

e) The teachers who make good grades in this course should be given preference for admission to the 9-month condensed course.

Reference has been made earlier in this report to the 10-day course organised by the Andhra Pradesh Government with the assistance of the Peace Corps Volunteers. This intensive course lays emphasis on imparting workshop skills to science teachers so that they may not only be in a position to maintain and repair their laboratory equipment, but should also be able to improvise simple apparatus with the help of hand tools. The team is of the view that all State Institutes of Science Education should organise courses of this nature lasting from 10 to 15 days. Suggestions for a syllabus of this course are given in a subsequent paragraph.

4.10 In the earlier paragraph, the various ways in which the inservice short-term courses could be organised have already been described.

These short-term courses should attempt (i) the up-dating of the content of the science teacher at the graduate level; (ii) extensive laboratory practice in new experiments and demonstrations which can be used in the school courses; and (iii) introducing some manual and manipulative skills to enable him to maintain and repair laboratory equipment and improvise new apparatus.

To achieve the above objectives, some selected key-topics from physical sciences or biological sciences should be selected and taught to the teachers. The topics should be such that they would have a place in the school syllabus also. The laboratory work should mostly include the new experiments included in the P.S.S.C., CHEM. Study, B.S.C.S., Nuffield and those developed by Department of Science Education, NCERT and its Study Groups. The emphasis in the course should be on developing good demonstration techniques and supervising pupils' individual laboratory work. The Workshop practice course should include training in carpentry, sheet metal work, soldering and simple glass-blowing.

4.11 The above workshop course can also be used for imparting a short two-week course referred to in paragraph 4.9 above, for improvisation and repair of laboratory equipment to a large number of science teachers and laboratory assistants wherever they are available. The UNESCO Source Book for Science Teachers can be used as a useful reference material for this course.

Course for under-graduate teachers

4.12 The Team has noted the anxiety of the Directorates of Education of some States for strengthening the teaching of science at the middle stage (classes V/VI - VII/VIII). They rightly feel that if science continues to be taught indifferently at that stage by teachers who are not qualified to teach the subject, the chances of attaining a reasonably good standard in the subject in the secondary classes will be far from bright. The need for helping these teachers to acquire a better understanding of the subject and to learn suitable techniques for imparting instruction more effectively assumes greater importance in view of the recommendation of the Kothari Commission to teach science at this stage not as 'general science', as has been the practice so far, but as separate disciplines viz. physics, chemistry and biology, etc. As stated earlier, owing to shortage of graduate science teachers, the teaching of the subject even in the secondary classes is entrusted to undergraduate teachers in some States like Maharashtra and this position is not likely to change in the near future. The Team, therefore, recommends that the State Institutes of Science Education should devise a suitable course for undergraduate teachers in their States. The Team is also of the opinion that this course should be of 9 months' duration, which may be spread over three summer vacations and should be open only to those who have studied elective science at least upto the high school level. In view of the large numbers of teachers involved, it will not be possible for the State Institute of Science Education to conduct the course. Therefore, the course may be conducted at the district or the regional level in a local training college or in a higher secondary school. The Institute will assist in designing the course in all its details and also arrange short orientation course for trainers in charge of the course at the district or the regional level. Suggestions regarding the syllabus for the course are given in the following paragraph.

4.13 The course for under-graduate science teachers should have the major aims of (a) providing a deeper and up-to-date understanding of science topics included in middle school science courses, (b) skills of improvising simple apparatus from local resources, and (c) the techniques of effective demonstration. For achieving these objectives, the syllabus in each subject should be so developed that at least 60% of the time would be devoted by the panels set up by the NCERT and the materials prepared by the Department of Science Education for the middle schools can be used with profit in designing this course. Each teacher should develop competency in at least two subjects of science, the suggested combinations are: (1) physics & mathematics, and (2) biology & chemistry.

Other Measures for Strengthening the
teaching of science

4.14. The team has offered some suggestions on the main training courses which may be conducted under the Crash Programme. It may, however, be mentioned here that it will be entirely for the State Directorate of Education to take decision regarding the type of courses and their duration in relation to the needs in the State. The Team recommends that the State Institute of Science Education should be encouraged to experiment with any other type of course or courses which it may consider worthwhile. In this connection, the Team commends the effort of the State Institute of Science Education, Rajasthan which has tried with success various new ideas in this field.

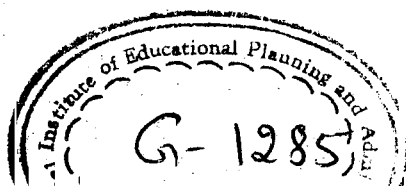
4.15 Although the main emphasis in the Crash Programme was on the supply of science equipment and the organisation of training programmes, it was recognised that there were other supporting activities which were equally important for improving science education. Accordingly, the State Institutes of Science Education were also required to undertake other activities such as the reconstruction of the science curriculum, the preparation of text-books and other instructional materials in science for students and guide-books for teachers, the preparation of designs for laboratory rooms and furniture, the laying down of specifications for the laboratory equipment, etc. It is encouraging to find that although the Institutes have not had enough time to devote their attention to these activities, a small but promising beginning has been made in some directions. Most of the Institutes have been involved in the revision of science and mathematics curricula for schools in their States. They have also prepared standard lists of science equipment and apparatus. The Institute in Kerala has already published over 45 supplementary readers in science in Malayalam, while the Institutes in Madhya Pradesh and Rajasthan have started a free repair service for laboratory equipment. The Institute in U.P. has rendered much assistance to the Education Directorate in the State in the preparation of text-books and teachers' hand-books. The Team recommends that in the coming years the State Institutes of Science Education should be strengthened to enable them to pay increasing attention to these activities. A lot of useful work is being done by the Department of Science Education, NCERT and the State Institutes can adapt, for use in their States, the syllabi, text-books and other instructional materials prepared by the Department. The Team, however, wishes to emphasise that the State Institutes should develop their own expertise by involving in this work both university and school teachers. For example, while the designs for physics and chemistry laboratories, suggested by the COPF Team for higher secondary

schools in Delhi, might be found useful for large schools, the State Institute of Science Education in Madhya Pradesh will find it worthwhile to evolve a suitable design for a single combined science laboratory for small higher secondary schools in that State. Likewise, while the State Institutes of Science Education may take steps to popularise booklets on different scientific topics in Indian languages for young boys and girls, brought out by the Council of Scientific & Industrial Research and other organisations, they should, on their own, produce supplementary reading material in regional languages either with the assistance of suitable groups of teachers, as is being done in Kerala or by entrusting the work to individual scientists, who may be interested in writing on science subjects for children and adolescents.

State Institutes of Science Education

4.16 Having discussed its training and other functions, it will be appropriate to offer some suggestions on the set up of the State Institute of Science Education. To begin with, the States were advised to set up only a Science Unit with a nucleus staff: (a) to conduct surveys concerning the position of science education in the State, (b) to organise training and other activities envisaged under the Crash Programme, and (c) to assist the Directorate of Education in the purchase and supply of laboratory equipment to schools. Obviously, it was not possible for the Science Unit to perform all these functions with the small staff provided. Provision was, therefore, made for the State to set up a full-fledged Institute of Science Education from the commencement of the Fourth Plan. While the staffing pattern continues to be on the 'Unit' level in Gujarat, Haryana, Maharashtra, Mysore, and Punjab, additional staff has been appointed in the States of Andhra Pradesh, Kerala, Madhya Pradesh, Rajasthan, U.P. and West Bengal. Only in Madhya Pradesh, Rajasthan and West Bengal, it has been possible for the Science Institutes to set up their own laboratories. Workshops have been set up in the Institutes in Madhya Pradesh and Rajasthan only. All the Institutes have set up libraries, but these need considerable strengthening.

4.17 Since the Institute is required to conduct short inservice courses and discharge other functions envisaged in the Crash Programme, it should be provided with adequate accommodation and equipment for the staff, the office, the laboratories, the library, lecture and seminar rooms, the workshop, the trainees' hostels etc. It is idle to expect the Institute to function effectively unless these facilities are given. The Crash Programme also makes provision for an experimental school to be attached to the Institute. The Team is, however, of the view that there is no immediate need for the setting up of the experimental school. In fact, the



Institute should not confine its research activities to one school, but should select ten or twelve schools within a radius of about eight to ten miles, in which it can try out its new ideas, new techniques, new teaching materials etc. The Institute should also be provided with a jeep or a station wagon to reach the schools. While these basic facilities should be available in all Institutes, those which have assumed the responsibility for the 9-month condensed course should have, in addition, more laboratory equipment to teach science subjects at the appropriate level.

4.18 The Team suggests the following staffing pattern for all Institutes:

(i)	1. Director or Head of the Institute - In Professor's scale	1
	2. Deputy Director in Professor's scale	1
	3. Readers. (1 for each of the subjects, physics, chemistry, biology & mathematics)- in Reader's scale	4
	4. Lecturers. (2 for each of the subjects)	8
	5. Senior Research Assistants. (including 1 with knowledge of Statistics)	4
	6. Laboratory Assistants	4
	7. Laboratory Attendants	4
	8. <u>Workshop Staff</u>	
	a). Workshop Supdt. in the scale of Asstt. Engineer	1
	b) Carpenters	2
	c) Mechanic	1
	d) Glass-Blower	1
	e) Electrician	1
	f) Workshop Attendant	1
	9. <u>Office Staff</u>	
	a) Office Supdt. or Head Clerk	1
	b) Stenographer	1
	c) U.D.C.	2
	d) L.D.C.	2
	e) Accountant	1
	f) Daftary	1
	g) Peons	2
	10. Librarian	1

(ii) In the case of Institutes conducting the 9-month condensed course, the following additional staff may be given:

1. Readers or Asstt. Professors	2
2. Lecturers (two for each subject)	8
3. Laboratory Attendants	3

(iii) The following suggestions are offered in regard to the recruitment and training of the staff for the institutes:

Persons with good subject matter background and experience of either having attended or conducted Summer Institutes Programmes should be preferred for manning the positions in the institutes, specially at the level of Readers. 50 per cent of the staff at the Lecturer level should be drawn from Post-graduate School Science teachers or Science teacher educators. The staff should be provided adequate opportunity to attend programmes of Summer Institutes and other curriculum development work being done in the Department of Science Education, NCERT. Persons taking up the National Institute of Education associateship course with science education as specialisation which is proposed to be offered by the National Institute of Education from this year, will be eminently suitable for positions in the State Institutes of Science Education.

(iv) To provide motivation to good teachers and Principals of schools to come and work in the State Institutes, it appears necessary to give them some allowances to compensate for the loss they have to suffer in surrendering the privileges of free accommodation etc. which are available at present in States to Principals of Schools and Colleges.

4.19 In the matter of the administration of the Institutes, as already mentioned, different patterns have emerged. West Bengal has set up a high-powered autonomous body to run the State Institute of Science Education. In Kerala, the Institute is a part of the State Institute of Education. In Haryana, the Science Unit is under the control of a director who is also in charge of the State Bureau of Educational and Vocational Guidance and the State Evaluation Unit. In Maharashtra and Mysore, the Science Units are parts of the State Directorates of Education. In Andhra Pradesh, the Institute of Science Education is under the Director of Higher Education, while the schools in the State are under the Director of Public Instruction. In Madhya Pradesh, Rajasthan and U.P., the Institutes have separate identity, although in the case of U.P., the Institute is situated in the same building as the State Institute of Education and shares with it hostel accommodation, seminar and lecture rooms etc. Since the Institutes have been in existence only for a short period, it is too early to judge the efficacy of any particular administrative arrangement. The Team is, however, of the opinion that as the activities of an Institute grow both in number and variety, it will be necessary to have a full-time director with adequate financial and administrative authority to discharge his responsibilities expeditiously. In particular,

wherever necessary, the director should be given the authority to get his publication work done through private printing presses.

4.20 The Team makes the following other suggestions concerning the State Institutes of Science Education:-

(i) While the Institutes will help and advise the Directorates of Education in all technical matters concerning science and mathematics education, they should not be saddled with any responsibility relating to purchase and distribution of science equipment to schools or of any administrative work relating to the scheme for science talent search or the organisation of science exhibitions and fairs etc. Later in this chapter, the Team has recommended the setting up of a separate science cell in the Directorates of Education to deal with all such matters.

(ii) The Team has given thought to the suggestion made in the Crash Programme that the Institute of Science Education should along with organisations like the State Bureau of Educational and Vocational Guidance and the Evaluation Unit, be integrated with the State Institute of Education. The Team is of the view that collaboration in the academic field is more important than administrative integration. Also while retaining their distinct identity, these organisations can share common facilities like the library, lecture and seminar rooms, hostels for trainees etc. They can also pool their resources in the organisation of refresher courses. The Institute of Science Education needs, in particular, the cooperation of the State Audio-visual and Evaluation Units.

(iii) The State Institutes of Science Education should also maintain intimate relations with the universities in the State. The Team has already emphasised the need for involving universities in the nine-month condensed course and other short-term courses. The assistance of the university teachers will also be required for the revision of the syllabi and preparation of text-books and general reading materials in science and mathematics. The Institute should also be closely associated with the State Board of Secondary Education and the Team recommends that the Director of the Institute should be an ex-officio member of the Board in his State.

(iv) The team strongly feels that the Department of Science Education, NCERT should maintain close contacts with the State Institutes of Science Education. In many cases, the Institutes are not aware of the activities of the Department of Science Education. The Team is of the view that the Department of Science Education should provide effective leadership in all aspects of science education at the school level. It may make available to all the Institutes copies of

syllabi, text-books, instructional materials which it may develop from time to time. It may also furnish details of specifications of all prototypes of science apparatus, prepared in the Central Science Workshop. It may organise regular meetings and seminars for the directors and other members of the staff of the Institutes to discuss matters of common interest. It may also hold short-term orientation courses for the staff of the Institutes. Finally, it may publish a periodical new-letter to highlight the activities of the Department and the Institutes and also arrange for exchange of reports, publications etc.

Purchase and Supply of science equipment

4.21 The Team is satisfied that the directive given in the Crash Programme to restrict the assistance for the supply of science equipment to schools which were teaching science upto the end of the Second Plan has been generally observed. From its own observations and also from the information given to it by the State officials, the Team is also satisfied that a large majority of the secondary schools functioning at the end of the Second Plan have been covered during the three years in which the Crash Programme has been in operation. The Team, therefore, recommends that the benefit of the Programme should now be extended to schools, which started teaching science subjects at the secondary level during the Third Plan. As a first step, the Team suggests that surveys of the requirements of these schools should be taken in hand immediately and a phased programme of supplying equipment to them during the Fourth Plan should be finalized. In this connection, the Team wishes to record that the expectation raised in the Crash Programme that all new schools would be properly equipped has not been realised.

4.22 As indicated in an earlier chapter, all State Governments have compiled standard lists of science equipment and apparatus. The Team suggests that these lists should contain only essential equipment needed for demonstration and practical work by students and should be strictly in accordance with the prescribed syllabus. These should be carefully reviewed every year in the light of any changes which may be made in the syllabus. The Team also suggests that in the case of costly items like microscopes etc. where a number of models are available in the market at varying prices, the standard lists should offer detailed guidance about the purchase specifications of such instruments and apparatus. Separate specifications will be necessary in the case of demonstration apparatus.

4.23 Very clear instructions were given that the assistance under the Crash Programme was to be given only to fill the gap between existing science equipment in schools and that suggested in the 'norms'. Therefore, it was intended that the needs of each institution would be assessed separately and the grant calculated accordingly. The Team regrets to note that in some States like Maharashtra and West Bengal no attempt, whatsoever, was made to assess individual needs and grants were sanctioned on a purely ad hoc basis. In other States, the information regarding the deficiency was furnished by schools in the proformas sent to them. No attempt was made to check on this information. The Team noticed that in some schools certain items were purchased merely as show pieces for the laboratories. In other cases, the Team found that several items were surplus to the normal requirements of the school. The Team also found that some schools, which were well-established and had built up fine laboratories over many years, were also paid grants under the Crash Programme, for which there was little justification. Of course, the grants have been put to good use wherever the science teachers or heads of schools were experienced and had bought the equipment solely with a view to its use for demonstration or practical work by students. Enquiries made by the Team revealed that no State had any organisation in the field to guide science teachers, many of whom are new to the profession and have little experience of setting up laboratories. The inspector in most states is pre-occupied with routine administrative functions and has hardly any time to help teachers in their professional work. Further, there are very few officers in the inspectorate who have the special competencies to assist in any programme of strengthening science education in schools. In most states, it was found that no worthwhile scrutiny of the inventories received from schools was possible as there was no Science Unit or Cell at the headquarters to examine them. The Team is of the firm opinion that grants for purchase and supply of laboratory equipment under the Crash Programme are not likely to yield the desired results, unless qualified science staff is appointed both at the headquarters and in the field to ensure that the grants are put to good use. Suggestions in regard to this staff are given later in the chapter.

4.24 Another deficiency which merits serious attention is the inadequate provision of laboratory rooms and furniture. Although it was clearly stated in the Crash Programme that State Governments and/or the managements of schools would make good this deficiency, very little has, in fact, been done. The Team was given to understand that in the absence of suitable laboratory accommodation, the equipment supplied to some schools remained unused. The Team suggests that before supplying equipment, State Directorates of Education should ensure that the grantee institutions have the minimum facilities for arranging practical laboratory work.

