

LOW-COST SCIENCE TEACHING EQUIPMENT:  
TRAINING FOR USE

Practical Work in Science

Although practical work in science was considered to be essential, it was reported that many schools in the South Pacific region did little or no practical work. In some cases this was due to lack of science equipment resulting from a rapid expansion of education systems and a failure to equip new schools adequately. In others it was due to a lack of scientific background among teachers; a lack of training in the use of equipment; a failure to see the relevance of experiments in developing concepts; heavy teaching loads; large class sizes and related problems of discipline; pressure to cover syllabus in which practical work was often not directly included in a student's final assessment; and lack of a laboratory attendant.

A number of suggestions to overcome the problems and difficulties were considered. They included lighter teaching loads for science teachers to allow for adequate preparation for experiments; timetabling designed to provide free periods before practical classes; and smaller laboratory classes. It was also suggested that in order to be seen as a really important component of science teaching, practical work should be relevant to the science curriculum and be made part of the assessment procedures.

Choosing Equipment

Many factors influence the choice of items of equipment for developing an understanding and appreciation of a particular science concept. They include the intellectual level, maturity, and manipulation skills of the pupils; suitability of the equipment for the objectives of a particular lesson; cost; storage facilities and requirements; and subsequent maintenance and repairs.

It was suggested that the ministry of education in each Commonwealth South Pacific country should prepare guidelines indicating basic equipment requirements for teaching the current national science curricula. An example of such a document, prepared by the Malaysian Curriculum Development Centre for teaching integrated science, was shown to participants.

The advantages of having special kits of equipment include suitability for storage and portability, since in the Pacific region few classrooms have sufficient security for storing separate items of equipment. There is a tendency, however, on the part of some teachers not to use any of the equipment in a kit if parts are missing or broken.

As far as possible students using low-cost equipment should perform experiments themselves rather than watch a teacher demonstrating them. It was recognized, however, that there are occasions when demonstration needs to be used for pedagogic and economic reasons.

## Problems Association with the Use of Equipment

Problems related to ordering, distribution, storage, maintenance and repair were discussed. They are summarized in the discussion on the sub-theme, Training for Production. Further problems relating to the effective use of equipment were considered. They included lack of manipulative skill among teachers a failure to understand how to demonstrate specific concepts in a practical way. As mentioned above, many teachers find they have insufficient time or skill to set up apparatus or to try out new experiments for themselves. In the Pacific region, understanding instructions in a foreign language or in technical English is often a problem, and it was recommended that simplified English instructions should be given wherever possible.

There is an obvious need for assistance for the teacher, and each of the participants was urged to convince his or her home government of the need to employ laboratory assistants. Such assistants could set up equipment, help with practical classes, and store, maintain and repair equipment.

## Training of Teachers in the Use of Equipment

Pre-service, in-service and on-the-job training are all necessary for the most effective use of equipment in science teaching. Training is needed to give teachers a satisfactory knowledge and understanding of basic science concepts and of the curriculum they will be teaching. The philosophy behind the particular curriculum and the psychological principles involved in its teaching should be understood, and experience in handling all equipment used with the science curriculum should be included.

Many other aspects of the training of science teachers were considered. Among these were the design, production, evaluation, and simple maintenance and repair of equipment; and the development of a resource bank consisting of such materials as newspapers, journals, magazines and diagnostic tests.

## Pre-Service Training of Teachers

For adequate pre-service training, teacher training institutions should have laboratories with suitable storage and workshop areas. The training situation must as far as possible match that of a typical classroom. In the primary teachers' colleges especially, improvisation, using cheap materials such as bottles, empty cans and plastic bags, should be encouraged. New Zealand and Fiji reported on teachers' colleges which have set up model school laboratories with school-type equipment.

One problem with courses at teachers' colleges is the lack of time for adequate training. Furthermore, the academic background of incoming students is often low and has to be improved before they can learn about teaching.

Suggested programmes for secondary-level teacher training should include practical work in science, technical skills, courses in repair and maintenance of science equipment, and lessons in graphic art.

## In-Service Training of Teachers

The type of in-service programmes mounted must depend on the academic background and training experience of the teachers. In-service activities should be used to upgrade teachers' knowledge, teaching methods and skills; introduce

and train in the maintenance and repair of equipment; involve teachers in the revision of curricula; and produce worksheets and other classroom materials.

It was pointed out that in-service training sessions should be a continual, ongoing service to teachers and could be of varying duration. The need for structured, well-organized, possibly national programmes, was noted. Such in-service training exercises should call upon the human and physical resources of training colleges, existing science education organizations, and national or regional equipment centres. Suggestions were made for identifying suitable in-service centres among existing institutions such as schools and audio-visual centres.

Some participants commented on the inability of in-service programmes to motivate teachers in their countries. It was suggested that teachers may be motivated if a programme is relevant to the classroom situation, if it is practically oriented, and if it offers some chance for self-improvement. Expenses for teachers attending courses should be paid, and the programmes should be considered as a factor for promotion.

### The Role of Science Teachers' Organizations

There is a need for teachers to belong to organizations such as the Commonwealth Association of Science and Mathematics Educators (CASME) and the International Council of Associations for Science Education (ICASE). Science teachers' organizations can contribute to the general improvement of science education and should be recognized and encouraged by ministries of education.

A science teachers' organization may assist teachers through participation in curriculum work, distributing equipment and materials, and in developing tests and item banks. In addition, the organization can exchange ideas and information among members and with other organizations elsewhere. When considered necessary, a science teachers' organization can act as a pressure group in obtaining policy changes for science education.

Participants were reminded that all such improvements require changes in attitude towards science, particularly by educational administrators, heads of science departments in schools, headteachers, inspectors, curriculum officers, planning and finance officers, and chief education officers.