PRINTED RESOURCES FOR THE CLASSROOM

This section is more of a sample than a list of the great volume of printed material that is being produced for science teaching in the region. We must consider, I think, whether teacher educators and curriculum developers are finding the most effective means of reaching teachers who are too numerous for them to meet in person as often as they would like. The common solution is to send the teachers materials which, it is hoped, they will read and use. Since the materials, in practice, are read and used to an extent which does not match the time and expertise which went into producing them, one must ask if there are better printed resources, or better ways of producing printed resources, than are being developed at present.

Production Methods

Leaving aside for the moment large scale commercial printing and small scale production for up to 10 copies, teacher-educators in the Caribbean rely on three main methods.

1. Stencils, which may be typed or cut electronically. This, by far the most common method, is the most readily available, the least difficult to learn, and production can be very quickly executed by a small team of one to three people (the writer, the typist and the machine operator). However, the products tend to be dull, lacking in variety, bulky and fragile, and these are important considerations for writers anxious that teachers should read and use what they have written. Most associations, ministries, universities, centres and teacher educators know only too well that teachers commonly say "A pink booklet? Oh, yes, I think I got one of those...". For production runs of up to a few hundred, materials costs are probably somewhat lower than by the other methods to be discussed below, but hidden costs (labour, for example) could lead to a smaller cost differential than is generally supposed.

2. Typed camera-ready for production on an offset press of the kind that exists at the three UWI campuses. The carbon ribbon typewriter necessary for a good image is now common, and the method is considered satisfactory enough for Commonwealth Secretariat and UNESCO publications. Because it allows reduction, paper costs and bulk can be reduced by, say, one third. The plates are much more expensive than even an electronic stencil, and a production run of at least several hundred might be considered necessary before the cost becomes justifiable. However, the automation of the printing press and ancillary equipment reduces labour costs of printing, collating and stapling. An excellent example of such an efficiently produced circular is the CLEAPSE Bulletin, a single double-page spread, reduced in order to accom-

modate a fair amount of material. Impressed by this example, educators in Trinidad and Tobago explored the feasibility of bringing out publications in a similar format. A newsletter from the UWI St Augustine Teachers' Centre was estimated to cost about US $30 for 1,000 copies of approximately 3,000 words. The Association for Science Education of Trinidad and Tobago has estimated that production of 250 copies of its monthly Bulletin by this method would cost less than US $10 for each issue, and would make very much smaller demands on its members and those who help them. Where printers are under-employed, the delay between receipt of camera-ready copy and production may be only a day or so. (Larger publications requiring collating and stapling would take longer. Taking all these factors into consideration, it has been agreed by some groups in Trinidad and Tobago that camera-ready typing for offset printing could, in real terms, be more economical and more effective than the familiar stencil method.

3. Composed for production on an offset press. Composing looks more professional, allows for a justified page, and gives more words per page without reduction in print size. However, composer operators and graphic artists who paste up their corrections tend to be expensive and slow, and the St Augustine experience is that this process is a serious bottleneck in production. One wonders how many of our works really need such (slow, expensive) quality production.

It is suggested here that the second method of production deserves more use than it has had in the Caribbean so far. We may have been slow to come to terms with the existence of the printing press and the carbon typewriter ribbon, and a change in strategy might prove effective in reaching teachers sensitive to the appearance and bulk of materials with which they are swamped.

Curriculum Guides

It is probably safe to say that every Commonwealth Caribbean country has been engaged in science curriculum development during the past decade.

The first projects were lower-secondary integrated science projects, which become documented in the International Clearinghouse Reports (e.g. Lockard, 1977). Their relationship to one another and to other international projects has been outlined in Reay (1977) and I W Williams (1979). WISCIP of Trinidad and Tobago, still on stencils, is on the verge of a major revision exercise; WISC of the Caribbean (Adey), complemented by a choice of three sets of pupils texts from UWI Mona of Jamaica (Reay and Turner), have been printed commercially; Jamaica's Grades 7-9 materials (on stencils) are to undergo endless evaluation and revision; and Guyana's SDSP is currently under evaluation (51).

At the upper secondary level, Jamaica's Core Curriculum (on stencils) is also undergoing endless evaluation and revision, the philosophy being that the curriculum should never be static. The CROASE curriculum for CXC (2, 3) has been given considerable help in its pilot stage by a commercial publisher, who type-set even the first draft pupil materials and is prepared to wait for final publication as long as is needed for refinement of ideas. The only specialised science guide known to have been produced for the Caribbean is the Physics

Teachers Guide developed by the UWI Mona Physics Department under sponsorship from OAS (16).