4.25 Much stress was laid in the Crash Programme on the supply of quality equipment at reasonable cost. In the States of Andhra Pradesh, Gujarat, Maharashtra, Uttar Pradesh and West Bengal little guidance was offered to schools on the subject. In Mysore, the State authorities have entered into a rate contract for purchase of selected precision instruments. In Punjab, the rate contract covers most of the items supplied to schools. Only in Kerala and Madhya Pradesh, the States have gone in for central purchase and distribution. The authorities in Kerala have taken a step forward and have arranged for manufacture of 33 items in the Government Small Scale Industries Units. Madhya Pradesh on the other hand, has evolved a very elaborate and time-consuming but fool-proof method of obtaining at competitive rates equipment of high quality. The Team was impressed by the thoroughness with which each item was checked with the approved sample. The distribution system at the divisional headquarters was, however, not as efficient as it should be owing to lack of storage facilities and staff to cope with this work. In States which have not adopted the rate contract system or arranged for supplies by central purchase, the schools are required to follow the normal procedure of calling tenders and accepting the lowest quotation. In most cases this results in purchase of apparatus of inferior quality. During its visit to one of the schools, the Team came across defective balances which had not been put to any use since they were purchased. In Punjab, the Team observed that some of the items bought under the rate contract system were also defective. The Team, therefore, feels that if full benefit is to be derived from the grants made under the Crash Programme, the State Directorates of Education must not be content with merely sanctioning the grants, but should take a more active interest and offer detailed guidance to schools. This has become particularly necessary since the average science teacher does not have sufficient experience and ability to choose the right quality of equipment.

4.26 The Team endorses the recommendations made in Chapter III of the 'Report on Science Education in Secondary Schools' by the Committee on Plan Projects, Government of India, concerning science apparatus and other equipment. In particular, the Team invites attention to an important recommendation requesting NCERT to set up, on a high priority basis, a semi-autonomous agency for undertaking the work of laying down norms and standards of science apparatus.' The Team suggests that immediate action should be taken on this recommendation. The proposed agency can undertake among others the following activities, in collaboration with the Department of Science Education and the Central Science Workshop of N.C.E.R.T.

i) Develop indigenous designs for science equipment and apparatus. Specimens of school science apparatus should be obtained from advanced countries and studied carefully so that some of their good features could be introduced in our designs.

ii) Lay down norms and standards of science apparatus for the guidance of Indian manufacturers.

iii) Prepare prototypes for supply to Indian manufacturers.

iv) Locate sources of supply of quality equipment and apparatus from firms, both in public and private sectors and prepare a directory for the guidance of State Governments. The directory should contain specifications of items, their prices, names of manufacturers and their agents.

v) Arrange with Government and private firms for the manufacture of such items, which are not being made in the country or, if made, are not of the requisite standard.

The proposed agency can also seek active assistance of the Indian Standards Institute, Central Scientific Instrument Organisation, National Physical Laboratory and other official and non-official organisations interested in this field.

4.27 The Team feels that the purchase and supply of science apparatus on the part of the State Governments will be greatly facilitated by the setting up of the agency referred to in the preceding paragraph. Meanwhile, State Governments which do not undertake central purchase and distribution of all items, may at least arrange for the central purchase and distribution of costly items, where precision is required such as microscopes, spectrometers, analytical balances etc. In the case of some other important items, the State Government may enter into rate contract with reliable firms whose samples must be carefully examined and approved by a committee of experts. In the case of each such item, full details of specifications should be given. A strict quality control should be exercised by making test-checks of items supplied. There may be still other items of comparatively less value and consumable stores (glassware, chemicals etc.) whose purchase may be left to the heads of schools. Even here, a list of reliable firms may be supplied to schools.

4.28 The Team reiterates the recommendation made in the COPP Report referred to in paragraph 4.26 above that an officer of the rank and status of the Deputy Director of Education should be appointed to direct all programmes.

of science education. He should be assisted by two or three technical assistants and the other staff. The Team also endorses the recommendation in the report that science inspectors should be appointed to ensure the proper implementation of the programmes. The Team is convinced that the Crash Programme and other projects for strengthening science education at the school level will not make headway unless the staff suggested is appointed in the districts and at the headquarters. While appreciating the need for appointing additional staff, some of the States pleaded helplessness on account of their tight resource position. In such cases, the Team suggests that the States may be permitted to utilize a part of the grant under the Crash Programme to appoint the staff at the level of the Directorate.

4.29 Appendix VI gives the position regarding the utilization of grants sanctioned by the Union Ministry of Education for the purchase of science equipment. In 1964-65, some States diverted the entire grant under the Crash Programme to the purchase of science equipment. This explains higher expenditure in column 3 as against the Central grant in column 2 in the case of some States. In States like Punjab and Madhya Pradesh, there were large short-falls in 1965-66 mainly due to the fact that the sanction of grants were received in the Directorates of Education fairly late in the financial year and it was not possible to utilise all the grants before the end of the financial year. West Bengal showed a shortfall of Rs. 10 lakh during that year. In 1966-67 Maharashtra could utilise only Rs. 2.62 lakh against the Central grant of Rs. 24.65 lakh and the sanction for the grants were issued only on the last day of the financial year. Also the amounts shown under columns 3, 5 & 7 represent only the sanctions issued by the State Governments and not what was actually spent by the schools. In most States, a large number of utilisation certificates are still outstanding. It is, therefore, difficult to give any reliable estimate of the actual utilization of the total Central grant of Rs. 514.87 lakh made to State Governments during the three years. The Team is of the view that the full utilization of Central grants will not be practicable unless there is advance planning. Further, the team feels that the administrative procedures should be streamlined so that the schools get at least four clear months during which they could complete the purchases. It may also be mentioned that Mysore is the only State which insists on 25% contribution from aided schools towards the purchase of science apparatus. This practice is against the spirit of the Crash Programme and should be discontinued. The present position about utilization certificates is highly unsatisfactory and strong action should be taken against the defaulting schools.

Need for Advance Planning

4.30 As stated in the foregoing paragraph, there is little advance planning for utilization of grants under the Crash Programme. At present, the Central grants are released on a year to year basis and the States have no idea of the grants they are likely to receive in any particular year. When the intimation regarding the Central assistance is received, the State Directorate of Education submit its proposals to the State Governments. Unfortunately, the proposals are not based on any well thought-out plan or field survey and the effort is somehow to spend the grants. The sanction of the State Government is usually received in the Directorates of Education late in the financial year and the schools are not given sufficient time to complete purchase of apparatus and equipment. The State Institutes of Science Education have no idea of the funds that would be given to them for the training programmes and often the training courses cannot be organised during the summer vacations, which incidentally is the best period for arranging the courses, because the sanction of funds is received much later. The Team, therefore, recommends that every State should conduct district-wise surveys and formulate its science education plan for the entire Fourth Plan period. This plan should include requirement of science teachers, arrangements for their pre-service and in-service training, construction of laboratories, purchase of science equipment, preparation of science text-books etc. Once this detailed plan is ready, the State can pool its own resources-plan and non-plan-and the Central Government's grants and use the funds in accordance with the priorities set out in the Science Education plan.

4.31 At this point, the Team wishes to offer a few suggestions on the proposed State science education plan. The Team attaches the highest importance to the quality of the science teacher, which, in turn, depends on the academic and professional qualifications of the teacher. The highest priority should, therefore, be given to the quality of the pre-service and in-service training programmes. It is unfortunate that sufficient attention has not been paid so far to the pre-service training of the science teacher. Most of the secondary training colleges follow a stereo-type pattern of training which has hardly any relevance to the day-to-day needs of the science teacher. Next in importance is the provision of essential laboratory equipment particularly to new secondary schools coming up in the rural areas. As for replacements and purchase of consumable stores, the schools should be permitted to levy a science fee on all students taking science in secondary classes. This fee is being collected in some States already. Good text-books are essential. Audio-visual aids, particularly films, can go a long way to enliven the teaching of science. Funds may also be provided

for laboratory rooms, particularly for the new secondary schools in the rural areas. Above all, there should be provision for adequate inspecting & administrative staff for science education. The present Crash Programme lays undue emphasis on purchase and supply of equipment to schools. The Team suggests that the priorities indicated above should be reflected in the financial allocations under the Programme.

4.32 The Team regrets that no action has been taken by the Union Ministry of Education on the provision made in the Crash Programme for the setting up of a committee of officials of the Union and State Governments to review the progress of the Crash Programme from time to time. Also, no action has been taken by the States on the suggestion made in the Crash Programme for the setting up of advisory committees to guide the working of the State Institutes of Science Education, except in West Bengal, where the programme of the Institute is discussed and approved in its Governing Board. The Team suggests that the advisory committees at the State level should be set up to review the progress of the entire school science education programme from time to time.

4.33 Conclusion - From the observations made in this report, it is clear that the scope of the Crash Programme needs enlargement and its implementation needs improvement. It is, however, not the Team's intention to create an impression that the grants sanctioned by the Central Government have been wasted and that the Crash Programme has served no useful purpose. On the contrary, the Team is of the opinion that despite many shortcomings, the Crash Programme has rendered timely assistance to hundreds of secondary schools in the country. But for the Crash Programme, those schools could not have acquired equipment required for the proper teaching of science. It is true that the training programme has not made a visible impact so far, but it can be claimed with confidence that valuable experience has been gained over the past three years. The State Institutes of Science Education have begun to feel their way and there is no reason to doubt that with the provision of necessary physical facilities and staff their contribution in the coming years to the improvement of science education in schools will be substantial. The Team, therefore, believes that it will be most unwise to abandon the Crash Programme. Actually, there is a strong case to place the Programme on a permanent footing. During its discussions with State officials, the Team was given to understand that the States had no resources to carry through any major programme of science education without Central assistance. As it is, the States are finding it hard to meet their current obligations arising out of what has been called the explosion in education. Consequently, they may find it impossible to plan ahead and provide for quality programmes

which yield results after many years of hard and patient work. In view of the vital role of science in the defence and development of the country, the Team is of the opinion that, irrespective of the constitutional position, the Central Government should share with the States the responsibility for expansion and improvement of science education in schools. The Crash Programme should, therefore, grow into a long-term major project for revolutionising school science so as to serve as a sound base for higher science and technical education in the country.

5. Summary of Recommendations

5.1 Since for many years to come science teachers with B.Sc.(Hons) for M.Sc. qualifications will not be available in sufficient numbers for employment in higher secondary schools and in Intermediate colleges, long-term arrangements should be made for conducting the 9-month condensed course (4.3).

5.2 In view of the shortage of graduate science teachers in many States, it will be necessary for the States concerned to take long-term and short-term measures to augment their supply.(4.4)

5.3 The present arrangements for conducting the condensed course in different States should continue. The cooperation of State Institutes of Science Education and the universities is essential for the proper conduct of the course.(4.6)

5.4 The condensed course should develop competency at B.Sc.(Hons) level in one science subject/introduce the teacher to new methods and techniques of teaching science by exposing him to new curriculum materials developed in advance countries and India. (4.7)

5.5 The stipend for the 9-month condensed course should be raised to about Rs.100/- p.m. Candidates for the course should be selected by merit and should be below the age of 40 years. All candidates should be interviewed before admission to the course. (4.8)

5.6 Every science teacher should be given a short refresher course once in five years. The duration of the course should be from six to eight weeks. The course may be conducted in one stretch or in two or three periods or in the form of a weekend course. The stipend should be increased to about Rs.100/- p.m. These qualifying in the test held at the end of the course should be given a cash award or one advance increment.(4.9)

5.7 Short intensive courses lasting from 10 to 15 days should be arranged for science teachers to impart manual skills to maintain and repair laboratory apparatus and to improvise simple apparatus from locally available material.(4.9)

5.8 The short-term inservice courses should help to update the content of science teachers at graduate level, introduce them to new experiments, demonstration and some basic manual and manipulation skills needed for repair, maintenance and improvisation of equipment.(4.10).

5.9 State Institutes of Science Education should devise a suitable course for undergraduate science teachers. The course should be of nine months' duration spread over the summer vacations. The course should be conducted at the district or the regional level. (4.12).

5.10 The undergraduate science teachers course should be designed to provide a deeper and upto-date understanding of science concepts taught in the middle schools, develop basic manual skills for improvising simple science apparatus and introduce the teacher to the techniques of effective demonstrations.

5.11 In addition to the main training courses suggested, the State Institutes of Science Education should experiment with other types of courses according to the needs in the States (4.14)

5.12 The State Institutes of Science Education should give more attention to other activities, such as the revision of science curriculum, the preparation of text books and guide-books, the preparation of designs for laboratory rooms and furniture etc. They should take advantage of the work being done in the Department of Science Education, NCERT. At the same time, they should develop local expertise with the help of university and school teachers (4.15).

5.13 The State Institutes of Science Education should be provided necessary accommodation and equipment for the laboratories, the library, the workshop, the hostel etc. It is not necessary to set up the experimental schools immediately. The Institutes should conduct their experimental work in ten to twelve schools within a radius of 8 to 10 miles (4.17).

5.14 The staff of the State Institutes of Science Education should be strengthened according to the recommended norms to enable them to play their proper part in developing and implementing the total science programmes of the States (4.18)

5.15 As the activities of the State Institute of Science Education grow, the Institute should be placed under the charge of a full-time director with necessary financial and administrative powers. (4.19).

5.16 The State Institutes of Science Education should not be given the responsibility for routine administrative duties. There should be close collaboration among the various technical organisations set up at the State level, namely, the State Institute of Education, the State Institute

of Science Education, the Bureau of Educational and Vocational Guidance the Evaluation Unit, the Audio-visual Unit etc. The State Institute of Science Education should maintain close liaison with the universities and the board of secondary education in the State (4.20).

5.17 The Department of Science Education, NCERT, should provide effective leadership in all aspects of science education at the school level. (4.20).

5.18 The benefit of the Crash Programme should be extended to schools which started teaching of science subjects during the Third Plan. The requirements of these schools should be surveyed and a phased programme drawn to supply equipment to them. (4.21)

5.19 The standard lists should contain only items of essential equipment and apparatus. They should also give detailed specifications in the case of costly items (4.22)

5.20 In order to derive the maximum benefit from grants provided under the Crash Programme, qualified staff should be appointed at the headquarters and also in the districts to help in the implementation of the programme. (4.23)

5.21 Before sanctioning grants to schools, the Directorates of Education should satisfy themselves that the grantee institutions have the minimum facilities for arranging practical laboratory work. (4.24)

5.22 State Directorate of Education should offer detailed guidance to schools regarding purchase of science apparatus. (4.25).

5.23 NCERT should set up a semi-autonomous agency to:

- a) develop indigenous designs of science equipment and apparatus
- b) lay down norms and standard of science apparatus.
- c) prepare prototypes for the guidance of manufacturers.
- d) locate source of supply of quality equipment, etc. (4.26)

5.24 State Governments should arrange for the central purchase of costly items of equipment requiring high precision. They may arrange rate contract in respect of some other items and leave to heads of institutions the purchase of items of comparatively less value (4.27).

5.25 States may be permitted to utilise a portion of the grant under the Crash Programme for the appointment of staff in the Directorates of Education to deal with the Programme (4.28).

5.26 Advance planning is necessary for proper utilization of the Central grants. Administrative procedures should be streamlined and schools should be given sufficient time to make purchases. Strong action should be taken against schools which fail to furnish utilization certificates in time. (4.29)

5.27 Every State should conduct district-wise surveys and formulate its science education plan for the Fourth Plan. This should be examined by the Union Ministry of Education and grants should be sanctioned according to mutually agreed priorities. (4.30).

5.28 The State science education plan should give the highest priority to pre-service and in-service training programmes. Next in importance are supply of essential laboratory equipment in new secondary schools, preparation of good text-books, supply of audio-visual aids and appointment of inspecting and administrative staff. These priorities should be reflected in the financial allocations under the Crash Programme. (4.31).

5.29 A reviewing committee should be set up at the Centre. Advisory committees should be set up at the State level. (4.32)

5.30 The Crash Programme should be expanded and reorganised into a long-term major project for revolutionising school science in the country and the Central Government should share with the States expenditure on this project.

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Appendix.I

Itinerary of the Evaluation Team.

1. Chandigarh March 20 and 21, 1967
2. Calcutta March 30 and April 1, 1967.
3. Burdwan March 31, 1967.
4. Bhopal April 10, 11 and 12, 1967.
5. Hyderabad April 14, 15, 16 and 17, 1967.
6. Bombay April 24, 1967.
7. Poona April 25, 26 and 27, 1967.
8. ~~Allahabad~~ May 5 and 6, 1967.

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SPECIAL CENTRALLY SPONSORED PROGRAMME FOR
THE IMPROVEMENT OF SECONDARY EDUCATION.

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SCHEME I STRENGTHENING OF SCIENCE LABORATORIES.

1. Object of the scheme.

The object of this scheme is to strengthen the science laboratory equipment in secondary schools to a prescribed norm so that students at this crucial stage of education receive better and more practical instruction in basic science subjects, viz: Physics, Chemistry and Biology. It is intended to carry out this strengthening as a special crash programme to be completed within a period of two years, viz. 1964-65 and 1965-66.

