

## BACKGROUND PAPERS

### SCIENCE EQUIPMENT CENTRES I: NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING (NCERT)

#### Introduction

The NCERT was established in New Delhi in 1961 with a view to improving school education. In general it:

- (i) undertakes, aids, promotes and co-ordinates research in all branches of education;
- (ii) organizes pre-service and in-service training mainly at advanced level;
- (iii) organizes extension services;
- (iv) undertakes and organizes studies, investigations and surveys relating to educational matters or the appraisal of educational programmes;
- (v) disseminates improved techniques and practices; and
- (vi) acts as a clearing house for ideas and information on all matters relating to school education.

One of the six constituent units through which NCERT functions is the National Institute of Education. This Institute has a large purpose-built workshop where science kits are designed, developed and produced.

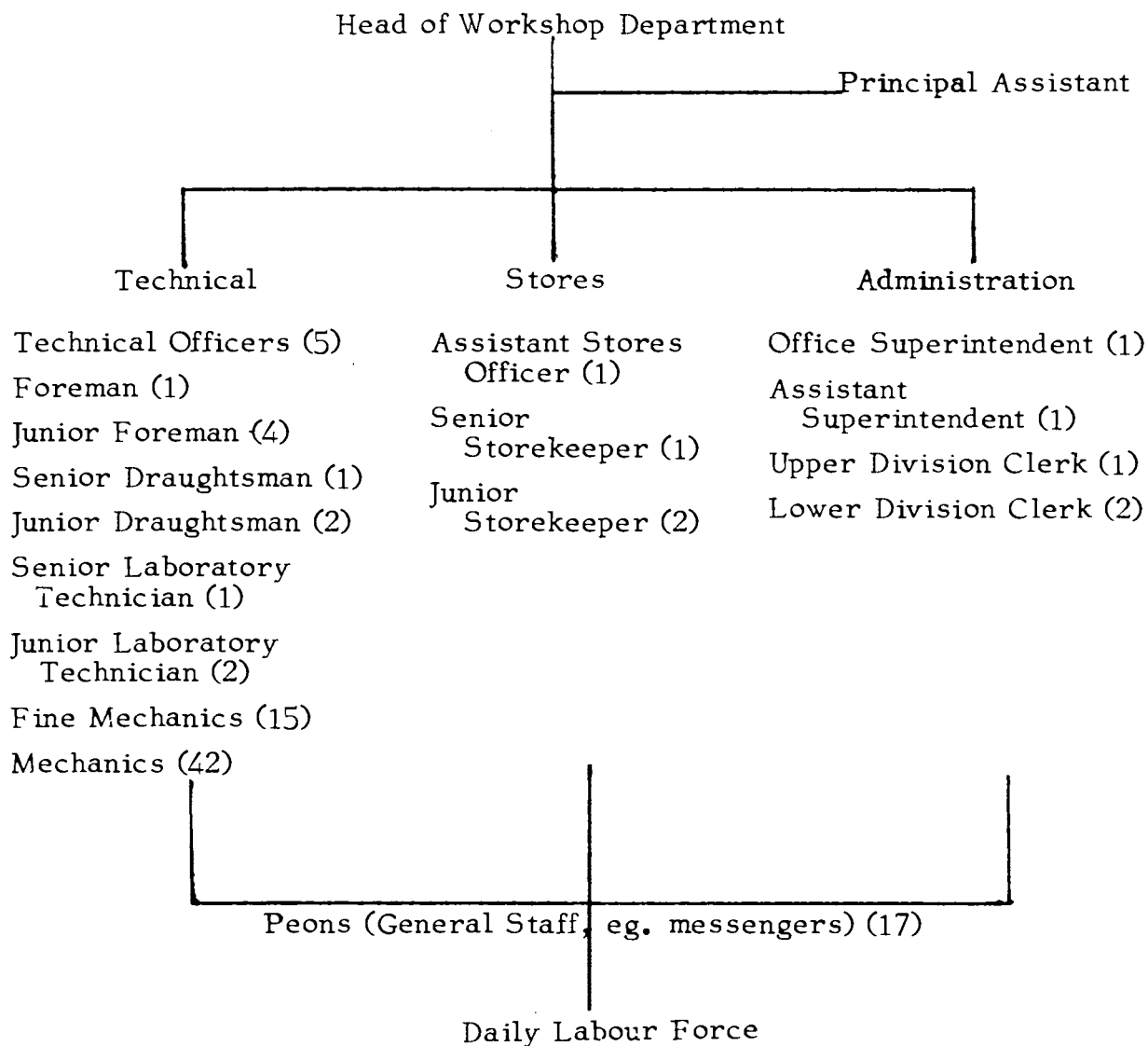
#### Workshop Department

This was established to:

- (i) study industrially-manufactured equipment for teaching science with the view to improving its quality;
- (ii) design, manufacture and organize the trial of new teaching equipment;
- (iii) generalize and utilize local and foreign experience to design and produce teaching equipment;
- (iv) produce new designs for manufacture by industry.

