THE POTENTIAL FOR LOCAL MANUFACTURE OF SCHOOL SCIENCE EQUIPMENT AND THE PROBLEMS OF EQUIPPING SCHOOL LABORATORIES

In the Caribbean, the traditional approach to science teaching - over-emphasis of teacher demonstration and learning by rote - is generally giving way to a new approach which involves inquiry, discovery, and the encouragement of pupil participation. The programmes being developed will therefore tend to depend heavily on an adequate supply of equipment and will become successful and effective only when the local resources are fully exploited and utilized.

The seminar looked into some issues highlighted in the lead paper based on Kenya's experience and which were also brought up in the country papers. It discussed the problems and difficulties which countries in the Caribbean face in equipping their school science laboratories, and explored the potential for local manufacture of science apparatus.

Improvization and Production

For many people, cheap apparatus is synonymous with improvization. No matter how well equipped a school science laboratory might be, teachers may sometimes find it necessary to improvize. Improvization should therefore be seen as something confined to the individual teacher: in other words, it should be viewed as an aspect of a teacher's training and his approach to work.

The meeting also pointed out that improvization should not be seen as being unrelated to mass production since, in many cases, it leads on to mass production. Thus, although the type of production with which the meeting concerned itself is not usually handled directly by teachers, teachers have a great contribution to make. This is because experience in many countries indicates that for a production unit to make the greatest educational impact, mass production of equipment must be carried out in such a way as to increase the involvement, confidence and skills of the average teacher. The teacher must be encouraged to view the production project personally if it is to meet with real success. As an example, the success of the development of the Science Equipment Production Unit (SEPU) biology kits in Kenya may be partly attributed to the fact that the consultant was a teacher with local experience and the majority of the members of the committee which decided on the original objectives were also teachers. Moreover, field trials, development of the accompanying teacher training programme, evaluation, and all aspects of production involved members of the teaching profession.

Present Source of Equipment and Evaluation

Though a certain amount of improvization, particularly by physics teachers, has added considerably to the range of apparatus available in some schools, schools are, in general, equipped with apparatus imported from the United States and the United Kingdom. A few countries also import equipment from Canada and Japan.

Participants expressed their opinions on the efficiency of individual suppliers. Some suppliers are more prompt and efficient in handling orders than others. United States and Canadian suppliers were more conveniently placed for certain territories, but their equipment did not always suit curricula based on United Kingdom sources such as Nuffield science and Scottish Integrated Science.

UNICEF provides equipment which is markedly less expensive than other sources, but its delivery period is often longer and more uncertain. Attention was drawn to the fact that it might be better, assuming there were no currency problems, to order direct through UNICEF's EVE catalogue.

Difficulties and Problems in Equipping School Science Laboratories

Economic, professional and educational issues were discussed. In view of the fact that almost all of the equipment used in Caribbean schools is imported, great concern was expressed about the long delays that occur between a school wanting the apparatus and actually getting it. Foreign exchange problems, import restrictions, and devaluation featured conspicuously when the causes of delay were reviewed.

Once the apparatus is in the school, other difficulties operate. Students, especially in the junior secondary schools, are usually weak in manipulative skills. This often results in a high rate of breakage.

Frequent staff transfers often mean that the teacher who originally ordered the item has left, and no one else seems to know what to do with certain items of equipment already available in the laboratory. The result is obvious - abuse and breakage, or an item left to gather dust on a shelf. Also, because of the fact that buying is, in some cases, done in very limited quantities by individual schools, there is lack of uniformity not only in the science apparatus found in different schools within a particular country but also within subject departments within a single school. This situation makes purchasing of spare parts, repairs and servicing difficult and expensive to undertake.

In discussing the above difficulties and problems, the opinion was expressed that it might make sound practical sense to co-ordinate all purchases of equipment through the activities of a central purchasing authority. In this case, it was thought that items could be evaluated by professional specialist staff and the most suitable items purchased in bulk and distributed.

There were reservations, however, to the establishment of such a central purchasing unit. Apart from political reasons, it was felt that a central unit would be beset by transportation difficulties. Also, such a system would have to contend with different systems of taxation and the effects of inflation and devaluation in currencies which are a feature of present systems of supply operating in the different territories. It was noted, nonetheless, that with the assistance of CARICOM, adequate legislation could be set up in each country to offset the taxation problem and thereby help cut down the cost of equipment.

At this stage the discussion revealed that there was need for clarification of the term "low-cost". The use of the term had given rise to confusion for a number of reasons. Some participants had identified the term "low-cost" with cheap sources of commercial or imported supply, and were consequently interested in finding out more about such sources of equipment. Others wanted to relate low-cost equipment to locally produced items but could not reconcile

this idea with the fact that those items, partly because they are mass produced for a large population target, sometimes cost more than imported ones. Again there was the misconception that production of science equipment entails the acquisition of expensive machinery. It was pointed out that this need not be so. Indeed, it has been shown by the SEPU and other experiences that many valuable items of equipment, especially those for primary school science, can be produced with inexpensive machinery.