2. Scope of the scheme:

(a) Secondary schools, in this context, will include all schools teaching science subjects at the level beyond the elementary stage (i.e., beyond class VII or VIII as the case may be). This term shall not include pre-University or Intermediate classes attached to colleges of which examinations are conducted by Universities and not by Boards of Secondary or Higher Secondary Education. Secondary schools of all descriptions such as High Schools, Higher Secondary Schools, Multipurpose Schools and Post-Basic Schools will be eligible for the strengthening, irrespective of whether they are run and administered by State Governments, Local Bodies, or private managements. Recognised but unaided schools are expected to have enough science laboratory equipment of their own and therefore they will not be covered by the scheme. / be

(b) The norm referred to in paragraph (1) will, for the purposes of a Higher Secondary school, be the norm indicated as the minimum essential requirements in the C.O.P.P. Team's Report on Science Laboratories in Higher Secondary Schools. If any minor adjustments are to be made in this standard list to suit local syllabi, the State Governments concerned may do so under intimation to the Education Ministry.

(c) For other categories of secondary schools the norms will be laid down by the State Governments concerned and intimated to the Education Ministry. These norms would be different for different categories of secondary schools depending on the science courses taught in each category. They shall include only the minimum necessary equipment for teaching the science subjects at the secondary stage. For fixing the norms, due regard would be paid to the syllabi prescribed for the courses and to the need for economy consistent with efficiency.

(d) Laboratory equipment will include the laboratory furniture required for storing purposes, but not buildings or other furniture needed by the school. An amount not exceeding 5% of the total money sanctioned for this scheme can be spent on the required furniture.

(e) A small portion, not exceeding 2% of the amount sanctioned for the scheme, may also be spent, if needed, on consumable science material and replacements required for the experiments immediately.

(f) The scheme is not intended to introduce new science subjects in schools which do not have the same, nor to provide initial equipment to schools, whether old or new, for their upgrading or for starting of fresh science courses therein. For the present, the scheme will cover only schools which were functioning at the end of the Second Plan (i.e. 1960-61) which are now teaching science subjects, whether of the high or higher secondary standard. This pre-supposes that they will already have some laboratory equipment which is to be strengthened and brought up-to-date for more effective practical instruction with the assistance provided in this scheme.

Financial estimates

The estimated cost of the minimum essential laboratory equipment for a higher secondary school recommended in the COPR team report is estimated to be as under:

(i) Physics	Rs. 25,000/-
(ii) Chemistry	Rs. 17,000/-
(iii) Biology	Rs. 14,000/-
(iv) General Science	Rs. 3,000/-

For a high school, the corresponding expenditure is estimated to be as under:-

(i) Elective Science	Rs. 15,000/-
(ii) General Science	Rs. 3,000/-

Taking into consideration the available funds and the extent of strengthening needed by laboratories of different types of science courses taught in secondary and higher secondary schools in the country, assistance is proposed to be given to States on the following basis:-

Higher Secondary School or Intermediate/college with Physics, Chemistry and Biology. Rs. 12,000/-

Higher secondary school or intermediate college with Physics and Chemistry only - Rs. 8,000/-

High School with Elective Science. Rs. 4,000/-

The actual assistance required for strengthening science laboratory equipment in each eligible school will depend upon the gap between its existing equipment and the prescribed norm. Calculations of financial estimates indicated above are, therefore, taken to have been made only on the basis of an average cost per school. Some schools will get more than this average and some less within the same State.

On the above basis, the total cost of the scheme over the two years 1964-65 and 1965-66 will be Rs. 464.48 lakhs. The distribution of this assistance for different types of schools/courses in the various States is given in Statement I.

Participation by the States

The State Governments (and/or private managements concerned in the case of aided schools) will be required to make up any deficiency in the provision of laboratory room and furniture like work-tables etc. The State Governments will also have to make up the deficiency with respect to the appointment of properly qualified teachers of science. The expenditure on this item in the case of aided schools may be shared on the existing basis by the concerned private managements in the schools wherever found necessary, except that in the case of existing teachers advantage should be taken of Scheme II intended to provide special training for such teachers.

Central Assistance

The entire expenditure required for strengthening the science laboratories on the basis indicated above will be sanctioned as Central assistance outside the States ceilings of Plan expenditure and of the Central assistance, both of which may have already been agreed upon and approved earlier. This arrangement will work for the remaining two years of the third Plan, for the present.

The Ministry of Education will, in the first instance, release funds to each State on an ad-hoc basis, keeping particularly in view the number and nature of institutions in each State likely to be covered by the scheme.

A committee of officials of the Government of India (Ministry of Education and Ministry of Finance) and some officers from States (selected secretaries and D.P.Is. by rotation) will be constituted by the Ministry of Education. This committee will meet periodically to review the progress of the scheme and make necessary adjustments, allotments or re-allotments to individual States. They would also recommend modifications or improvements, if any, in the scheme as it progresses.

The financial adjustment of these grants as between the Central and State Governments will be done in the same manner as in the case of other Centrally sponsored schemes, viz., that the sanctioned funds will be placed at the disposal of the State Governments in advance and they will implement the scheme and furnish periodical progress reports and utilisation certificates wherever necessary.

Conditions of grant

The following conditions will govern the grant of Central assistance under the scheme:-

(i) Satisfactory arrangements will be made to ensure that the assistance is utilised fully and properly for the specific purposes outlined in the scheme. In particular, it will be ensured that the quality of equipment purchased with these funds is the best possible equipment, that the prices are reasonable and that the items purchased are those actually needed by each institution for attaining the prescribed norms. In the case of Government or local body schools, purchase of equipment in bulk may be preferred. Also, in respect of items for which I.S.I. standards have been laid down, purchases should be made from the firms willing and able to supply the material according to those standards.

(ii) The State Governments will also ensure that all the eligible institutions coming within the scope of the scheme implement it so that their science laboratories are properly strengthened by the end of the Third Plan.

(iii) As the scheme is to supplement the efforts already being made by the State Governments/private managements, the State Governments shall not reduce their own assistance to secondary schools for strengthening science equipment. They will also not reduce the existing provision for science-equipment already made in the 1964-65 budget and generally provide at least the same amount for the year 1965-66.

(iv) The State Governments shall take necessary steps to see that the laboratory equipment already in the schools and that to be purchased from this grant are maintained well and are repaired whenever needed. Consumable materials, replacement and small gadgets for the proper use of the equipment will be provided for in the regular budget of maintenance of the school.

(v) No new school shall be given recognition unless there is provision for laboratory equipment according to the prescribed norm. The object is that during the Fourth Plan an attempt should be made to improve the levels from the minimum essential to additional desirable equipment instead of being required to spend again a good portion of the available resources on bringing sub-standard schools to the minimum normal level.

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SCHEME NO. II - SPECIAL TRAINING OF SCIENCE TEACHERS

Object of the scheme

The object of the scheme is to raise the standard of science teaching in secondary schools by organising special training programmes for teachers of science. The scheme is to meet, to some extent, the shortage of post-graduate teachers of sciences to teach higher secondary classes. It has also to provide short training to existing teachers of science in order to improve their competence and thus to enable them to teach that subject in secondary classes more effectively. The scheme also provides for the establishment of an expert Unit of Science Education in each State. This unit will organize various programmes for the training and re-training of science teachers and will attend to all other needs of schools in respect of the improvement of science education in the State. The latter needs will include curriculum reconstruction, production of textbooks, improvement in the methodology of class teaching, laying down of norms for laboratory equipment, preparation of simple apparatus, science talent search etc. It may be added that this Unit will also be helpful in implementing scheme I.

Scope of the scheme

In regard to the scope of the scheme, the points mentioned under scheme I will mutatis mutandis apply.

The training of teachers to handle higher secondary or intermediate classes will be required only in those States which have adopted these courses. The re-training of science teachers in the short 10-week courses for more competent science teaching at secondary school level will be required particularly for the high schools which teach science as an elective or an optional subject (and not merely general science as a core subject). As regards the Unit for Science Education, only a beginning will be made from 1964-65 in order to meet the most urgent requirements and the full Unit, as indicated in the enclosed note (Appendix), will be established during the fourth Plan.

Details of the scheme

In order to improve the academic qualifications and training of graduate teachers of science and to equip them to teach the higher secondary or intermediate classes, a 9-month course will be organized in the Faculties of Science of selected universities or post-graduate colleges in each State. During 1964-65 the course may begin in September and may be carried till the end of May, 1965. The next course may commence from July, 1965. On that basis, the expenditure for various items connected with one such course as well as the total expenditure on all the courses of this category during the two years is estimated to be as under, assuming each course to train a batch of 30 teachers:-

Item of expenditure	Number	1964-65 (6 months) Rs.	1965-66 Rs.	Total Rs.
Lecturers @ Rs.400/- p.m. fixed)	3	7,200	14,400	21,600
Laboratory Attendant (@ Rs.80/- p.m.)	3	1,440	2,880	4,320
Clerks (@.Rs.150/-p.m.fixed.)	1	900	1,800	2,700
Upkeep of science laboratories		2,500	4,000	6,500
Stipend to trainees @ Rs.30/- p.m.	30	5,400	10,800	16,200
Salary of substitute teachers @Rs.200/- p.m.	30	36,000	72,000	1,08,000
Rent of buildings to provide hostel accommodation @Rs.500/- p.m.	1	3,000	6,000	9,000
Total:-		56,440	1,11,880	1,68,320
Non-recurring for books -		20,000	-	20,000
Grand Total:		76,440	1,11,880	1,88,320
		i.e.	i.e.	i.e.
		76,000	1,12,000	1,88,000
		15,20,000	33,60,000	48,80,000
(For 20 courses in all the States)			(For 30 courses in all the States)	

The 10-week refresher course should also be organised in the Departments of Science of selected universities or post-graduate colleges in the States. These courses should be run all the year round and each batch may comprise 30 teachers. In view of the smallness of the period of training, no substitute teachers will be required in this case. The expenditure on each such course as well as the total expenditure on all the courses during the two years is estimated to be as under:-

Item of expenditure	Number	1964-65	1965-66	Total
		(6 months 2 batches)	(12 months i.e. 4 batches)	
		Rs.	Rs.	Rs.
Lecturers @ Rs.400/- p.m. fixed)	3	7,200	14,400	21,600
Laboratory Attendant (@Rs.80/- p.m. fixed)	3	1,440	2,880	4,320
Cldrk-cum-typist (@Rs.150/-p.m. fixed)	1	900	1,800	2,700
Upkeep of science laboratories		3,000	6,000	9,000
Stipends to trainees @Rs.30/- p.m.	30	4,500	9,000	13,500
Rent of buildings @Rs.500/- p.m.		3,000	6,000	9,000
Total		20,040	40,080	60,120
Non-recurring cost for books		20,000	--	20,000
Total cost (recurring and non-recurring)		40,040 i.e. 40,000	40,080 i.e. 40,000	80,000
		8,00,000 (For 20 centres in all the States)	12,00,000 (For 30 centres in all the States)	20,00,000

In the case of Science Education Units, each Unit will, on an average, commence with the appointment of the Director, two technical members of the staff, and a small office establishment. Some adjustment in the final size of the Unit will have to be made depending upon the number of schools which it has to deal with and the nature of the problems in the State. Certain States having a very large number of schools may need additional staff in the Unit. Similarly, some other States, e.g. Nagaland, which have a smaller number of schools will need a smaller unit. These adjustments will be made while sanctioning Units for each States. No provision is being made for constructing buildings and the Unit will have to commence its work in a rented building to begin with. The expenditure on one Unit during 1964-65 and 1965-66 as well as the expenditure on all the Units expected to be established during these two years will be as under:-

	1964-65 (for 6 months only)	1965-66	Total
	Rs.	Rs.	Rs.
Director (Professor's grade)	6,000	12,000	18,000
Two technical staff at an average rate of Rs.500/- p.m. each.	6,000	12,000	18,000
<u>Office staff</u>			
One Steno-typist One typist-cum-clerk One peon) @Rs.550/. p.m. 3,300	6,600	9,900
Rent @ Rs.500/- p.m.	3,000	6,000	9,000
Furniture	15,000	5,000	20,000
Stationery, T.A., D.A., and other contingencies.	10,000	20,000	30,000
Total:-	43,300 i.e. 43,000	61,600 i.e. 62,000	1,04,900 i.e. 1,00,000
	Rs.4.30 lacs (for 10 units in all the States)	Rs.9.92 lacs (for 16 units in all the States)	Rs.14.22 lacs

Participation by the States

In this scheme, the responsibility of the State Governments is to negotiate with universities/colleges within their jurisdiction and to undertake the organisational work about the courses and the Units. The State Governments will also be responsible for the recruitment and posting of the substitute teachers, particularly with reference to Government schools.

Cost of the scheme

On the basis indicated above, the total cost of the scheme over the two years will be Rs.83.02 lakhs as indicated below:

Nature of the course.	1964-65 (Rs. in lakhs)	1965-66 (Rs. in lakhs)	Total (Rs. in lakhs)
9-month course	15.20	33.60	48.80
10-week course	8.00	12.00	20.00
Science Education Units.	4.30	9.92	14.22
Total:-	27.50	55.52	83.02

States Institutes of Science Education

The Third Five-Year Plan lays great emphasis on expanding and improving the facilities for science education in schools. To make a satisfactory progress in this direction, it is felt necessary that each State should organize an Institute of Science Education. This would be the technical arm of the Directorate of Education and the State Boards of Secondary Education for the promotion and improvement of science teaching in schools at all stages.

More specifically, the functions of the Institute may be as under:

- i) To reconstruct the science curriculum at school stage on the basis of continuous studies and experimentation;
- ii) To prepare textbooks and other reading material on science for students and teachers;
- iii) To devise measures for improved experimental and laboratory work in science;
- iv) To design and organise in-service training courses for teachers of science;
- v) To organise post-graduate condensed courses for science teachers at the school level;
- vi) To design improved methods of pre-service training of science teachers;
- vii) To organise training programme for science teachers in co-curricular activities;
- viii) To prepare instructional materials, including teaching aids, for science education for the guidance of schools;
- ix) To collaborate with other organizations in promoting experimental work in improved science teaching; and
- x) To undertake all other work directed to improve teaching of science in the State.

The State Institute of Science will also work as the State level counterpart of the Department of Science sponsored by the Ministry under the National Council of Educational Research and Training. The NCERT Department of Science is working on broad programmes and pilot schemes for improvement of science teaching in schools and is conducting investigations on specific topics from an all-India point of view. The State Institutes of Science Education will adapt to local conditions the results achieved by the NCERT and reach them to the schools within the State. The Institute may also be required to undertake special studies and intensive programmes in a particular

field related to science education which may be specially applicable to that State alone.

It may be mentioned that State Institutes of Education have already been set up in different parts of the country. It is proposed that during the Fourth Plan, the existing organisations in the States dealing with educational planning, research, statistics, in-service training, text-books, educational and vocational guidance service, examination reform should all be integrated with those Institutes. It is suggested that the proposed Institutes of Science Education should also be parts of the same institutes of Education and may in that case be Science Education Departments of the State Institutes of Education.

Curriculum and literature.

It is felt that the entire country should have a broadly uniform curriculum in science at the schools level. The present efforts at the Central level are towards evolving model syllabi of science for various levels in line with the modern developments that are taking place in India and abroad. This general pattern may be tailored by those Units to the needs and resources of the States. Besides, the syllabi, the Units should develop suitable literature in regional languages in the form of curriculum guides, resource books, handbooks for teachers and audio-visual and other teaching aids appropriate to the syllabi. They can also develop instructional materials centre in science and a suitable reference library for consultative services to schools.

Preparation of textbooks and supplementary reading material

Much time and effort is being spent by the NCERT in producing textbooks, supplementary and other reading materials for science education in schools. Most of these are being written in English and, therefore, will not be directly useful to a majority of school students because the medium of instruction in schools is usually the regional language. The State Units will, however, have to examine this literature and translate or adapt it in the regional languages for their areas. They will also have to prepare, or guide the preparation of, other books and reading material to suit local needs and thus supplement the work of N.C.E.R.T.

Improving experimental and laboratory work

The Units should prepare suitable designs for

science laboratories for schools at different levels and give expert guidance to new schools which will build new laboratories or suggest improvements in existing laboratories. It will prepare standard lists of minimum and essential equipment needed for teaching a particular syllabus followed in the State as well as a list of desirable equipment so that priorities may be determined by the State Government in giving financial assistance.

It can also locate the places and firms from where quality articles of equipment and apparatus in science can be obtained and give guidance to the Schools in making purchases of quality articles.

In-service training programmes

One of the major activities of such Units will be in-service training programmes for teachers of science in the form of short refresher or re-training courses of 10-12 weeks for the existing B.Sc. Science teachers of secondary schools. The implementation of the training programme should, however, be one of the chief responsibilities of the State Units. It may be envisaged that if the programme is carried on a year round basis in 4 or 5 batches of 30-40 each, then about 150 teachers may be re-trained by each Unit in a year. The number of such training centres in a State may be decided by studying its needs and resources. The over-all objective should be that every practising teacher is able to attend such a refresher course once in 5 years so that the quality of existing teachers goes on improving.