## Workshop Staff

The workshop department has approximately 100 members of staff and, depending upon demand, also employs a daily labour force as required. The following chart outlines the structure of the staff, but a particular title does not necessarily reflect the actual duties of the individual. For example, of the technical officers, one is responsible for office administration: In the fine mechanic grade, two are in the packing section.



Recruitment of staff is done through national advertising, and the successful applicants are appointed to their appropriate grade and duties. A system exists whereby any individual who shows aptitude can apply for the relevant trade test and be upgraded.

There is much flexibility in staffing. Besides each individual having his specific duties, personnel can be co-opted for other duties; this flexibility enables heavy demand areas to be supplemented to smooth out bottlenecks when they look like occurring. It should be pointed out, however, that this policy can only be practised effectively when employer/staff relations are good.

### Development of Science Kits

In developing kits, close liaison is generally maintained with the staff of the science and mathematics department of NCERT as well as with UNESCO specialists supplied under UNDP/UNESCO assistance. The interchange of staff that takes place when developing a piece of apparatus allows more than one individual to participate in the design at various stages. Trials of developed materials are carried out in a school near to NCERT. Where necessary, they are modified prior to inclusion in the kits.

During the development process the production of the apparatus is kept in mind so as to minimize alterations between the form of the prototype and the form of the finished product.

On completing the development of the item, workshop production drawings are produced and made available for anyone wishing to construct the apparatus.

### Production of Kits

In addition to the facilities for constructing apparatus in the workshop department, a number of items are constructed by local manufacturers. There are currently some twelve commercial manufacturers who tender for the batch requirements of the kits. The procedure adopted by the workshop is to request tenders for a fixed number of items with the suppliers working to the strict requirements of the department. All items submitted to the workshop are inspected by selected members of the workshop staff, prior to acceptance.

By maintaining their own quality control standards, the reliability of the manufacturers has improved, particularly since the success of each manufacturer's tender rests heavily on the quality of his past products. New tender companies have to supply sample products prior to approval for tender. In addition, these companies also offer their products on the open market for purchase by schools. The department supplies a list of such suppliers to all schools who write to the NCERT for information on the availability of the kits.

Under the course-work activities of the science and mathematics department of NCERT, courses on quality control have been operated by the workshop. These courses have been organized for member state Ministries of Education who have provided Quality Control Officers to specifically monitor the quality of products when purchased from commercial companies. The participants have been instructed in the requirements of their duties and provided with a kit of instruments and samples purchased out of UNICEF funds.

## REGIONAL CENTRE FOR EDUCATION IN SCIENCE AND MATHEMATICS (RECSAM)

RECSAM was established by the South-East Asian Ministry of Education Organization (SEAMEO) in 1967 with the main purpose of assisting member

states in the improvement of science and mathematics teaching and thereby providing the firm foundation necessary for meeting the scientific and technical manpower requirements of South-East Asian countries in the future.

RECSAM is located on the Malayan Teachers College campus, Penang, Malaysia. The Centre is administered by a Director who is responsible to a Governing Board appointed by the South-East Asian Ministers of Education Council. The Director is guided by an International Advisory Council in the development of the Centre's programme.

The programme at the Centre is organized under four broad headings - training, research, information and special services, and administration. The Training Division operates courses aimed at training key personnel in the modern techniques of teaching and evaluation in science and mathematics. The Research Division operates courses aimed at developing complete prototype units or modules in science and mathematics as well as conducting some pilot studies on child learning. The Information and Special Services Division produces and disseminates information and ideas through reports and other publications. It also maintains contact with appropriate institutions and bodies within and external to the SEAMEO region. The Administration Division handles the organization and running of the Centre.

### Facilities

The first phase of the building programme involved the construction of hostel accommodation and a recreational block.

The recreational block is temporarily being used as the teaching/administrative block. Its facilities include classroom/laboratory space, workshop space, stores, printing/duplicating space, resource area (the main library is at present located in Malayan Teachers' College building), dark-room for photographic work, office space for staff, dining room (now a general purpose hall), and administrative offices.

The hostel accommodation is located in close proximity to the teaching area and consists of some 100 units of single/double room accommodation. The hostel facilities include common rooms and laundry facilities.

In the second phase of the building programme, provision has been made for a new building which will have administrative/teaching block, two laboratory/workshop blocks, a library/information block, and a conference hall. It is envisaged that while one of the workshops will be used for course work, the other will serve as laboratory for production of prototype apparatus for the teaching of science and mathematics.