The list of primary science curriculum development is so large that probably no single person in the Caribbean knows what is being done. In the Eastern Caribbean, every country is developing its own curriculum, many of them supported by science kits donated by UNICEF/UNESCO (3). Jamaica's primary science has received support from OAS and has set up six centres in a range of educational institutions in strategic rural locations, one of them having a delivery van (22). SAPATT, a joint enterprise of the Ministry of Education and UWI St Augustine (9), produced its first draft on stencils and evaluated this draft, with the aim of publishing small booklets with sturdy covers all printed by the typed/reduced/offset method outlined earlier. Guyana's Primary Science Education Programme guides are similar, except that they are not reduced, and the books are approximately A4 in size (45). Barbados was the first country in the Caribbean to undertake primary science curriculum renewal, in the early 1970s. A complete revision on stencils has since been completed by staff members of the Ministry of Education and the Teachers' College, and the material, which takes children up to 11+, is in all primary schools (3). After trials of teaching guides and basic science modular kits, the Bahamas expected to provide all primary schools with them, as well as with a Children's Reference Library of topic books. A Science Resource Centre in each school was to house the bulk of these materials. Although improvisation was to be encouraged, the programme would not rely solely on it. Although these plans were expected to be implemented in 1978, the survey has not been able to confirm that the plans were realised.

Most if not all of the curriculum development teams involve teachers as writers of the materials, with some editing being carried out by the co-ordinators. It has, however, been observed in Jamaica that primary teachers are more likely to use the materials if these are given after a workshop or if they are familiar.

They appear to lack the confidence to modify the activity or the suggested materials, and have difficulty in generalising from an example (e.g. from 'red pea' to 'seed'). Accordingly, while workshops help, the teachers want a very specific set of instructions to hold on to. It is also felt in Jamaica that printed materials should take account of the reading levels and Piagetian levels of the teachers, so that there is a need to collect data on these levels (52). The co-ordinators are sad to hear so often from teachers the request, "We're running out of facts - please send us some more." SAPATT's emphasis is an attempt to overcome this well-understood, but generally unsolved, problem of primary teachers.

Books for Children

Commercial publishers have produced a good selection of Caribbean texts for lower secondary integrated science. For the same level, one publisher embarked on a series of single concept books for the Caribbean (for example, one on sugar), filling an educational need (Adey 1974). These have not proved commercially viable, possibly because a slim spineless booklet of the Nuffield Background Reader type vanishes into a stack of books and is overlooked by readers and teachers; accordingly, the series was discontinued after only four were published.

Two commercial primary series for the Caribbean are known, one for the upper levels and one for all levels. When each country is developing its own primary course, always with at least major co-ordination by the Ministry of Education, a Caribbean-wide market, or even a national one, may not evolve, and publishers are assessing developments closely, conscious that the primary population in even one country is large and that few countries have the equipment and money to produce more than teachers' guides for primary schools. With its Timehri Readers, the Guyana Ministry of Education collaborated in an interesting way with a commercial publisher. With the help of a Commonwealth Secretariat regional course on book production in 1974, Guyanese teachers have been preparing manuscripts in workshops and are thrilled to see their work in print. While local production facilities do exist, they work out more expensive than when the international publisher arranges for printing in some other Commonwealth country; in any case the local printers cannot handle the 35,000 or so copies required. The art-work, layout and editing services, initially all provided by the publisher, are gradually being taken over locally. Although the Timehri Readers do not pretend to be science readers, and the primary science curriculum team plans in due course to produce readers to support its curriculum, it is not at all easy at the primary level to distinghish between science and non-science. For this reason, it seems appropriate to draw attention to this attractive series in a paper on science resources (7).

Jamaican primary teachers have asked for a regular 'newspaper' for children, an interesting idea. In Trinidad at least there is a Government periodical for children, but science content is absent.

Worksheets

While worksheets are no new idea, this author has been startled at the discovery that entire generations of postgraduate students have never come across them. The developers of WISCIP recognised the production problems of such a venture in the late 1960s, and provided none. By the time the Caribbean Regional Science Project had come into being, school resources were somewhat better, and worksheets were included in the WISCIP/C guides; a little in advance of the publication of the WISC Teachers' Guides, these were edited and published as WISCIP/C workbooks. While they sold well, a teacher-educator visiting a class generally found that very few pages in the book had been completed. Some teachers have expressed the view that worksheets produced by others are unlikely to suit a teachers' style and may even damage it (35). The Caribbean experience has been without doubt that the Scottish Integrated Science Worksheets, provided as a resource during lower-secondary curriculum development, have not proved useful to teachers.