Post-graduate condensed courses

The shortage of M.Sc. teachers for higher secondary schools is already well known. It is felt that the entire course of study of the regular M.Sc. classes of a university may not be needed for teaching in higher secondary schools. In any case, the output of M.Sc.'s to join teaching profession will continue to be slow for many years to come. For a better depth of knowledge and a clarification of concepts, it is necessary for the B.Sc. teacher to know content matter beyond the B.Sc. level. The condensed course of M.Sc. in a particular subject may, therefore, be given to a B.Sc. teacher to enable him to teach the higher secondary classes in the subject. Such courses may be made attractive to a teacher if the State Governments give due recognition by the award of a diploma and grant of a higher scale or special increments to such diploma-holders.

Pre-service training programmes

In so far as the pre-service programmes of training science teachers are concerned, it may be expected to be carried on by the training institutions. It should, however, be the responsibility of the State Unit to frame the syllabi of content and methodology courses for the training schools and colleges throughout the State and to help in periodically training the teaching staff of the training colleges of the State in the new methods of science teaching.

Training programmes for co-curricular activities

The science teachers need specialized training for organizing co-curricular activities in science, like Science Clubs, which are necessary to strengthen science teaching in schools. The skills which are required for such activities are not usually given in the training colleges. The State Units can give training to selected Club sponsors in workshop skills and related activities, so that they may organise such activities in a more efficient way. Such training courses may be provided all the year round and it is possible to train 150-200 teachers during periods of 10-12 weeks each.

The Science teachers also need training in the handling of audio-visual equipment and repairs of laboratory equipment. The State Units can train Science teachers in such programmes in the form of short refresher courses ranging from 8 to 12 weeks.

Instructional materials, including teaching aids

Films and other visual aids like filmstrips, charts, models, etc. can be used effectively in the teaching of science and supplementing the work of the teachers. The State units of Science Education can help the schools in securing these aids. The Units can also give guidance to the schools on the preparation of these and other instructional aids with the help of locally available materials.

Experimental work in improved science teaching

The Science Education Units have to play an important role in encouraging and guiding the schools and teachers in undertaking research projects in science teaching. A wide field is available for the purpose and should include projects in curriculum, techniques of teaching, audio-visual

aids, designs of laboratory space and furniture, equipment for teaching particular branches of science, work-load of science teachers, survey of improvement programmes in other countries in science teaching, inspection of science in schools, syllabi of training colleges, use of community resources in teaching science, objectives of teaching science, techniques of evaluation and science programme for gifted or backward children etc.

Practising school

It is necessary for each State Institute of Science to have a fully equipped higher secondary school for practical training and for research purposes. The school should have provision for teaching in the science stream.

Staff

The staff requirement of a State Unit will be as under:

- | | | |
|---|----|-----------------------------------|
| 1. Director or Principal | 1 | In the Professor's grade |
| 2. Vice-Principal or Administrative Officer | 1 | P.E.S. Class I or Reader's scale. |
| 3. Subject teachers in science subjects and methodology | 5 | -do- |
| 4. Lecturers | 7 | P.E.S. Class II grade |
| 5. Research Assistants and Librarian | 6 | Post-graduate teachers' scale. |
| 6. School Principal | 1 | P.E.S. Class II grade. |
| 7. Teaching staff and librarian for school | 15 | Post-graduate teachers' scale. |
| 8. Workshop Superintendent | 1 | P.E.S. Class II grade |
| 9. Instructors for workshop | 4 | Post-graduate teachers' grade |
| 10. Ministerial staff for the Unit and the school, including one senior stenographer and office superintendent. | 9 | Usual scale |
| 11. Laboratory bearer, Workshop Attendants, Library Attendant, and Daftri | 9 | Usual scale |
| 12. Peons for Unit and school and chowkidars | 6 | Usual scale |

Suitable provision for building, equipment, furniture and workshop will also be necessary.

Immediate beginning

To start with, the Principal and two staff members may be first appointed to take up the following work:-

- (i) Survey to collect basic data regarding the position of science teaching in the State with regard to curriculum, enrolment, resources available in science laboratories, position of science teachers etc.
- (ii) Making inventories of apparatus needed for implementing a syllabi of various subjects in terms of:
 - a) Minimum essential items needed for demonstration by the teacher.
 - b) Minimum essential items needed for practical experiment by pupils individually.
 - c) Desirable extra items for demonstration and practical experiments.
 - d) Audio-visual equipment needed for science teaching
- (iii) Survey of laboratory equipment as available at present in schools and the equipment that needs to be supplied further through the grants that are to be sanctioned by the Ministry of Education.
- (iv) Make a blue-print for the future set-up of the Institute in terms of the needs of the State.

Location and administrative arrangement

The Unit may be located in one of the universities of the State to look after the development of science education at the school stages. The entire expenditure on the establishment and maintenance of the Unit would be borne by the Government and the university will not have to incur any expenditure. The location of the Unit in a university is likely to result in economy of expenditure, because the existing laboratories, library etc. of the university can be used by the Unit. It will also provide necessary facilities and create a favourable atmosphere for raising the educational standard of science teaching, which is the main function of the Unit. The guidance and cooperation from the university professors for study and research purposes and for consultation with them for every other matter would be more convenient if the Unit is located in the same premises.

Although the Unit be administered by the State Department of Education, an Advisory Committee may be set up to guide its working. This Committee will have representatives of the university, the State Department of Education, training colleges, Heads of secondary schools and the State Association of Science Teachers.

STRENGTHENING OF SCIENCE LABORATORIES

Name of State	No. of Schools 1960-61		No. of schools with Elective Science	Proposed assistance (Rs. lakhs) for Total Higher Secondary Schools with						High Schools with			Total assistance Cols. 9, 10 & 11	Total assistance Cols. 8 & 12			
	Higher	High		Phy. & Chem. @	Phy. & Chem. & Biology *	Genl. Science	£	5, 6 & 7	Elec. Science	Genl. Science	Without Science (No assistance being given)						
1	2	3	4	5	6	7	8	9	10	11	12	13					
				<u>Schools</u>	<u>Sch-ools</u>	<u>Cost</u>	<u>Sch-ools</u>	<u>Cost</u>	<u>Sch-ools</u>	<u>Cost</u>	<u>Schools</u>	<u>Cost</u>	<u>Schools</u>	<u>Cost</u>	<u>Schools</u>	<u>Cost</u>	
				<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	<u>Cost</u>	
Uttar Pradesh	140	1082	93	62	4.96	31	3.72	47	0.94	9.62	-	-	1082	21.64	-	21.64	31.26
Bihar	32	528	16	10	0.80	6	0.72	16	0.32	1.84	-	-	350	7.00	178	7.00	8.84
Madhya Pradesh	185	1340	600	123	9.84	62	7.44	-	-	17.28	415	16.60	925	18.50	-	35.10	52.38
Gujarat	-	1099	11	-	-	-	-	-	-	-	11	0.44	1088	21.76	-	22.20	22.20
Assam & Kashmir	24	226	29	16	1.28	8	0.96	-	-	2.24	5	0.20	-	-	221	0.20	2.44
Kerala	-	879	93	-	-	-	-	-	-	-	93	3.72	786	15.72	-	19.44	19.44
Madhya Pradesh	705	69	300	200	16.00	100	12.00	405	8.10	36.10	-	-	-	-	69	-	36.10
Andhra Pradesh	-	1253	-	-	-	-	-	-	-	-	-	-	1253	25.06	-	25.06	25.06
Maharashtra	94	2104	1500	62	4.96	32	3.84	-	-	8.80	1406	56.24	698	13.96	-	70.20	79.00
West Bengal	130	648	363	88	7.04	42	5.04	-	-	12.08	233	9.32	415	8.30	-	17.62	29.70
Odisha	-	9	-	-	-	-	-	-	-	-	-	-	9	0.18	-	0.18	0.18
Orissa	5	445	8	3	0.24	2	0.24	-	-	0.48	3	0.12	442	8.84	-	8.96	9.44
Punjab	192	1277	100	66	5.28	34	4.08	92	1.84	11.20	-	-	-	-	1277	-	11.20
Rajasthan	304	233	237	158	12.64	79	9.48	67	1.34	23.46	-	-	-	-	233	-	23.46
Uttar Pradesh	750	1021	800	200	16.00	100	12.00	450	9.00	37.00	500	20.00	-	-	521	20.00	57.00
West Bengal	769	1188	386	124	9.92	62	7.44	583	11.66	29.02	200	8.00	988	19.76	-	27.76	56.78
Total	3330	13401	4536	1112	88.96	558	66.96	1660	33.20	189.12	2866	114.64	8036	160.72	2499	275.36	464.

@ Rs.8000 per school

* at the rate of Rs12,000 per school

£ at the rate of Rs.2,000 per school

Tour Reports of the Evaluation Team*1. Punjab

The Evaluation Team reached Chandigarh on the evening of 19th March, 1967. The Team called at the office of the Director of Public Instruction on the following day at 10.30 A.M. Besides Prof. Balwant Singh, Director of Public Instruction, the Joint Director, Smt. Parampal Singh and the Deputy Director, Shri Inder Singh were also present at this meeting.

2. At the outset, the D.P.I. remarked that the allocation for education in the State's Fourth Plan had been reduced considerably. It was his considered opinion that Central assistance was absolutely essential for implementing programmes of qualitative improvement. Education received a comparatively low priority in the State Plan. He was, therefore, strongly in favour of maintaining the centrally sponsored sector in respect of selected programmes for raising standards of education in schools.

3. Coming to the Crash Programme, he explained that although the Ministry of Education allocated funds for the scheme in June or July of the financial year, the sanction from the State Government was received towards the end of the financial year. For example, the sanction for 1964-65 was received from the State Government on 19th January, 1965. In 1965-66 the financial sanction was received only on 27.1.1966 and during 1966-67 on 28.2.1967. The late receipt of the sanction naturally placed the Education Department in a difficult position as all the formalities for purchase of science apparatus had to be rushed through during the last five or six weeks of the financial year. He suggested that there should be some device by which these grants could be carried over to the next financial year so that the Department was given sufficient time for completing the purchases. In this connection, he mentioned that his Department informed the district officers and heads of schools in advance of the grants which they were likely to receive and asked them to make necessary advance preparations. Even so, the results were not as satisfactory as they should be.

* These reports were sent, in the first instance, to the Education Secretary/D.P.I. of the State concerned for comments. Andhra Pradesh, Madhya Pradesh and Maharashtra sent comments which have been taken into consideration while finalising the reports.

4. Prof. Balwant Singh mentioned that before 1958 every secondary school which was raised to the status of a higher secondary school was given a grant of Rs. 1.05 lakh, of which Rs. 50,000 was for science equipment and the rest for the laboratory building, fittings, furniture etc. On account of financial stringency, the grant was reduced from 1958 onward to only Rs. 25,000 per school. In 1964, this grant was further reduced to Rs. 15,000. The bigger schools, which had a number of sections in each class, were naturally at a disadvantage as they had to provide apparatus for a large number of students. Also those middle schools which were straightaway upgraded as higher secondary schools were in a difficult position as they had no base from which proper laboratory facilities could be built up.

5. With the help of the State Science Education Unit, the Education Department had compiled a standard list of equipment for high and higher secondary schools. The deficiencies of each school were ascertained in relation to this list.

6. The Central Government had laid down that the funds under the Crash Programme should be utilised only for schools set up upto the end of the Second Plan. The D.P.I. felt that this decision prevented his Department from assisting a large number of schools started in the Third Plan which were in fact in need of immediate assistance for science equipment. The resources of the State were inadequate to meet the demands of these schools.

7. Regarding the procedure for purchase of science equipment supplied to schools, Prof. Balwant Singh pointed out that the Controller of Stores of the Government of the Punjab invited tenders from various firms. The goods offered by the firms were then inspected and approved by a Special Purchase Committee appointed by the Government. Prices were approved by the Controller and a copy of the rate contract was supplied to all schools. Purchases for government schools were mainly arranged through the Department. In the cases of non-government schools, the purchases in one year were made through the Department and in other two years, the schools negotiated with the firms direct. In spite of these elaborate arrangements, the results were not satisfactory. Some of the apparatus received by the schools was defective. Some of the reputed firms did not enter this business because they could not quote prices which small and unreliable firms were able to quote. Prof. Balwant Singh felt that the tender system should go and standard equipment must be purchased from standard firms at negotiated prices. He also felt that the Central Government or the State Governments could set up their own Workshops for manufacturing those items of equipment where precision was required.

8. Prof. Balwant Singh said that they had no funds to assist schools for construction of science laboratories and it was quite possible that in a few cases the equipment supplied to schools would be lying unused for want of a laboratory room.

9. Regarding availability of science teachers, Prof. Balwant Singh said that the grades of post-graduate teachers in higher secondary schools had been improved and brought on par with those of lecturers in affiliated colleges. Yet there were not more than 20 M.Sc. teachers working in all the 120 higher secondary schools in the State. The position regarding supply of B.Sc. teachers was better but even here the supply fell short of the demand. Although the Department had recently sent a requisition for 100 B.Sc. trained men teachers, the Subordinate Staff Selection Board of the State could select only 57. Against the demand of 100 untrained B.Sc. men teachers, the supply was 83. In the case of women teachers, the supply of trained science teachers was only 37% of the demand. There was also shortage in the case of mathematics teachers. Only 63% of the posts for trained mathematics teachers could be filled with qualified men candidates. In the case of women, the corresponding percentage was 45.

10. As regards special training programmes for upgrading the knowledge of existing science teachers, the State had tried various methods. In 1959-60, the State had, on its own initiative, organised a nine-month condensed course for 129 science teachers to equip them for teaching in higher secondary classes. The course was arranged with the assistance of the Punjab University who were paid a sum of Rs. 1,800 per trainee. In the opinion of the D.P.I., the course was not a success because the syllabus was somewhat unsuited for teachers of secondary schools. No diploma was awarded at the end of the course. There was hardly any motivation for the trainees who did not derive any monetary benefit apart from one advance increment in their existing grades. On the other hand it was a problem to appoint substitute teachers in the place of those deputed to attend the condensed course. This arrangement was continued for three years. Later, in 1965-66, the Punjab Government organised under the Crash Programme condensed courses in chemistry and biology at the Government College, Chandigarh and in physics at the Punjab University. Here again, the Department was not quite happy with the conduct of the courses. The teachers also did not show any interest in these courses for want of monetary incentives. The Punjab Government also tried the experiment of upgrading the qualifications of the existing science teachers by having them placed in the M.Sc. courses in the Punjabi,

Kurukshetra and Agricultural Universities of the State. But the outcome was again disappointing because teachers who got the M.Sc. degrees were reluctant to return to schools inspite of the legal bonds they had furnished. Quite a few left schools and joined affiliated colleges. In 1966-67, no condensed course was organised. In regard to short-term courses, the Department arranged only one 10-week course in 1965-66. 30 teachers were selected for the course, but only 13 attended. This was due to the difficulty of finding substitute teachers. The present thinking in the Department is that only a full-fledged Science Education Institute could undertake the training programme on a sound and permanent footing. The Science Unit set up in the State had ceased to function after reorganisation of the State. The Unit should be revived and upgraded as a regular Institute which should be located in a small but well-equipped college near Chandigarh and should arrange short-term and condensed courses in cooperation with the staff of the college. The laboratories of the college could be suitably strengthened. The Department is also of the view that all science teachers should attend 10-week refresher courses by turns and the brighter ones among them should then be picked up for the nine-month condensed course. An examination should be held at the end of the course and successful trainees should be given a post-graduate diploma which should entitle them to the grade of Rs. 180-450 which is the present grade sanctioned by the Government for third division M.Sc. Prof. Balwant Singh was hopeful that a course specially designed for science teachers by the State Institute of Science Education had a better chance of success provided the teachers had the prospect of going into the higher grade referred to above.

11. On the afternoon of 20th March, the Evaluation Team visited two local schools, but found that they were not functioning normally owing to examinations. The science teachers were not available on the premises at the time of the visit and, therefore, no information could be collected.

12. On 21st March, the Team visited in the morning, first the D.A.V. Higher Secondary School, Chandigarh. This is one of the largest schools in Chandigarh with an enrolment of over 2,500 students. The school has as many as 6 science sections in class XI with 60 boys in each class section. According to the Punjab University syllabus, students taking science as an elective subject for the higher secondary examination have to perform practicals in biology in class IX & X and in physics and chemistry in class XI. The school received a grant of Rs. 4,625 under the Crash Programme during 1964-65 and the school authorities were permitted to purchase the equipment from firms

approved under the rate contract system. Since the school authorities made purchases directly they were able to select good quality apparatus. In the following year i.e., 1965-66, the school received a grant of Rs. 8,000 but the orders for the bulk of the apparatus were placed with the firms by the Department. Some of the items received by them were not of high priority and left to themselves, the school authorities would have purchased other items of day-to-day use. Also, about 10 to 15% of the apparatus was defective. The Evaluation Team inspected the laboratories of the school and some of the defective items of equipment supplied to the school. The Team was not impressed with the upkeep of the laboratories. The Team was informed that the annual expenditure on the school laboratories was : Physics - Rs. 4,000, Chemistry - Rs. 5,000, Biology - Rs. 4,000, General Science - Rs. 2,000. The Education Department permitted the school to collect science fund from students. This fund was utilised for meeting part of the expenditure of the laboratories.