### Functions

RECSAM undertakes the following activities:

1. Training programmes for key educators in modern methods of teaching science and mathematics.
2. Development of action-research techniques.
3. Critical study of selected pilot project materials.
4. Development of specific studies and instructional materials to be carried out as pilot projects.

5. Critical examination of research on curriculum materials and methodology.
6. Development of simple techniques in apparatus making, using low-cost materials.
7. Organization and conduct of professional seminars and workshops for educators.
8. Gathering of information and acting as a clearing house for science and mathematics education.
9. Consultation and special services for SEAMEO member countries.
10. Promotion of indigenous efforts in curriculum development.

Formal relations have been established with UNESCO, thereby providing mutual co-operation in matters and activities related to science and mathematics education. This link also enables the Centre to benefit from the provision of specialists and consultants when required.

### Financing

In mid 1970 RECSAM became semi-operational with the completion of the first phase of its building programme, and this commenced the first five-year operational plan for the Centre. The total cost of the plan was projected as being US\$8.7 million, of which the United States of America contributed 50 percent. The Government of Malaysia, as the host country, assumed responsibility for the capital and operating costs of the Centre, whilst SEAMEO had the responsibility for raising the special funds for the Centre's activities. The latter are generally raised through grants and donations, in cash or kind, from interested governments, organizations and institutions. The second phase of the building programme, aimed at providing the Centre with its own purpose-built buildings, is being financed jointly by the governments of the United States of America and Malaysia. Work on this phase commenced in 1975, and occupation of the premises is expected in late 1976.

The second five-year development plan commenced in July 1975. Since then, RECSAM has taken full responsibility for obtaining its own finances.

The responsibility for the total operational costs for the second five-year plan was taken over by the Government of Malaysia in June, 1975. The amount allocated was approximately M\$4.6 million, with an additional M\$3,150,000 for the construction of additional facilities in the building programme and for awarding scholarships and fellowships.

The breakdown of financing for RECSAM is listed under two headings:

1. Operational costs which include personal emoluments, services and supplies, grants and subsidies.
2. A special fund to cover training and research scholarships, seminars and conferences, Governing Board meetings, and personnel exchanges.

### Staffing

RECSAM is staffed by tutors recruited from within the SEAMEO region, but specialists from outside the region are also on the staff. Also, the services

of short-term consultants are utilized as and when required, these services often being generously provided by governments throughout the world.

The following chart which shows the staff and posts for 1975/76 indicates the current organizational set up of RECSAM:

### Courses

The Training and Research Divisions are responsible for the courses conducted at the Centre and work closely together. The courses were laid down in the first five-year plan and have been modified in the light of experience gained. The differentiation of responsibilities is best seen in that the Training Division runs courses aimed at training key personnel in the modern techniques of teaching and evaluation, whilst the Research Division's development courses are aimed at developing complete prototype units or modules, as well as conducting some pilot studies on child learning.

Courses are conducted in elementary science, elementary and secondary mathematics, integrated science, biology, physics, chemistry, and elementary and secondary science apparatus. Between 1968 and June 1975, some 900 participants have attended training courses at the Centre. Depending on the nature of the course/seminar/workshop, the period spent at that Centre by participants ranges from two to twelve weeks.

One of RECSAM's objectives is to make use of the "multiplier effect" for progress in science and mathematics by training key personnel who on their return home can then train others and influence development. Ideally, this would suppose that the catchment area should be senior educational administrators and educators, such as would be found in teacher training institutions. In practice, such individuals can seldom be regularly released for courses lasting for ten to twelve weeks. Courses at RECSAM are, therefore, attended mainly by personnel from the teacher/teacher trainer level. This does not negate the objective of the multiplier effect provided that when special courses for senior educational administrators are held, information is included about what has been taught to the teacher trainers.

### Equipment Unit

In October 1973 RECSAM hosted a Regional Workshop on the "Production of Low-Cost Teaching Materials for Primary Science and Mathematics" which was sponsored jointly by SEAMEO and Deutsche Stiftung Fur Internationale Entwicklung (German Foundation for International Development). Amongst the recommendations of that workshop were:

- (a) There should be established a regional equipment unit at the SEAMEO Regional Centre for Education in Science and Mathematics, with the following functions:
  - (i) Designing and fabrication of prototype equipment for science and mathematics.
  - (ii) Training of key personnel from the SEAMEO countries for designing and production of prototype materials.
  - (iii) Acting as a clearing house for collection and dissemination of information regarding materials for science and mathematics.
  - (iv) Exploring ways and means by which the science and mathematics equipment needs of the region can be met.