Attention was drawn to the fact that the purpose of this seminar is to find ways and means by which Caribbean countries could produce suitable items of equipment cheaply. Admittedly the initial cost of locally produced items may sometimes be higher than that of imported ones, but it was pointed out that replacements and repairs would be facilitated and hence the equipment would be cheaper in the long run. In any case, it was generally agreed that it might be better to acquire something dearer if it is more relevant and more suited to the local curriculum, a condition which imported items, generally, are not able to satisfy because of the wide market for which they have been produced.

The concern over the establishment of centres for the production of low-cost equipment was so great that the meeting set up a Committee to: (a) examine and make recommendations on feasible ways of establishing local and/or regional systems of production based on criteria of cost, educational and national goals, and (b) prepare an outline of a project which could be submitted to an international funding agency.

After discussing the Committee's report, the meeting agreed that even though the idea of a regional production unit was a good one, it would at the moment be premature to recommend its establishment. However, it was recommended that local production units should be set up with a view to working towards the establishment of a regional unit later if feasible. It was agreed that a co-ordinating or monitoring unit should be established whose main functions would be:

(a) To collect, evaluate and distribute information on science teaching equipment.

(b) To advise and make recommendations on local production of science equipment.

(c) To encourage relevant local activity.

(d) To determine the feasibility of setting up regional, sub-regional or local production units.

It was also recommended that the Caribbean Regional Organization of Associations for Science Education be requested to perform the functions of the co-ordinating unit.

Existing Local Resources

Even though no organized effort is being made in any of the countries to produce equipment on a large scale for schools, it was noted that individual territories had already produced some prototypes. Participants mentioned the following prototypes as having been produced during in-service courses for teachers or by students in schools where industrial arts departments exist: circuit boards, spirit or kerosene oil lamps, mobile benches, trolleys, test tube racks, tripods, metre rulers, plastic lenses, resistors, laboratory

stools, exhibition tables, and wooden models. In addition to cost consideration, it was noted that in any local production enterprise the following factors should be borne in mind: the apparatus must be made to fit the curriculum; there must be uniformity in specifications of equipment produced; items of equipment produced must be accompanied by comprehensive instructional manuals; items of equipment produced must be robust, sturdy and durable.

The existing local resources in the Caribbean were grouped under four headings: Natural Resources, Energy Sources, Low-cost Labour, and Industrial Skills. The table shows that as a whole, the Caribbean has adequate local resources to make a production unit a viable concern. For instance, wood could be obtained in abundance in Guyana, Grenada, Dominica, Belize, St Vincent, and the Bahamas; labour is said to be cheap in Dominica; Trinidad, Guyana, and St Lucia could provide energy sources; there is adequate supply of water in Guyana and Dominica; mineral sources abound in Guyana, Trinidad, Jamaica, St Kitts, and St Lucia; and a lot of industrial skills are found in Trinidad, Dominica, Guyana, St Lucia, and Barbados.

Natural Resources			Energy Resources	Low-cost Labour	Industrial Skills
Wood	Water	Mineral			
Guyana Grenada Dominica Belize St Vincent Bahamas	Guyana Dominica	Guyana Trinidad Jamaica St Kitts St Lucia	Trinidad Guyana St Lucia	Dominica	Trinidad Dominica Guyana St Lucia Barbados

Contribution of Teachers, Technicians and the Community in the Production, Distribution and Evaluation of School Science Equipment

There was relatively little discussion on this section. Naturally, the role of teachers and technicians is a key one in any attempt to produce equipment at low cost, and the comments expressed in the lead paper were accepted without question.

Regarding the involvement of other personnel in the community, the youth camps found in Jamaica were cited as an example of possible sources of artisans that could be employed in a local enterprise. In this regard, reference was also made to the Guyanese system of community high schools whereby students attend school for two days of the week and work in factories for the remaining three working days. It was thought that this type of work experience could probably be channelled into the production of items of school equipment.

Experimental Units for the Production of Science Equipment at Various Levels

Whatever may be the nature and size of a unit for producing science equipment, factors such as time, money and siting need to be considered. Of these

constraints, the participants found it worthwhile to react to the issue of siting.

Considering the wide range of differences existing between territories in the region, participants thought it premature to discuss the establishment of a Caribbean-wide production unit. Consequently, participants decided to express their views in terms of individual territories or groups of territories, rather than of the Caribbean as an entity.

In this regard it was agreed that the development of experimental units in the various territories would depend on certain aspects of their educational and commercial practices. For instance, In Jamaica where many of the secondary schools with industrial arts departments run on a two-shift system, large scale production by these schools would not be feasible; improvization would be the only realistic thing to expect under the circumstances. On the other hand, participants from some of the countries represented - notably St Vincent and Trinidad - thought that their industrial arts centres and technical colleges could operate as production units.

Outside of normal institutions, the Youth Camps of Jamaica was noted as an organization that could undertake local production of equipment. No matter where the siting is, however, it was agreed that the success of the Unit would depend on good management and the application of hard-headed business methods which take into account the need for an extensive programme of evaluation and teacher training.