13. The Team next visited Mani Majra High School situated at a distance of about 6 miles from Chandigarh, within the Union Territory of Chandigarh. This is a co-educational school with about 700 pupils in classes VI to X, one-third being girls. The school received a grant of Rs. 1,500 during 1964-65 and Rs. 2,000 in 1965-66 under the Crash Programme. The first grant was utilised by the head of the school himself. In the case of the second grant, purchases amounting to Rs. 1,500 were made through the Department and the balance of Rs. 500 was utilised by the head of the school directly. Here again, it was explained to the Team that the quality of some of the apparatus received through the Department was not upto the mark. The school had sufficient apparatus but the laboratory room was small and the furniture was inadequate. The school had one B.Sc. trained teacher. Among the equipment received by him was a set of maintenance tools which was being put to good use.

14. The Team next visited the Government High School at Dehra Bassi. This is again a co-educational school with a large number of girl students. In class IX, there were 97 students and in class X, 90 students. All students were studying general science. The school received under the Crash Programme only one grant of Rs. 1,500 during 1964-65. The Team was unable to see the laboratory as the key was with the science teacher who was away with examination duty. The Head-mistress thought that school had enough science apparatus but not sufficient furniture. She was not satisfied with the performance of the science teacher.

15. While visiting the school, the Team noticed with satisfaction that 8 new class-rooms were under construction with the assistance of the local community. The Government had contributed Rs. 1,000 for each room and the local community was expected to contribute the balance i.e. about Rs. 1,500 per room. The Team met some members of parent-teacher association who had volunteered to get the building constructed under their own supervision with every possible economy. The Assistant Director of Education, who accompanied the Team on the trip, explained that the Punjab Government was helping the village communities to put up additional class-rooms by contributing Rs. 1,000 per class-room. This scheme was working well and was evoking good response from the public.

16. On the afternoon of 21st March, the Team met the D.P.I. again and gave him their impressions. They also discussed with him the future plans for strengthening science education in the State. The D.P.I. felt that the following measures were required to improve science teaching in schools in his State:

a) A science supervisor should be appointed in every district. The supervisor should work under the guidance of the District Education Officer and should be incharge of all work connected with science education in the district. The absence of qualified supervisory staff for science in the district was a great handicap in implementing any programme for strengthening science education.

b) The Science Education Unit in the State had practically ceased to exist after the reorganisation of the State. The Unit had to be revived and strengthened so as to perform its normal functions and also to conduct regular 10-week short-term and 9-month condensed courses.

c) Schools established upto the end of the Second Plan had been supplied apparatus under the Crash Programme but schools established after 1961 were in many cases deficient in laboratory equipment. Science apparatus should be supplied to these schools as soon as possible.

17. The Team also called on Shri Pritmohinder Singh, Education Secretary of the Punjab Government. The D.P.I., the Deputy Secretary and the Under Secretary of the Education Department of the Punjab Government were also present. The working of the Crash Programme was reviewed. It was agreed that the State Science Education Unit should be revived as early as possible. The delays in the issue of financial

sanctions would be eliminated and the procedure for purchase of science equipment would be streamlined. It was also agreed that the training programmes for science teachers would be reorganised. The Education Secretary also said that the recommendations made by the Education Commission in regard to science education would be examined and given effect to within the resources available with the State Government. It was felt that a detailed survey should be made in each district of the immediate and essential needs of all secondary schools in respect of laboratory rooms, furniture and equipment and a plan of action be drawn up for the remaining years of the Fourth Plan. When this overall plan was ready, ways and means should be devised to implement it with the resources of the State Government and such assistance as could be received from the Central Government under the centrally sponsored scheme for the strengthening of science education at the secondary stage.

2. West Bengal

The Evaluation Team reached Calcutta on the morning of 30th March, 1967. The same day at 11 a.m. the Team called on Dr. B. Dutta, Secretary, Education Department and explained to him briefly the object of their visit. Later, they met Prof. Dutt, Deputy Director of Public Instruction and Shri S. C. Ray, Chief Inspector of Secondary Education. There was a detailed discussion on the implementation of the centrally sponsored scheme relating to the strengthening of science education and special training of science teachers (Crash Programme).

2. There are about 1,600 higher secondary schools (upto class XI) in the State of which about 1,200 have provision for the teaching of science. In addition, there are 1,400 high schools (upto class X) of which about 500 have provision for the teaching of elective science. All high and higher secondary schools have provision for the teaching of general science. According to the present regulations, teachers with B.Sc. (Hons) or M.Sc. qualification are qualified to teach in class XI. An Hons. graduate is placed in the grade of Rs. 225-470. He draws D.A. at the rate of Rs. 40/- and housing allowance at the rate of about 10% of the salary. M.Sc.s. are given a start of Rs. 240/- p.m. Teachers with B.Sc. degree are qualified to teach in high schools. According to Prof. Dutt's estimate, only about 600 higher secondary schools have qualified science teachers. The others have to make do with B.Sc. teachers who have taken six-month condensed course, arranged by the Government of West Bengal at five colleges including the

Presidency College. The output from the condensed course is about 350 every year. The teachers undergoing the course are paid a stipend of Rs. 50/- p.m. in addition to their normal emoluments. According to Prof. Dutt, the condensed course is too brief to equip teachers to handle the subject in class XI. He was of the view that only M.Sc. teachers could do real justice to the syllabi prescribed for science at the higher secondary level, but he added that it was difficult to obtain services of M.Sc. teachers on the emoluments offered to them at present.

3. The State Institute of Science Education had been established at the Burdwan University. Prof. Dutt felt that the Institute should have been set up in Calcutta so that its advice on technical matters relating to science education could have been more readily available to the Directorate of Education.

4. It was explained that upto 1962, every secondary school raised to the status of a higher secondary school received a grant of Rs. 55,000 for construction of laboratories and another grant of Rs. 50,000 for apparatus and furniture. After 1962, owing to financial stringency, these grants could not be given with the result that about 600 higher secondary schools started after that year had to be satisfied with make-shift arrangements. The State Government paid a contingent grant of Rs. 3,000 per annum. to every higher secondary school teaching science course. This included the salary of a class IV servant.

5. As regards the supply of science equipment under the Crash Programme, the Government of West Bengal had set up a Committee consisting of the D.P.I. and other senior officials of the Directorate of Education to select schools, which were to be given financial assistance under the scheme. The State Government's sanction for the release of funds under the scheme was usually received towards the end of the financial year. The Directorate drew the entire grant before the close of the financial year and distributed it to the schools by June in the next financial year. The schools were furnished with a model list of apparatus and appliances for guidance and were asked to complete the purchases within a month of the receipt of the grant. Grants were sanctioned to schools on a uniform basis during 1964-65 and 1965-66, that is, Rs. 12,000 for higher secondary schools with physics, chemistry and biology and Rs. 8,000 for higher secondary schools with physics and chemistry. High schools teaching elective science were sanctioned Rs. 4,000 each, while all schools were sanctioned Rs. 2,000 for general science. It is proposed to sanction grants for 1966-67 after

ascertaining the needs of individual schools. The grantee institutions are required to purchase equipment of good quality after calling for tenders. Prof. Dutt, however, stated that on his visit to schools he had noticed that some of the items of equipment supplied to schools were defective.

6. It was explained that in each district there were four principal officers of the Directorate: an Inspector of Schools, an Inspectress of Schools, a Social Education Officer and a Physical Education Officer, the first three being class II officers. These officers functioned independently of one another and were responsible directly to the senior officers at the headquarters. Prof. Dutt felt that the district officers had little time for detailed inspection work. He was of the view that there was need for a qualified officer at the district level to supervise and guide science teaching in schools.

7. In the afternoon, the Team visited the Ballygunj Government High School. The school teaches up to higher secondary level and has four sections each in classes IX-XI. Two of these sections are for science (about 90 students) and one each for technical subjects and humanities. The school has provision for teaching physics, chemistry and biology. Science practicals are held from class IX upwards. In class XI, there were four periods for theory and two for practicals per week in each science subject. Languages - English and Bengali - account for 19 periods per week. The school has three science teachers all with B.Sc. (Hons) degrees. The school received the grant of Rs. 55,000 for science equipment when it was upgraded as a higher secondary school. The school received a grant of Rs. 12,000 under the Crash Programme in June, 1965. The grant was cashed on 9.3.1966 and payments for purchases were completed in March 1966. The science teachers prepared lists of apparatus, which were purchased after calling for tenders. The headmaster felt that the system of purchases was satisfactory. He also felt that the grant under the Crash Programme was welcome since it helped the school to make good the deficiencies. The Team inspected the school laboratories and were generally satisfied with the quality of the apparatus purchased from the grant. The laboratories were kept well. In regard to the technical stream, the Team was given to understand that there was not much demand for the technical course, the teachers had not enough work to do and a lot of costly equipment was lying without being put to much use.

8. On 31st March, the Team went to Burdwan to visit the State Institute of Science Education. They first met Dr. D. M. Sen, the Vice-Chancellor. Others present at the meeting were: Dr. A. Mookherji, Hony. Director of the Institute, Shri S. N. Chatterji, Registrar of the University and Shri P. N. Sen Gupta,

Reader in the Institute. Dr. Sen explained that it had not been possible to recruit sufficient M.Sc. or B.Sc. (Hons) teachers in higher secondary schools. Hence it was necessary to select on merit B.Sc. teachers already working in schools and give them content courses. The Institute of Science Education had been set up with an independent governing body, of which the State Minister of Education was the President and the Vice-Chancellor was the Vice-President. The Institute was organising content courses upto Honour's level in physics and chemistry. A course in biology would be started in 1967-68. The Institute had rented premises from the Burdwan University where it had set up its own physics laboratory. As for chemistry, the course was organised in the chemistry laboratory of the university. The Institute had a separate library. An experimental school was under construction. The building was estimated to cost about Rs. 1.90 lakhs and more funds would be needed for equipping it. While the cost of construction according to usual P.W.D. specifications was Rs. 35/- per sq. ft., the cost had been brought down to Rs. 11.50 per sq. ft. by adopting techniques developed by Prof. A. C. Roy, former Principal of the Silpur Engineering College and now Vice-Chancellor of the North Bengal University. The experimental school was to house model laboratories in all science subjects, a workshop, science museum and a library. The idea was to develop a kind of science education centre to which students from neighbouring schools could be brought from time to time. The Institute was in need of a hostel for the trainees. Dr. Sen indicated that the Institute would shortly undertake publication of general literature on scientific topics. It was also proposed to select about 20 schools for intensive work so that the new ideas ~~developed in the Institute~~ could be tested in actual classroom conditions. Dr. Sen also proposed to build up a circulating library for science teachers.

9. The Team visited the Physics Department of the Institute and saw the class and the laboratory. They also visited the Chemistry Department of the University where the trainees were taking their practical tests. Next, they visited the building of the experimental school under construction and also quarters for lecturers of the university, built according to the new low-cost technique. The Team was satisfied with the arrangements made for the content course at the Institute. It was, however, explained by the staff of the Institute that there was need to introduce methodology in the course and this would necessitate the prolongation of the present course from 9 to 12 or 15 months.

10. The Team visited the Burdwan Municipal High School. The school has two science sections in classes IX and X and one science section in class XI. The headmaster said that there was a growing demand for the science course. The school had B.Sc. (Hons) teachers in physics and biology and a B.Sc.B.T. teacher in chemistry. The headmaster of the School was also an M.Sc. in physics. The school had received, in 1958, a grant of Rs. 1.05 lakh for science. On 13.7.1965, the school received a grant of Rs. 12,000 under the Crash Programme. The Team visited the school laboratories which were well-equipped. The quality of apparatus purchased from the grant under the Crash Programme was satisfactory.

11. Accompanied by Sarvashri B. K. Bose and Anil Dasgupta Dy. Inspectors of Schools, the Team visited two schools on the morning of 1st April. The first school visited was the Shailendra Sircar Vidyalaya, a well-established recognised, but un-aided school, with an enrolment of about 1,100 pupils. In class XI, there were 90 pupils - 45, 30 & 15 in science, technical and humanities streams respectively. Here also the science stream was popular, because the students for the technical stream were at a disadvantage in securing admission to engineering colleges. The school had M.Sc. teachers, 2/physics, 2 in chemistry and 1 in biology.- This school had received an initial grant of Rs. 50,000 for science apparatus. A grant of Rs. 12,000 was sanctioned to the school in April 1966 under the Crash Programme. Of this, a sum of Rs. 8,000 had been spent and orders worth another Rs. 2,000 had been placed already. The school laboratories were well-equipped and well-kept and the grant under Crash Programme had been utilised with great care. The headmaster felt that the school would need a sum of Rs. 10,000 every five years for replacements and additions. This would be in addition to the recurring expenditure of Rs. 6,000 per annum of which the State Government contributed Rs. 3,000. /in

12. The Team next visited Kankhuly High School, P.O. Garden Reach, 24 Parganas. The school is situated in rural surroundings, but a large number of inhabitants of the area work in factories nearby or in Calcutta, which is accessible by the local electric train. The school was established in 1952, was affiliated as 10-class high school in 1961 and has been upgraded as 11-class higher secondary school with one stream (humanities) from 1967. The school has 421 pupils with 140 pupils in class V and 41 in class XI and 14 teachers, three with B.Sc degrees. About 12 students offered elective science for their high school examination. Under the Crash Programme, the school had received a grant of Rs. 4,000 in June, 1966. One of the class rooms is used as a science laboratory. The apparatus is sufficient for high school elective course and will hereafter

be used for general science course for higher secondary classes. The apparatus purchased from the grant was of good quality, although in many cases it had not been put to use owing to lack of experience on the part of the teacher. Most of the students appeared under-nourished. The school building has been put up with community effort and is fairly satisfactory for its present needs. No effort had, however, been made to plant trees, shrubs or flowers. The school had an un-inviting look which was in marked contrast to the pleasant green of the fields across the nearby canal.

13. In the afternoon, the Team met Dr. B. Dutta, Secretary, Education Department. The D.P.I., and other senior officers of the Directorate were also present. The Team summed up their impressions as under:-

a) The schools visited had adequate arrangements for science practicals. The grants sanctioned under the Crash Programme were on the whole well-spent and the apparatus purchased in the four schools was of good quality.

b) The Institute of Science Education at Burdwan University was doing good work and should be strengthened further. The content course should be extended by three or six months to provide for workshop practice and the teaching of methods in science education, in which case additional B. T. training may not be necessary in the case of such trainees. The Institute should also be strengthened to undertake other functions spelt out in Government of India's scheme, specially those relating to curriculum and text-books. The Institute should also start work with about 15 to 20 schools in the surrounding area to test the materials which it may develop from time to time. The idea of the experimental school, as conceived by the Institute was, however, considered as over ambitious at the present stage.

(c) A senior officer should be placed in charge of all school science education programmes at the headquarters. At the district level also, there was need to appoint science education officers with suitable qualifications and experience. The guidance at the school level was considered necessary if maximum benefit was to be derived from the funds spent for strengthening science education.

In the discussion which followed, the Education Secretary said that the suggestions of the Team would be considered. He was of the view that all aspects of the problem namely, training programme, work on curriculum and text books, science equipment and suitable administrative and inspection arrangements needed attention. He felt that it would be very helpful if the Central Government could give an indication of the assistance his State could expect to receive over the next four years under

the Crash Programme. This would enable him to evolve a suitable plan of action. He was in favour of continuing the centrally sponsored scheme for strengthening of science education as the scheme was of an all-India importance, the benefits of which would be visible after a period of 10 to 15 years.

3. Madhya Pradesh

The Evaluation Team reached Bhopal on the morning of 10th April, 1967 and met the D.P.I., Dr. A. Misra. During the course of their discussion, the Team gathered the following information:-

i) There are about 1,200 higher secondary schools in the State. Of these about 850 are managed directly by the State Government. Nearly 300 higher secondary schools were started after 1961.

ii) The State is finding it difficult to recruit good M.Sc. teachers for teaching science subjects. Third class M.Sc. teachers belonging to the neighbouring State of U.P. are usually employed in the State. But even they are unwilling to go to difficult stations in the interior, with the result that about 150 posts of M.Sc. are vacant. A B.Sc.B.T. teacher starts on a salary of Rs. 164 in the grade of Rs. 150-270 and an M.Sc.B.T. teacher on Rs. 270 in the grade of Rs. 250-450. A B.Sc.B.T. teacher who completes the nine-month condensed course successfully is eligible for the scale of pay allowed to an M.Sc. The State has recently decided to give D.A. at Central Government rates.

iii) The District Education Officer (class II officer), assisted by Assistant District Inspectors, is in charge of primary and middle schools in the district. The Divisional Superintendent of Education, assisted by 2 or 3 Deputy D.S.Es and Assistant D.S.Es, looks after the educational administration in his Division. He is also expected to inspect higher secondary schools, but usually finds no time to do it. It has, therefore, been arranged that professors from P.G.B.T. colleges should inspect schools during their spare time.

iv) The State is passing through a period of severe financial stringency. As a measure of economy, there is a ban on the purchase of furniture or equipment.

v) No science fee is charged in schools and the schools do not receive any regular science grant for purchase of chemicals, glassware and other consumable stores.