## ADMINISTRATION

### Academic Staff

Director (1)  
Deputy Director (1)

### Non-Academic Staff

Registrar/Bursar (1)  
Financial Assistant (1)  
Personal Assistant to Director (1)  
Stenographers (2)  
Book-keeper (1)  
Clerical Officers (4)  
Clerical Assistants (2)  
Typists (2)  
Store-keeper (1)  
Assistant Store-keeper (1)  
Drivers (2)  
Office Boys (3)  
Maintenance Technician (1)  
House Servants (10)  
Gardeners (6)  
Watchmen (4)

## TRAINING DIVISION

### Academic Staff

Assistant Director (1)  
Training Officer for Science (1)  
Biology Officer (1)  
Chemistry Officer (1)  
Mathematics Officer (1)  
Physics Officer (1)

### Non-Academic Staff

Laboratory Assistant (1)  
Laboratory Attendants (4)  
Typists (2)

## RESEARCH, DEVELOPMENT & EVALUATION DIVISIONS

### Academic Staff

Assistant Director (1)  
Biology Officer (1)  
Mathematics Officer (1)

### Non-Academic Staff

Laboratory Assistant (1)  
Workshop Technician (2)  
Typists (2)

## INFORMATION/SPECIAL SERVICES DIVISION

### Academic Staff

Assistant Director (1)  
Information Officer (1)  
Librarian (1)  
Library Assistants (2)  
A.V.A. Supervisor (1)  
Graphic Artist (1)

### Non-Academic Staff

Clerical Officer (1)  
Clerical Assistant (1)  
Typists (2)  
Library Attendants (2)

- (b) Each member country examines the feasibility of establishing a national design and prototype production unit as a component of its curriculum development and/or bilateral assistance in establishing such a centre should be explored.
- (c) Countries should decide on their own priorities for prototype equipment development which should cater for the present curricula in mathematics as well as science.

The Fifth Governing Board Meeting of RECSAM, held in September 1974 decided "that the Centre in its attempts to implement some of the recommendations of the Workshop should develop the necessary materials only to the stage of educational prototypes, and that the emphasis should be on the training of personnel who would be likely to be employed as designers in national equipment workshops".

The Training Officer (Science) who is a member of the academic staff is responsible for the technical component of the course work as well as arranging the specialist courses on laboratory management/equipment, etc. In addition, he is also involved in other duties related to his own academic discipline. He is assisted in his work by one workshop technician, two laboratory assistants and a laboratory attendant. The technical staff are locally trained by the RECSAM staff and by attending ad-hoc courses. At present the workshop facilities consist of a laboratory area equipped with hand tools and workbenches. The new building will have two workshops - one for course work and one for prototype design and development.

Those RECSAM courses that are related specifically to equipment are perhaps best described in the following extract from a paper entitled, "RECSAM's Programmes and Courses for Development and Production of Prototype Science Equipment", presented at the aforementioned Workshop:

To assist each member country build up a core of equipment, key personnel who could develop prototype equipment and produce design plans for dissemination, as well as organize in-service training of teachers and laboratory personnel in equipment production, RECSAM has successfully implemented the course, "Development of Primary Science Apparatus" code titled RMI-1 in 1972 and again in 1973. This intensive course of about ten weeks' duration is specially designed for SEAMEO key personnel who are actively involved in equipment design, development and manufacture in their respective countries, or who are in positions which make them likely to be so. So far, fourteen key personnel have undergone this course, namely, two each from Indonesia, Khmer Republic, Malaysia, Philippines, Singapore, Thailand, and one each from Laos and Vietnam.

The terminal behavioural capabilities expected of participants on completion of the RMI-1 course are that they should be able to:

- (a) improvise simple science and mathematics equipment for use in the primary grades;
- (b) carry out routine maintenance and minor repairs on simple equipment;

- (c) transform new ideas for simple equipment into reality through designing, constructing and testing of such;
- (d) produce an equipment design plan acceptable for publication with the necessary technical drawings and parts specification included;
- (e) provide sound advice for the procurement of equipment from commercial sources;
- (f) carry out refinements on prototype equipment for possible mass production;
- (g) advise on plans for mass production of prototypes by government and non-government agencies;
- (h) assist in development of curriculum materials through design, and development of equipment hardware for these materials;
- (i) organize and conduct in-service courses for teacher trainers, teachers and laboratory personnel, to train them in the basic skills for equipment production leading to actual production of urgently needed equipment;
- (j) play leadership role in science/mathematics exhibitions and in school science/mathematics activities.

The course work described above has been continuing and the Centre has a display area for apparatus developed.

#### Audio-Visual Aids

The Centre has an audio-visual aids specialist on its staff, and work in audio-visual aids is a constituent part of the majority of courses offered at RECSAM. A small darkroom is available where course participants are able to receive instruction in the use of photographic materials and techniques. In addition, sound space is available for using a range of audio and visual apparatus and for receiving instruction in the techniques of operation of the workshop facilities in the new building, an expansion of the A.V.A. facilities will also take place.