The Jamaica Grades 10-11 programme provides materials for children who will not be proceeding to further education in science. These materials are programmed to make the children to some extent independent of their teachers. For children of the same age group preparing for CXC integrated science, Jamaica revises the CISC materials provided in insufficient quantities by CROASE, and includes worksheets (4).

There has been some interest in the production of worksheets on spirit duplicators. The machines are cheaper than the more well-known stencil duplicator, and easier to use in classroom or staff-

room and the masters may be prepared by the teacher on a table at home without access to a typewriter. Amongst the equipment given to the all-age schools of Jamaica has been spirit duplicators, but the software has been found expensive (4). It is not generally understood how many copies can be made with this method of reproduction - a hand-operated machine may, under local conditions, prove more useful than the more expensive electrical model, and no special duplicating paper and spirit solvent may be needed. We must be aware, however, that anything handwritten by the teacher consumes much more paper than a typewritten worksheet, and that paper costs may constitute the major part of total costs.

Science in the Press

A number of teachers and teacher educators build files of press clippings, conscious that there is a gap between the textbook and science in daily life, especially daily life in the Caribbean. A single copy of a press clipping, however, does not have much impact on a class of 30 or more children and in the Caribbean some thought has been given to ways in which they may be made available in quantity. Recognising also that teachers would welcome help about when such a resource could be best used, the 'Science in the Press' series was explored. A couple of sample booklets for children were prepared. These were made by pasting-up press clippings on a theme, together with questions which could prove useful for discussion, for examinations and tests, for assignments, and for thought. They included factual questions; questions to guide comprehension and criticism; open-ended questions on attitudes and social issues. It was made clear that the main resource was the press extracts, teachers being invited to use the questions and exercises provided or to design their own. The idea was that the region contains a rich potential of human expertise, and that kind of resource would make demands within the capabilities of almost any science-educator and the available material resources, and could contribute to regional co-operation. A regional planning meeting, at which constraints were faced, led to the following general decisions : any individual or group could design a booklet; preparation of paste-up would be carried out by colleagues within the country who had access to suitable equipment and expertise; reproduction on electronic stencils would be carried out by the local science teachers' association, where possible, and a set of the stencils would be sent to each of four reproduction centres in the Caribbean; from that point on, local decisions would be made about quantities, distribution and financing. It was agreed that a teacher would need at least one copy between two or three members of the class and would probably wish to acquire class sets for use from time to time. ASETT's decision, for example, has been to distribute single copies free with an invitation to interested teachers to purchase bulk sets at cost, which would range from approximately US $1 for five copies of a 12-page booklet to free if paper were to be donated by, for example, the Ministry of Education. Other issues discussed included the question of copyright; the possibility of enlisting the aid of the regional UWI/USAID Project and the Caribbean Examinations Council; and the ways in which CROASE might be associated with the scheme.

One of the most appealing features of the 'Science in the Press' venture is its simplicity. Any teacher in a few spare hours at home can design a booklet or half a booklet(a specimen text is shown in Appendix 6). The teacher's design is quickly turned into a set of electronic stencils. Distribution of stencils to colleagues in the Caribbean is complimentary, because of the reciprocal nature of the

enterprise, and local production is carried out in ways which suit the needs and resources of science-educators in the various countries.

In addition to the educational value of the booklets themselves, the series offers opportunities for co-operation within a country and regionally. One example is Technology, prepared by a teacher-educator in Jamaica and a teacher in Trinidad (who do not know each other), with the cover design from a fourth former. A dozen or so 12-page booklets have already been prepared or nearly prepared, and there appears to be no limit to the number expected in the future.

Other Printed Resources

In addition to printed resources for the classroom, there has, of course, been a large variety of reports, handbooks, notes for teachers, workshop manuals and similar materials not intended for large-scale circulation or long-term use. Such materials tend to drop out of sight rather more quickly than they deserve to, and it is probable that educators in the Commonwealth Caribbean are constantly reinventing the wheel.

Some more permanent, out-of-classroom, printed resources will be mentioned later.