2. The Team next visited the Science Unit in the D.P.I.'s office. It is understood that in 1963, the State sanctioned a sum of Rs. 5,000 for science equipment for each school. Schools were authorised to purchase science apparatus direct from the dealers. The State authorities were not happy with the results. In many cases the funds were not used properly and the quality of apparatus purchased was sub-standard. Profiting from this experience the State authorities have now evolved an elaborate procedure for centralised purchase of all science apparatus from the funds made available under the Crash Programme. Briefly, tenders are invited on an all-India basis in respect of all items included in the standard list compiled by the Education Department. The firms also required to submit samples of the apparatus. The rates are tabulated and the samples are carefully examined. A high-powered Purchased Committee set up by the Government makes the final selection after taking into consideration both the quality of the samples and the prices quoted. Orders are then placed and the firms are required to supply approved items at Bhopal or direct to schools. Every item received in Bhopal is carefully checked with the approved samples. The Team was impressed with the thoroughness and competence with which the entire job is handled. Shri P. S. Kapoor, Director of the State Institute of Science Education, and his colleagues have put in days of hard and devoted labour to make a success of the difficult assignment entrusted to them.

3. In 1964-65, supplies of science equipment were calculated at the rate of Rs. 2,475 for schools teaching physics, chemistry and biology, Rs. 1,500 for schools teaching physics and chemistry and Rs. 500 for schools teaching general science only. In 1965-66 and 1966-67, the corresponding figures were Rs. 5,110, Rs. 3,000 and Rs. 2,000 and Rs. 4,480, Rs. 2,000 and Rs. 1,500 respectively. Actual requirements of individual schools were taken into consideration while distributing science equipment. In 1964-65, the entire equipment was purchased centrally and distributed from the headquarters. In 1965-66, some equipment was purchased at Bhopal centrally and distributed through the respective D.S.Es. Items like glassware and chemicals were supplied by the firms direct to schools. Other equipment was supplied to D.S.Es. direct for the distribution to schools. For 1966-67, some equipment like chemicals and glassware is being supplied to schools directly while the rest is purchased centrally and then distributed through the divisional offices. In all the three years, the Science Unit collected information regarding requirements of each individual institution, placed orders for bulk purchase and arranged supplies to schools either directly or through the divisional offices. Since all purchases are made after going through an elaborate procedure and the purchases have to be completed by the end of the financial year, it has not been possible to utilize fully the grants received under the Crash Programme.

4. In the afternoon, the Team visited the State Institute of Science Education which was set up in October 1966. The Institute is located in a large, new school building. From July this year, a Demonstration Higher Secondary School (classes VI-XI) will start functioning in the building. The Science Education Institute will then have facilities for trying out its ideas regarding teaching of science in the middle and secondary sections of the school. The Audio-Visual Unit of the State, which is also located in the school building, will be a great help to the Institute in its training programme. The staff of Institute consists of one Director, a Vice-Principal, six Assistant Professors, a Workshop Superintendent, an Office Superintendent, clerical staff, laboratory staff etc. The Institute proposes to undertake the following activities: training courses, curriculum research and publications, strengthening of science laboratories of schools and extension work with schools.

5. Under the Crash Programme, the State organised, in 1964-65 and 1965-66, 9-month content courses for existing B.Sc. teachers in the Motilal Vigyan Mahavidyalaya, Bhopal. The syllabus for the course is approved by the Vikram University which awards a post-graduate certificate to successful trainees. Each year a batch of 30 teachers is selected. The trainees are required to take up to two subjects for their course and the combinations offered are: (i) physics and chemistry, (ii) physics and mathematics, (iii) chemistry and zoology, (iv) chemistry and botany and (v) zoology and botany. In addition, 10-week courses were organised in 1964-65 (two batches) and in 1965-66 (two batches). These courses consist of content, methodology of teaching and workshop practice and there are 25 to 30 teachers in each batch. Following its establishment, the State Institute of Science Education has taken over the responsibility for running both types of courses. The Institute organised in 1966-67 one 9-month content course and 2 ten-week courses. The Institute has no hostel for its trainees. The Institute has started equipping its own laboratories in the new building. It has a small library. It has also recently set up a workshop, which is used for training teachers in improvising and maintenance of science equipment. In addition, the Institute has started a repair service. Schools have been advised to send their damaged apparatus to the workshop. In the opinion of the Team, this is an extremely useful service and will result in the utilization of costly equipment now lying damaged in schools.

6. The Team next visited the Model Multi-purpose Higher Secondary School, T.T. Nagar, Bhopal. The school set up by the State Government for the education of the children of its employees in the new township, is now managed by the Board

of Secondary Education, Madhya Pradesh. It has 950 pupils in classes VI-XI and a staff/43 teachers, including one P. T. I. The school has four streams: science, humanities, commerce and art. The science stream is the most popular with 158 pupils in class/XI. The corresponding number in humanities and commerce are: nil, 7 & 12 and 18, 18 and 10 respectively. Only 2 pupils in class X have taken the art stream for which three lecturers are employed. In the higher secondary classes, there are 13 science teachers, 11 M.Sc.s. and 2 B.Sc.s. The school has a large building with well-equipped laboratories. A new science block with separate physics, chemistry and biology laboratories has been set up recently with facilities for 60 to 70 students to perform practicals at one time. The Team felt that there was no immediate need for putting up the new block. The school has a large library. Some of the expensive books in the library are not likely to be used by the students and the staff. All possible facilities are available in the school, which is maintained at an annual cost of about Rs. 3.30 lakhs. Yet this school, furnished and equipped on a generous scale, has nothing particular to its credit in the form of new experiments or innovations or a special teaching programme. The school has received Central grant under the scheme for strengthening of model multi-purpose schools. Under the Crash Programme too, the school has received grants for which there was not much need.

/of

/IX, 182
pupils in
class X &
202 pupils
in class

7. On the 11th April, the Team visited the Government Higher Secondary School, Raisen. The school has only three top classes IX, X & XI, with an enrolment of 198 pupils (including 25 girls) and a staff of 16 teachers. A government middle building under a separate headmaster is held in the same school, from 7-30 to 11.00 A.M. Nearby is another building where tribal children living in a hostel. The higher secondary school has 3 science teachers in the lecturer's grade, two M.Sc.s. and one trained B.Sc. There is one untrained B.Sc. also on the staff. There are two laboratory rooms: one for physics and chemistry and the other for biology. There is plenty of equipment, but the laboratory rooms are not properly organised. The biology room is in disorder. The equipment is not being put to efficient use. Otherwise also the school does not appear to be managed well. One of the rooms is broken, another is used for storing broken furniture. The water pump is unserviceable and needs repairs. The school has not been inspected for the last three years.

the
tribal
Deptt. runs
a separate
middle
school
for

8. The Team next visited the Government Higher Secondary School, Sanchi. The higher secondary department of the school has only 50 pupils. In the science stream, there are 7 pupils in class IX, 3 in class X and 5 in class XI. The science staff consists of 1 M.Sc. in lecturer's grade and 1 B.Sc. grade. In addition, there is an M.A. in Mathematics. There is enough science equipment in the school, some items are even surplus to its needs. The Team learnt that there were many schools in the State with small enrolment.

9. In the afternoon, the Team called on Shri R. C. Rai, Education Secretary, Madhya Pradesh. The Team complemented the Education Secretary on organising an efficient system of purchase of science equipment and placed before him the following suggestions for better implementation of the Crash Programme :

(i) Since all pre-1961 schools have been more or less covered under the Crash Programme, the future grants under the centrally sponsored scheme will have to be spent over schools established after 1961. It is necessary to have a careful survey and to estimate their requirements for science equipment. On the basis of the survey, the State could get a fair idea of the equipment required during the Fourth Plan.

(ii) There is urgent need for appointing suitable inspecting staff at the divisional level to ensure proper inspection of science education. This staff can advise and guide science teachers, many of whom are inexperienced and do not know how to organise their laboratories. This will ensure a proper and efficient use of the equipment supplied to schools.

(iii) The State Institute of Science Education has to be strengthened suitably. The present staff-- one in each subject - could not do full justice to teaching their subjects at the post-graduate level. The institute had also to undertake curriculum research, prepare text-books and carry out experimental work. It needed facilities of hostel etc.

Education Secretary thought that the Government of India should identify reliable firms from which standard equipment could be purchased without going through the elaborate procedure of calling tenders etc. He explained that owing to financial stringency, the State had reduced the Education Plan for 1967-68 from Rs. 5 crore to Rs. 2 crore. The State Government had decided not to open any new school in 1967-68. He agreed that there was need to strengthen inspecting staff but felt that it would not be possible to appoint any additional staff owing to lack of resources. It was, however,

open to the Education Department to find out whether they could spare additional staff for inspection by making suitable adjustments in the whole set-up.

10. Later, the Team visited the Regional College of Education, Bhopal and spent about two hours visiting the laboratories, the workshops and the library. They also discussed with the Principal the training programmes in the college.

11. On 12th April, the Team first visited Government Higher Secondary School, Obedullaganj. The school has 390 pupils in classes VI to XI. In class IX, 45 pupils study science, in class X, 37 and in class XI, 38. There is one M.Sc. teacher for physics and mathematics, 1 B.Sc.B.T. for chemistry and 1 M.Sc. for biology. The Team visited the physics room which has enough apparatus but not sufficient furniture and almirahs. The maintenance of the apparatus was poor. The chemistry room was in disorder. Costly microscopes were lying on floor and plenty of models were gathering dust in the store room. There was a lot of apparatus which was never used. The school has a qualified carpentary teacher. But the wood-work room was in utter mess. It was being used largely as a lumber room. It was clear that the staff had been neglecting its duty and the discipline in the school was lax. The school was in poor shape. The Team understood that the school had not been inspected since 1952.

12. The Team later visited Hoshangabad. They met Shri R. N. Khare, Divisional Superintendent of Schools. He has 143 Higher Secondary Schools in his jurisdiction of which 65 are government schools. He has two Deputy D.S.Es. and one Assistant D.S.E. to help him. But they are all kept busy with administrative work and departmental enquiries.

Shri Khare stressed the need for technical and clerical assistance for implementation of the Crash Programme, particularly in regard to distribution of science equipment. The Team visited S.N.G. Higher Secondary School, Hoshangabad. This is an aided school with 1,100 pupils in classes VI-XI. In class IX there are 89 science students and in class X and XI, there are 81 and 63 science students. It has a fully qualified staff. The laboratories are well-equipped and well-kept. The grant under the Crash Programme has been utilized properly. The Team next visited the Government Higher Secondary School, Hoshangabad, an old Zilla School, established in 1894. The school has well-qualified staff. The laboratories are well-equipped and well-kept. Some of the equipment in the school is surplus to its needs. The next school visited was Government Higher Secondary School, Powarkheda. The school has provision for teaching humanities, science and agriculture. It has

a 35 acre farm and two wells. In science classes, there are 4, 10 and 6 pupils in classes IX, X, XI respectively. Corresponding numbers for agriculture stream are 11, 13 & 9. The school has 1 M.Sc. lecturer and 1 B.Sc. teacher. Between them they teach physics, chemistry, mathematics and botany. The school has also two M.Sc. lecturers in agriculture. The science and agriculture laboratories were neatly arranged and well-kept.

13. In the evening, the Team called on the D.P.I. at his residence and shared the experiences with him. They again stressed the need for suitable staff at the district or divisional level for the proper implementation of the Crash Programme.

4. Andhra Pradesh

The Evaluation Team reached Hyderabad on 14th April. In the morning they met Dr. N. Ramlal, former D.P.I. and now Director of the State Science Education Unit. Later, Shri C. Gopinath Rao, Deputy D.P.I., joined the discussion. The Science Unit was set up in the State in November, 1964. Besides the Director, the staff now consists of 5 lecturers (1 has since left), a librarian and clerical and class IV staff. The Unit's office is located in rented premises. Accommodation has been secured in the Methodist School to house the library and to conduct the 10-week training courses. The laboratories and the workshop of the school are also available to the Unit for use by the trainees. For administrative purpose, the Unit is under the Director of Higher Education, Andhra Pradesh.

2. There are 2,600 secondary schools in the State. Of these about 230 are of the 12-year higher secondary pattern. According to the new pattern adopted by the State, elementary education will be of seven years' duration. This will be followed by secondary education for 3 years and higher secondary or p.u.c. course of 2 years' duration. The integrated syllabus of secondary schools of three years' duration which came into force from the current academic session provides for the teaching of science to all students as physical sciences and biological sciences. In 1970-71, the first batch of students will take the examination in the proposed 2-year higher secondary course.

3. A B.Sc.B.T. teacher is given a starting salary of Rs. 145/- p.m. in the scale of Rs. 130-250. The grade for M.Sc. teachers is Rs. 180-370. D.A. is given at rates admissible to Central Government employees. Since lecturers in pre-university classes get higher scales of pay, M.Sc. teachers are generally unwilling to work in schools. Therefore, for a long time to come the State will have to run condensed courses of nine months' duration to upgrade the knowledge of existing B.Sc. teachers, particularly those required to teach physical sciences.

4. The Osmania University has agreed to run the 9-month condensed course for the Science Unit. Trainees completing this course are awarded a post-graduate diploma and are eligible for the salary scale for M.Sc. teachers in higher secondary schools. The first course commenced in November, 1964 and the second in July 1965. The third course was started in January, 1967. Each batch consists of about 30 trainees. Every trainee has to take two subjects. At present, courses are organised only in physical sciences. Each course costs about Rs. 1.6 lakh, which includes salaries of substitute teachers.
5. The Science Education Unit organises 10-week training courses for B.Sc. teachers. The course consists of lectures, discussions and practical work. In addition, the unit organises about 40 extension lectures in physics, chemistry, botany and zoology by the staff of the Osmania University. These lectures deal with latest development in the respective subject areas. The trainees are also given workshop practice, training in handling audio-visual aids, etc. Two courses were organised in 1964-65 and three in 1965-66. Owing to late receipt of financial sanction only two courses could be organised in 1966-67. 30 teachers are admitted to each course.
6. The Science Unit has evolved a draft syllabus for classes VIII to X. It has prepared a kit for teaching chemistry in class VIII. The Unit has also helped the Department in compiling lists of science equipment and of library books. The Unit is now engaged on preparation of guide books for teaching science in classes VI & VII. The Unit urgently needs permanent accommodation for its laboratories, workshop, library, lecture rooms and a hostel. The Unit also needs additional staff for training courses and for follow-up work.
7. It was explained that normally all equipment required for Government schools had to be obtained through the Central Stores Purchase Department. But it was found that the equipment purchased through that Department was sub-standard. Therefore, it had been decided that only expensive articles, costing more than Rs. 300 need be purchased from dealers approved by the Purchase Department. At present, the practice is that in the case of government schools, the headmaster has the authority to make purchases direct after calling for tenders. In the case of the aided, municipal and zilla parishad schools, the grants under the Crash Programme are made to the respective managements who make the purchases direct from the dealers. In 1964-65 and in 1965-66, the Special Inspector in Science in the D.P.I.'s office sent the standard lists of equipment to all high and higher secondary schools, collected their requirements and calculated the grants

separately for each school. In 1966-67, the grants were made on ad-hoc basis: Rs. 12,000 and Rs. 8,000 in the case of higher secondary schools and Rs. 4,000 and Rs. 2,000 in the case of high schools. The post of Special Inspector in Science having been withdrawn, the work in connection with the distribution of grants has been entrusted to Dy. D.P.I. (Planning), who is already over-worked and who does not have even the minimum clerical assistance needed for this additional work. The position at present is that the higher secondary schools have adequate laboratory facilities. In the case of the high schools, the equipment has been supplied but in many cases there is no separate science room nor adequate laboratory furniture.

8. On 15th April, the Team visited the Zilla Parishad High School, Burton Road, Bolaram. The school has 400 pupils (classes VI-XI) and 26 teachers, including one P.T.I. and one Drawing Teacher. It is housed in an old mansion of a jagirdar. The property has not been repaired for years and a part of it has collapsed. Science is a compulsory subject, which is taught by a woman teacher, who had studied botany, physics and chemistry for her B.Sc. degree. The school has a lot of science equipment, some of which needs repairs. Some equipment is surplus to its needs. The Government has sanctioned a grant of Rs. 4,000 to this school from the Crash Programme for 1966-67. The teacher has prepared a list of requirements and forwarded it to the Zilla Parishad, which is expected to make the purchases. The list was examined and it was found by the Team that some items included in the list were unnecessary. There is, at present, no agency to scrutinize the lists or guide the teachers.

9. The Team next visited the Zilla Parishad Multi-purpose Higher Secondary School for Boys, Bolaram. This is a well-established school with a large and commodious building. 1,200 students study in the school (classes VI-XII). In the science stream, there are 124 pupils in class X, 117 in class XI and 73 in class XII. There is one B.Sc.B.Ed. for teaching chemistry and one M.Sc.B.Ed. each for teaching physics, mathematics and biology. The three laboratories of the school are very well-equipped. A grant of Rs. 12,000 under the Crash Programme has been sanctioned to the school recently. The equipment will be purchased by the Zilla Parishad. It was explained that the new apparatus proposed to be purchased will enable each student to perform the practicals individually. In the opinion of the Team, there was no need to give the grant of Rs. 12,000 to this School.

10. The Team also visited the Zilla Parishad Girls Higher Secondary School, Bolaram. There are 945 girls on roll in classes VI to XII. The number of students in science stream is 72, 58 and 37 in classes X, XI & XII respectively. The chemistry teacher is a B.Sc.B.Ed., while the physics and biology teachers are M.Sc. The school has two laboratories - one for physics

and chemistry and the other for biology. Both the laboratories are well equipped. The headmistress, a science graduate, has been working in the institution since it was established in 1932 and is devoted to her work. She collects science fund - Rs. 5 per ~~month~~ per year - and herself buys equipment from this fund with great care. Some of the balances supplied by the Zilla Parishad are defective and have not been used. The tables supplied by the Zilla Parishad are also not well-made. The school has received recently a grant of Rs. 10,000 under the Crash Programme. The purchases will be made through the Zilla Parishad. The Team saw in the biology room a microscope purchased some time back for Rs. 18/- only. The instrument was good enough for use in higher secondary schools.

11. In the afternoon, the Team called on the D.P.I., Shri M. V. Rajagopal. The Team explained to the D.P.I. the need for adequate staff at the headquarters for organising purchase of science equipment. They suggested that it would be worthwhile to centralize purchase in respect of costly items. They also drew attention to the need for adequate inspecting machinery at the district level to supervise science teaching. The Team also suggested that a detailed survey of the requirements in respect of science equipment may be made in respect of high schools established after 1961. The D.P.I. explained that in each district there were in addition to the District Education Officer, two or three inspectors - one for about 40 secondary schools - who were solely concerned with academic inspection of schools. Under this system every school was inspected regularly once a year. He would like to post atleast one inspector with science qualifications in each district, but there were not enough persons with these qualifications. He also appreciated the need for adequate staff at the headquarters for handling the programme, but explained that he was handicapped on account of the financial stringency and the consequent need for economy.

12. In the evening, the Team called on Dr. Ramlal at his residence. Dr. Ramlal explained the need for proper accommodation for the Science Unit and additional staff for the Unit.

13. On 16th April (Sunday), the Team called on Shri L. Bullaya, Director of Higher Education at his residence. The needs of the Science Unit were discussed with him.

14. Later, the Team called on Dr. N. V. Subba Rao, Principal of the Science College, Osmania University, at his residence. Dr. Subba Rao, who is in charge of the 9-month condensed training programme, made the following suggestions:-

i) The trainees should specialize only in one subject in the nine-month course.

Condensed

ii) About 3 or 4 years after the trainees had passed out from the 4 course, they should join a Summer Institute to get themselves familiarized with the methodology of science.

iii) Teachers in high schools should be trained in 10-week courses, where they should gain proficiency in two subjects. Workshop practice for physics teachers and training in glass blowing for chemistry teachers should be included in the 10-week course. It was also suggested that an Advisory Committee, consisting of representatives of the Science Unit, the State Department of Education and the University authorities, may be constituted to review from time to time the science education programme in the State.

15. On the morning of 17th April, the Team visited the Government Higher Secondary school, Nampally and saw the arrangements for 10-day course for science teachers organised by Volunteers of the American Peace Corps. The State Government have sanctioned 7 training centres at a cost of Rs. 23,000 per year per centre. The three volunteers of the Peace Corps explained to the Team the organisation of the course. About 15 teachers attend the course for 10 days. The course consists of lectures on basic scientific principles, methods of teaching and imparting of skills to trainees so that they could improvise simple items of equipment. Every trainee learns the use of hand tools and is expected to improvise 11 pieces of apparatus during the period of training. Training is also provided in the organisation of the science clubs in schools. At the end of the course, each trainee is presented with a copy of the UNESCO Source Book for the Teaching of Science and a set of hand tools costing Rs. 50/-. It was explained that in order to get maximum results, it was necessary to have a well-thought-out follow-up programme. The Peace Corps volunteers are sending a newsletter to all past trainees. The newsletter contains useful material on improvisation of new apparatus etc. The Team was impressed with the enthusiasm of the volunteers and felt that the course was serving a useful purpose.

16. The Team visited the Government High School, Amirpeth. The school has about 725 pupils on roll, in classes VI to XI. There are 2 B.Sc.B.Ed. teachers on the staff. The school is housed in an old building which is insufficient for its use. Accordingly, the classes are held in two shifts. The science equipment is locked up in three almirahs. Although there was enough equipment; there was no place for performing practicals. The school has received Rs. 2,000 as grant under the Crash Programme. Some of the new equipment need not have been ordered.

17. Later, the Team called on Shri N. Ramesan, Education Secretary. The Team explained to him the needs of the Science Unit and also the need for staff at the headquarters and in the districts for proper utilization of the grants received under the Crash Programme. Education Secretary said that the State was in serious financial difficulties and there were proposals for retrenchment & reduction of expenditure. However, he would consider the appointment of necessary staff etc. if the Government of India had no objection to meeting the expenditure from the grants received under the Crash Programme.

5. Maharashtra

The Evaluation Team reached Bombay on 24th April, 1967. The Team met Shri D. M. Sukhthankar, Deputy Secretary, Education Department, Government of Maharashtra in the Sachivalaya at about 12 noon. Shri E. R. Dhongde, Director of Education, Maharashtra and Dr. S. V. Kelkar, Director, State Science Education Unit were also present. The progress in the implementation of the centrally sponsored scheme for strengthening of science laboratories and special training of science teachers (Crash Programme) in the State of Maharashtra was reviewed.

2. There are at present about 4,000 secondary schools in the State. Of these, about 200 schools are of the higher secondary pattern, situated in Vidarbha and Marathawada. In Western Maharashtra, all secondary schools prepare students for the Secondary School Certificate Examination, which is taken after a period of 11 years' schooling (seven-elementary and four-secondary). The State Government has agreed in principle to adopt the structural pattern suggested by the Education Commission namely, 7 years of elementary education, 3 years of high school education followed by 2 years of higher secondary education. Whether the higher secondary course will be in the colleges or in the schools or in both still remains to be decided. Other details in connection with the proposed reorganisation have not been settled so far.

3. It is difficult to recruit teachers with post-graduate qualification to teach science in higher secondary schools. The State Government is, therefore, keen on organising nine-month condensed course in subject content for existing B.Sc. teachers so as to upgrade their knowledge in science subjects. Unfortunately it has not been possible so far to persuade the universities in the State to run such courses.

4. Fresh B.Sc. trained teachers receive in all about Rs. 250/- p.m. B.Sc.s. employed in industry earn more. Therefore, there is considerable shortage of B.Sc. teachers for teaching general science and elective science (physics and chemistry) in high

schools. For instance, in the Osmanabad District, out of 161 high schools, only 64 schools have graduate science teachers. The shortage is more acute in the rural schools. In most schools, S.S.C. or Intermediate passed teachers are teaching science in classes VIII and IX. Undergraduate teachers are also teaching science in classes X & XI in schools where graduate science teachers are not available. The State authorities are of the view that while short courses are necessary for B.Sc. teachers, as provided in the centrally sponsored scheme, in the circumstances now obtaining in the State, it is also necessary to organise suitable courses for the undergraduate science teachers. No training courses could be organised in 1964-65, under the Crash Programme. In 1965-66, 5 training courses of 10-week duration were arranged for graduate science teachers, one each in Bombay, Poona, Aurangabad, Jalgaon and Kolhapur. These courses were run by the authorities of local colleges, who were paid on an average a sum of about Rs. 17,000 per course. This amount included stipends to trainees. In all about 126 teachers attended the five courses. Generally speaking, the managements of schools are unwilling to depute teachers for training during the period when the schools are open because they are unable to arrange for substitute teachers. No training course for graduate science teachers could be arranged in 1966-67. Courses for undergraduate science teachers could not be organised from the funds provided under the Crash Programme, for want of sanction from Central Government. The State Unit of Science Education, therefore, persuaded 4 zilla parishads to provide the necessary funds. Thus in 1966-67 about 200 undergraduate science teachers were trained in courses whose duration varied from one to three yeeks.

5. The State authorities decided to allocate to every higher secondary school a sum of Rs. 8,000 and to every high school a sum of Rs. 2,000 for purchase of science equipment from the funds provided under the Crash Programme. A standard list of equipment was sent to all schools and schools were required to make purchase of equipment, according to their needs, from within the list supplied. However, it was not possible to assess needs of individuals as suggested in centrally sponsored scheme. It was also not possible to give any guidance in regard to the purchase of apparatus of good quality. Since all pre-1961 secondary schools were covered in the manner described above in the first two years i.e. 1964-65 and 1965-66, it was possible to utilize, in 1966-67, only a sum of Rs. 2.62 lakh out of the grant of Rs. 24.65 lakh placed at the disposal of the State by the Central Government. Further, the sanction for grants for 1966-67 was issued only on 31.3.1967 and it is, therefore, not known what part of the funds could be actually spent by the grantee institutions.

Individual schools and allocate funds in relation to the needs

6. The State Unit of Science Education was set up in June, 1965 and consists of a Director (Class I Officer) two technical Assistant (Class II officers), two junior clerks and one peon. The Unit is a part of the State Directorate of Education. At present, the Unit is housed at Poona in the building of the Government Training College for women primary teachers. The Unit has no laboratories, library or lecture rooms of its own. It is assisting the Director of Education in the administration of the Crash Programme and schemes for Science Talent Search, Summer Institutes, Vigyan Mandirs and Science Clubs and Fairs. The Unit has also rendered assistance in the preparation of new syllabi in mathematics and science in primary schools, preparation of lists of apparatus and equipment for different types of educational institutions, surveys of science teaching etc. Proposals for setting up a State Institute of Science Education have not materialized so far and, therefore, the training programmes and other important activities relating to curriculum, text-books etc. have not received sufficient attention.

7. During the course of the discussion, it was explained that the Finance Department of the State often took a rigid view on the implementation of the scheme. It was not possible to make even minor changes in the centrally sponsored scheme which were considered necessary in view of the local conditions, without first receiving concurrence of the Union Ministry of Education. This took a lot of time and the sanction of the Union Ministry of Education was often received late in the financial year. It was explained that gas plants which were needed in the laboratories of higher secondary schools did not find a place in the list of apparatus received from the Union Ministry of Education. Therefore, when sanction was given for purchase of gas plants in the case of a few higher secondary schools, the Accountant General, Maharashtra raised an objection. When a reference was made to the Union Ministry of Education, it did not give the necessary sanction, with the result that the audit objection still remained to be cleared. This red-tape was partly responsible for the rather slow progress of the centrally sponsored scheme in the State. It may be mentioned that the Team is in favour of supplying gas-plants to higher secondary schools teaching elective science.

8. The Team reached Poona on the evening of 24th April, On the following morning, it visited a small village Loni, on the Poona-Sholapur Road. The village has a secondary school (classes VIII-XI), called the Jai Hind High School, which is managed by the Vivekananda Shikshan Sanstha, Kolhapur. This organisation runs a chain of educational institutions, about 230 in number, including 7 colleges, 175 high schools and 32 hostels. The headman of the village has donated a residential house (wada) and some cash to the organisation. Some additions and alterations

have been made and the classes are held in the rooms of the Wada. The school was started in 1960. There are 300 pupils (classes VIII-XI) including 40 girls and 12 teachers. The school has provision for the teaching of general science. A science graduate, who had worked in the school for two years, resigned his post recently and an undergraduate teacher was in charge of the teaching of the subject. A long corridor-type room housed the laboratory. There were tables for practicals and four almirahs for storing the equipment. In addition, to Rs. 2,000 provided under the Crash Programme, the management of the school has spent about Rs. 1,000 on science equipment. The school has sufficient equipment for teaching general science, but with a little more care it should be possible to arrange the laboratory furniture and apparatus in a more satisfactory manner. The school has a small library, but this was in complete disorder on the day of the visit. It was suggested to the villagers who were present to collect some more funds for the school, but they regretted their inability to do so on account of poor harvests.

9. The Team next visited the Mahatma Gandhi Vidyalaya, Uruli-Kanchan. Shri Manibhai Desai, who is the Trustee of the Nature Cure Ashram, founded by Mahatma Gandhi, is also the founder and manager of the school. The Institution, established in 1950, is a multi-purpose school with technical and agricultural streams. There are 1,236 pupils (including 199 girls) on rolls in classes V-XI, 260 of whom live in the school hostel. The school has a fine campus with extensive grounds, a new building with a large auditorium etc. It is a well-managed institution with varied activities including a science club. The school has able and experienced science teachers and a well-equipped laboratory. The Team also visited the Pre-vocational Training Centre and the Rural Industrial Training Institute, both located on the school campus. Of late, Shri Manibhai Desai has taken great pains to organise a cattle breeding farm, and agricultural farm for producing hybrid seeds etc. A cooperative society for lift irrigation has also been set up. In the course of a few years, these activities will change the face of the neighbouring country-side. With its technical and agricultural streams, the school too is playing its role in the development of the area. /a

10. In the afternoon, the Team visited Shri Gopal High School, Sadashiv Peth, Poona. This is a co-educational school, with 660 pupils in classes V-XI. One-third of the pupils are girls. For the teaching of science, there is one B.Sc.B.Ed. teacher. Another teacher has taken his B.Sc. examination recently and there is one more teacher with Inter-science STC qualifications. There is a class-cum-laboratory in the old building of the school. The Team examined some of the apparatus purchased with the grant of Rs. 2,000 given under the Crash Programme and found that some

items need not have been bought at all. The school need not have purchased a costly microscope for Rs. 650. Instead, it would have been better to purchase some more demonstration equipment. It was clear to the Team that the science teacher needed guidance.

11. The Team next visited Nutan Marathi Vidyalaya and M.E.S. High School, Deccan Gymkhana. Both these schools are well-established and run by well-known educational societies of long standing and experience. Both institutions have over 2,500 pupils. They have good laboratories and experienced staff for teaching science and mathematics. In other respects too, the schools are very well-provided. The Team felt that such good institutions were not in need of the grants provided under the Crash Programme and some of the items purchased from the grants were not of an essential character.

12. On 26th April, the Team visited Adarsh Vidyalaya, Shirval, Satara District. This institution is managed by the Rayat Shikshan Sanstha, an organisation which runs a chain of educational institutions, including 250 high schools. There are 450 pupils in classes VIII-XI (including 52 girls) only 50 of whom pay fees. The school has provision for teaching general science and also elective science (physics and chemistry). No student of the school offered higher mathematics for the SSC examination. The school has one B.Sc.B.T., one B.Sc. and one Inter Science passed teacher for teaching science. All the teachers are young. The school received a grant of Rs. 2,000 in 1965-66 under the Crash Programme. Most of the equipment purchased is for the purpose of demonstration. This includes a telescope worth Rs. 425/-. Some of the items are not essential and it would have been better if some more sets of apparatus had been purchased to enable students to perform experiments. The store room adjoining the laboratory was dirty and in complete disorder. Some of the discarded equipment could be put to use after necessary repairs.

12. The Team next visited Shri Shivaji Vadyalaya, Surur, also in Satara District. There are 547 pupils including 97 girls in classes VIII-XI of the School. Since the school has no building of its own, the classes are held in seven different buildings in the village. Classes of this school are also held in two other villages at a distance of $1\frac{1}{2}$ mile from Surur. In course of time, these classes will be converted into full-fledged high schools. The school has been fortunate in obtaining the services of a retired science teacher, a very able and talented person. The purchases from Rs. 2,000 grant have been made very wisely and the laboratory has been arranged neatly in an improvised shed. A good teacher makes all the difference.

13. The Team also visited Dravid High School, Wai, a well-established school of over 50 years' standing. The school has 1,330 pupils (including 130 girls) in classes V-XI. The school has qualified science staff and a well-equipped laboratory. The school has also a science club which is quite active. The Team also visited the Sanjivan Vidyalaya, Panchagni, which is a partly residential institution. The school has all the facilities of a good residential institution, a large library and a good laboratory. The staff is well-qualified.

14. On 27th April, the Team visited the Anantha Vidyanthi Griha, a well-known institution of Poona which provides free lodging, boarding and education to about 250 poor children. The secondary school has good arrangements for teaching physics, chemistry and biology. The school runs a chemical technology course at the SSC level and teaches pupils how to manufacture ink, tooth-powder etc. In the technical section of the school, there is a production unit which manufactures a variety of articles on a commercial scale. The organisation runs a school for printing and has a large printing press which brings a profit of Rs. 1 lakh every year and which is the main source of the institution's income. A number of text books on science and technical subjects have been published. The institution has also manufactured a micro-projector for Rs. 130/- which is good enough for students in classes V-VIII. The organisation is run by a band of devoted workers, who have plenty of ideas and great enthusiasm for their work.

/Indian
manufacturers
could
profit a
great deal
by studying
this
apparatus.

15. The Team also visited St. Vincent School, Poona. The school has recently acquired science apparatus from a well-known German firm. The Team was greatly impressed by the range and variety of the apparatus, which was of excellent quality. Some of the apparatus was specially designed for class-room demonstration. /

16. In the afternoon, the Team held discussions with the Director of State Unit of Science Education regarding the future programme of the Unit. Later they called on Dr. C. D. Deshpande, Additional Director of Education and placed before him the following suggestions for consideration:

i) Since the pre-1961 schools were more or less covered, the supply of science equipment should hereafter be generally restricted to high schools set up after 1961. The State Science Unit should revise the present lists for teaching general and elective sciences including therein only minimum essential equipment and apparatus required both for demonstration and students' practicals. On the basis of the revised lists, the requirements of all post-1961 schools should be assessed and a phased programme of supply be drawn up. The assistance of training institutions

in the areas may be taken for this work. In the case of costly items like microscopes, galvanometers etc., detailed guidance regarding quality, prices etc. may also be given.

ii) While the Science Unit should continue to assist the Director of Education in regard to the administration of science education, it was necessary to set up a separate State Institute of Science Education to take over the training programme and other academic functions such as revision of curriculum, preparation of text-books and other general literature in science, design of laboratories and laboratory furniture etc. For this purpose, it was necessary to appoint suitable technical and ministerial staff, set up laboratories, a library, lecture rooms, hostel, etc. The Institute of Science Education should work in close collaboration with the State Institute of Education and other organisations dealing with the teaching of science and preparation of text-books etc.

iii) As for the training courses, the nine-month condensed course for higher secondary teachers should be organised to begin with in Nagpur and Marathwada Universities to cater to needs of Dwidharbha and Marathwada teachers. These universities should be approached again. As for the B.Sc. teachers working in high schools, the Science Institute itself should organise 6 to 10 week courses with such modifications in the present syllabi as may be considered necessary. Also in view of the peculiar conditions obtaining in the State, the Science Institute should organise 9-month course for undergraduate teachers now teaching in classes VIII-& IX. Later such courses for undergraduate teachers might be organised at the divisional level. Monetary incentives were necessary to attract undergraduates to the proposed course. In all training courses, practical work and improvisation of simple apparatus should be emphasized.

iv) Science education in schools cannot make much headway unless there is proper supervision and guidance. Most of the new science teachers, both graduate and undergraduate, need help periodically. At present the Zilla Parishad Education Officers were unable to carry out regular inspections, and most of the inspecting staff had no background of science. It was, therefore, necessary to appoint for 3 or 4 districts, one inspector who should be in charge of inspection and supervision of science and mathematics education.

17. The Team also called on Dr. C. Naik, Director of State Institute of Education and learnt with interest from her the efforts which were being made by her Institute to improve the teaching of science and mathematics at the primary level.

Special numbers of 'Jivan Shikshan', an organ of the S.I.E., were devoted to the teaching of science and mathematics. Special week-end courses were held for primary teachers in Poona in the teaching of mathematics. The Institute maintained close liaison with the Science Teachers' Association of Poona. Later, in the evening, the Team met Dr. Arnikar, Head of the Department of Chemistry of the Poona University. Dr. Arnikar assured the Team that he would reconsider the question of running condensed courses for higher secondary school teachers in his Department.

6. Uttar Pradesh

The Evaluation Team arrived in Allahabad on 5th May, 1967. The members of the Team called on Shri R. S. Johri, Additional Director of Education, Uttar Pradesh and discussed with him the progress of the centrally sponsored scheme relating to strengthening of science laboratories and special training of science teachers (Crash Programme). Shri G. M. Prakash, Deputy Director (Training) was present at the meeting. Later, Shri S. Sharma, Deputy Director (Finance) also joined the discussion.

2. Uttar Pradesh has about 2,500 secondary schools, of which about 1,000 are 10-year high schools and the rest 12-year Intermediate colleges. Under the Crash Programme, grants have been sanctioned to about 761 non-government schools established before 1961. During the first year of the scheme i.e. in 1964-65, a standard list of science equipment for high schools and Intermediate colleges was circulated and the requirements for individual institutions were assessed. Grants were sanctioned upto Rs. 20,000 in the case of Intermediate colleges and Rs. 6,000 in the case of high schools. In the subsequent two years, grants were sanctioned more or less on ad-hoc basis: Rs. 12,000 to Intermediate colleges teaching physics, chemistry and biology, Rs. 8,000 to Intermediate colleges teaching physics and chemistry and Rs. 4,000 to high schools teaching elective science. In all cases, institutions were selected on the recommendations of the District Inspectors of Schools. It was understood that all secondary schools established prior to 1961 were more or less covered under these grants.

3. In most cases, grants were released towards the close of the financial year. The grantee institutions are required to credit the grants into a separate saving bank account. The Pass Book for the account is deposited with the District Inspector of

Schools and funds are authorised to be drawn from the Pass Book only when the payments for purchases have to be made. Grantee Institutions are required to furnish utilization certificates by the end of June following the year in which the grants are released. A large number of utilization certificates are, however, still due even from those institutions which received grants in 1964-65. Since the Directorate of Education has no special field staff for science education and no physical check has been made in respect of purchases made so far, it is difficult to say whether the grants have been utilised properly and whether the equipment purchased is of good quality. It is possible that a few institutions may have misused the funds or submitted false accounts. The Additional Director was of the view that a comprehensive programme of science education at all school stages could be effectively implemented only when the necessary field staff was in position. According to him a science consultant should be appointed in each district.

4. The possibility of organising central purchase of some selected 30 or 40 costly items of equipment or offering detailed guidance to institutions in regard to the purchase of these items was discussed. It was explained that this would be possible only if there was adequate staff at the headquarters to deal with this work.

5. It is difficult to obtain services of post-graduate science teachers particularly for teaching physics and chemistry. These teachers receive a starting salary of Rs.175/- plus Rs.40/- as D.A. The State Government has, however, laid down rules under which managements can, in suitable cases, sanction upto 8 advance increments. Even so M.Sc.s are in short supply and the State Government has on its own started ten 9-month condensed courses in different universities and colleges in various science subjects for the benefit of existing B.Sc. teachers. From the funds made available to the State Government under the Crash Programme, two more condensed courses have been started in the Gorakhpur University. Teachers passing out of these courses are entitled to salary scales admissible to M.Sc. teachers. These courses are on the whole functioning satisfactorily and meeting a felt demand.

6. B.Sc. teachers are also in short supply, particularly in rural areas. The State authorities have organised 10-week courses for B.Sc. teachers working in high schools in order to improve their competence. Hitherto, these courses were organised in the Government Constructive Training College, Lucknow and the Government Central Pedagogical Institute, Allahabad. But from June, 1967, it is proposed to organise the courses in the State Institute of Science Education. It was explained that there was reluctance on the part of teachers to join the courses because they did not stand to benefit monetarily from attendance at such course. Also the managements were unwilling to relieve teachers, because they found it difficult to carry on work in the absence of the science teachers.

7. The Additional Director suggested the following priorities for expenditure to be incurred from funds to be made available hereafter under the Crash Programme:

i) Additional equipment for high schools to meet the demands of the revised syllabus. (Science practicals will be compulsory for the High School examination commencing in 1968)

ii) Science equipment for secondary schools started after 1961.

iii) Adequate staff at the headquarters and in the districts for implementing science education programme at all school stages.

iv) Various training programmes with built-in motivation for teachers attending such programmes.

8. In the afternoon, the Team visited the State Institute of Science Education and met Dr. Sitawar Saran, Director of the Institute and his three colleagues. The Institute occupies four large rooms in the building of the State Institute of Education. It also shares with the S.I.E. a lecture hall/seminar room and ample hostel accommodation. The Institute has arranged two short courses for biology teachers to enable them to teach the revised high school syllabus more effectively. In collaboration with S.I.E., the Science Instt, has also conducted a week-end course for 26 teachers of mathematics drawn from Junior High Schools. The staff of the Science Institute has actively participated in the preparation of departmental text-books in mathematics

for classes VI & VII, helped in the revision of science syllabi for the high school and Inter-mediate classes, prepared inventories of science apparatus and equipment for teaching of science subjects at the high school and Intermediate levels and compiled lists of suitable science books and magazines for primary and middle school pupils. A few brochures have been brought out by the Science Institute. While it has not been possible for the Institute to set up its laboratories or a workshop, a good library has been set up.

9. During the course of the discussion, the Director of the Science Institute laid much emphasis on orientation courses for teachers so that they could be adequately prepared for the new syllabi and textbooks which were being introduced in schools. Since it was difficult for the Science Institute to work directly with Junior high school teachers, the Director was of the view that the Institute should take up the orientation of trainers at the district level who would be drawn mainly from the staff of the normal schools and secondary schools. Other points made by him were: (i) need of monetary incentives to teachers who attend short-term courses, (ii) need for compensating members of the Institute staff for loss of some facilities on their appointment in the Institute (the staff of the State Institute of Education are receiving a special allowance), (iii) need for provision of a station wagon to enable the Science Institute to work intensively with a few selected schools, (iv) need for special facilities to enable the Science Institute to undertake publication work (at present being a Govt. organisation it is handicapped by departmental orders on this subject), and (v) the need for maintaining close contact with the Science Education Department of N.C.E.R.T.

10. The Team was given to understand that there was a move to transfer the Science Institute to Lucknow. The Team felt that the present location of the Science Institute was ideal in view of its proximity to S.I.E. Also since the Science Institute had to maintain close liaison with the Directorate of Education, the Central Pedagogical Institute and the Board of High School and Intermediate Education, the Team felt that it would be more advantageous for it to work from Allahabad.

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11. On 6th May, 1967 the Team visited Dwarika Prasad Girls Intermediate College. The Institution has 1200 girls on roll in classes VI-XII and has been teaching science at the high school stage for 10 years and at the Intermediate stage for the last 4 years. Apart from the grant of Rs. 4,000 received under the Crash Programme, the institution has also received a grant of Rs.15,000 from the State Government. The management of the school has also spent large amounts on the construction of the science block and purchase of science equipment. The laboratories are well-kept and well-equipped. The school has qualified staff rfor teaching science.

12. The Team next visited Sherwani Rural Intermediate College, Sallapur, at a distance of about 10 miles from Allahabad. The school has 625 pupils on roll, in classes VI²XII. There are three M.Sc. teachers, one each in physics, chemistry and mathematics for the Intermediate classes and one B.Sc. for teaching in high school classes. The school received a grant of Rs.6,000 under the Crash Programme and a grant of Rs.24,000 from the State Government. The manager of the school, who is a prominent industrialist has also contributed generously towards the cost of science laboratories and science equipment. The Team noted that the management had invested a lot of money in buying expensive science equipment, which was not needed. In the matter of construction of science laboratories also, a good deal of saving could have been made if the institution had taken guidance from an experienced person.

13. The Team also visited Aggarwal Intermediate College in the old part of the city. The school has a strength of 1,550 pupils in classes VI-XII. There are three science sections each in classes IX, X and two science sections in class XII. Since M.Sc. teachers are not available, the teaching of physics and chemistry is entrusted to two B.Sc teachers, who have completed the condensed course and also attended Summer Institutes for biology and mathematics, the school had post-graduate teachers. In classes IX, and X, three B.Sc teachers teach the subject. A sum of Rs.16,000 was paid to the school under the Crash Programme. The laboratories of the school are well-equipped. The Principal/the school explained that the grant had come in very handy to cope with the increasing numbers of students offering science subjects. On enquiry the teachers, who had attended the condensed course and the Summer Institutes,

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of

said that they had personally benefited a great deal from the course, but they admitted that the training had not influenced the class-room practices appreciably.

14. Afterwards, the team visited the Saryu-Pareen Intermediate College, situated in a crowded residential quarter of the city. The school has 750 pupils in classes VI-XII, and teaches sciences in classes IX & X only. An M.Sc. in mathematics teaches both mathematics and physics, while a B.Sc. in biology also teaches chemistry. Although new rooms were under construction, no care had been taken to build a room which would meet the special requirements of science laboratory. At present, the laboratory was located in a newly constructed room which had insufficient natural light. The arrangement of furniture and almirahs was clumsy. It was clear that the teachers needed a lot of guidance in organising the laboratory. The schools had received a grant of Rs.2,400 under the Crash Programme.

15. The last school visited was the Jamuna Christian Intermediate College. This is a large well-run institution of repute in the city. There are 1,300 students in classes VI-XII. There are 5 science sections in class XI and 4 in class XII. All science teachers are M.Sc.s. The institution had excellent arrangements for teaching science. Recently the school received a grant of Rs.12,000 under the Crash Programme. The school also received Rs.8,000 from the Union Ministry of Education for strengthening the teaching of agriculture. In addition, the State Government had sanctioned a sum of Rs.10,000 as science grant to the school. The Principal of the school said that he needed Rs.6,000, Rs.3,000 and Rs.2,000 as recurring expenditure per year for chemistry, physics and biology laboratories respectively. The Directorate of Education allowed the college to levy a fee of Re.1/- p.m. from every student offering science subjects, but according to the Principal this was insufficient.

15. In the afternoon, the Team called on Dr. C.M. Bhatia, Director of Education, U.P., and shared their impressions with him. They explained the need for a more detailed survey of the needs for science equipment of institutions set up after 1961. They also suggested that the staff of the Science Institute should be strengthened and facilities for laboratories and a workshop should be provided as early as possible. The Team also stressed the need for the appointment of adequate staff at the headquarters and in the districts to deal with all science education programmes at the school level.

Enrolment in 9-month condensed course
for graduate science teachers

Sl. No.	Name of State	1964-65	1965-66	1966-67	To (3)
1	2	3	4	5	
1.	Andhra Pradesh	29	29	31	
2.	Assam	NA	NA	NA	
3.	Bihar	NA	NA	NA	
4.	Gujarat	Nil	Nil	Nil	
5.	Haryana	-	-	Nil	
6.	Jammu & Kashmir	NA	NA	NA	
7.	Kerala	Nil	Nil	Nil	
8.	Madhya Pradesh	28	26	23	77
9.	Madras	NA	NA	NA	NA
10.	Maharashtra	Nil	Nil	Nil	Nil
11.	Mysore	Nil	20	21	41
12.	Orissa	NA	NA	NA	NA
13.	Punjab	Nil	27	Nil	27
14.	Rajasthan	-	-	16	16
15.	Uttar Pradesh	Nil	31	38	69
16.	West Bengal	-	56	55	111

NA - Not available.

Enrolment in short refresher courses
for graduate science teachers

S.No.	Name of State	Duration of course	1964-65	1965-66	1966-67	Total (4)+(5)+(6)
1	2	3	4	5	6	7.
1.	Andhra Pradesh	10 weeks	21	91	44	156
2.	Assam		NA	NA	NA	NA
3.	Bihar		NA	NA	NA	NA
4.	Gujarat	8 weeks	Nil	81	57	138
5.	Haryana		-	-	Nil	Nil
6.	Jammu & Kashmir		NA	NA	NA	NA
7.	Kerala	4 weeks	427	352	254	1033
8.	Madhya Pradesh	10 weeks	48	45	47	140
9.	Madras		NA	NA	NA	NA
0.	Maharashtra	10 weeks	Nil	126	Nil	126
1.	Mysore	10 weeks	-	11	31	42
2.	Orissa		NA	NA	NA	NA
3.	Punjab	10 weeks	Nil	13	Nil	13
4.	Rajasthan		Nil	Nil	Nil	Nil
5.	Uttar Pradesh	10 weeks	Nil	52	83	135
6.	West Bengal		Nil	Nil	Nil	Nil

NA - Not available.

Utilisation of Central Grants for the purchase of equipment for school laboratories

(Rs. lakhs)

States	1964-65		1965-66		1966-67		Total	
	Central grant	Utilised by States	Central grant	Utilised by States	Central grant	Utilised by States	Central grant	Utilised by States
1	2	3	4	5	6	7	(2)+(4)+(6)	(3)+(5)+(7)
1. Andhra Pradesh	5.70	5.70	9.93	7.63	14.63	14.63	30.26	27.96
2. Assam	1.42	2.61	3.00	2.38	4.42	NA	8.84	-
3. Bihar	9.78	9.78	16.41	16.41	20.64	NA	46.83	-
4. Gujarat	2.55	5.67	8.55	8.47	10.33	10.33	21.43	24.47
5. Jammu & Kashmir	0.78	NA	0.44	NA	1.22	NA	2.44	NA
6. Kerala	2.25	0.93	7.47	5.50	9.04	9.04	18.76	15.47
7. Madhya Pradesh	5.56	5.57	34.25	23.12	24.89	NA	64.70	-
8. Madras	3.00	3.90	9.53	5.73	11.66	NA	24.19	-
9. Maharashtra	10.98	16.46	28.52	31.04	24.65	2.62	64.15	50.12
10. Mysore	6.07	5.79	11.98	9.94	16.79	NA	34.84	-
11. Orissa	1.06	NA	3.66	NA	4.72	NA	9.44	-
12. Punjab	3.70	4.37	26.30	19.58	19.53	16.20	49.53	40.15
13. Rajasthan	7.80	6.55	3.93	4.69	10.91	NA	22.64	-
14. Uttar Pradesh	20.65	21.16	10.71	12.15	20.03	20.03	51.39	53.34
15. West Bengal	18.63	22.16	26.26	16.90	20.36	20.36	65.25	59.42
16. Nagaland	-	-	-	-	0.18	NA	0.18	NA
Total	99.93	-	200.94	-	214.00	-	514.87	-

* includes grant of Rs. 5.46 lakh for Haryana

NA - Not Available

- Information given in columns 2, 3, 4, 5 & 6 has been received from the Ministry of Education.
- Information given in col. 7 has been received from State Govts

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