Section 2

THE SCIENCE EQUIPMENT PRODUCTION UNIT: KENYA

Background

Primary education in Kenya is of seven years duration (standard one to standard seven) with the first four years being free. Education at this level covers a wide range of subjects including science and mathematics. Successful completion of primary education is marked by the award of a Certificate of Primary Education (CPE).

Secondary education takes place in Government-maintained schools, Harambee (self-help community) schools, or private schools. The private schools which are run by a person or organization (including religious societies) receive no assistance from the Government. Some Harambee schools receive Government help in the form of one or two teachers, and they may also obtain grants to help in the construction of classrooms, laboratories, and other school buildings. It is of interest to note that Harambee schools are gradually being phased out or being taken over as maintained schools by the Ministry of Education.

Entry into secondary schools is based on the performance of children at the CPE Examination. Entrants are generally those pupils with good marks who are at the same time able to pay fees, but scholarships and bursaries are available for very able pupils.

Secondary education is divided into two phases of four and two years' duration. At the end of the second year of the first phase of the basic secondary school course, there is an optional external examination which is normally taken by students in Harambee and private schools. This leads to the awards of the Kenya Junior Secondary Education Certificate. Students who successfully complete the four years of secondary schooling obtain the East African Certificate of Education (EACE)* which provides a basis for entry to the second phase of secondary education. The successful completion of these two years is marked by the award of the East African Advanced Certificate in Education (EAACE). This provides the basis for university selection.

Pre-service teacher education takes place in primary teacher training colleges, Kenya Science Teachers College (KSTC) and universities. There are three classes of teachers at the primary school level. Grade 3 teachers have pursued a two-year teacher training course after primary standard 7; Grade 2 teachers have completed a two-year teacher training course after secondary form

*To obtain a division 1 or 2 EACE, a candidate must obtain credit pass in maths and science.

2 or 4; and Grade 1 teachers have completed a two-year teacher training course after secondary form 4*. S1 teachers are lower secondary school teachers who after obtaining an EACE have pursued a three-year course at KSTC or who after obtaining an EAACE have completed a one-year course at KSTC. Senior secondary level teachers are normally expected to possess a university degree.

Table 1 gives some relevant educational statistics for the period 1972-76.

TABLE 1: SELECTED EDUCATIONAL STATISTICS: KENYA

	1972	1973	1974	1975	1976
Number of Primary Schools	6,657	6,932	8,000	8,049	8,500
Total Primary School Population	1,675,919	1,816,017	2,734,398	3,016,000	3,476,000
Number of Primary Teachers Colleges	17	17	17	17	17
Kenya Science Teachers College	1	1	1	1	1
Number of Polytechnics	2	2	2	2	2
Kenya Technical Teachers College	-	-	-	-	-
Number of Maintained and Assisted Secondary Schools	363	380	404	404	407
Number of Harambee and Private Secondary Schools	585	650	796	796	796
Number of Universities	1	1	2	2	2

Source: Ministry of Education Annual Report for 1972, 1973 and 1974
Unpublished data for 1975 and 1976

The Kenya Institute of Education (KIE)

As a result of a conference on educational institutes held under the aegis of the University of East Africa and the Ministries of Education in Kenya, Uganda and Tanzania, the KIE was established in April 1964. It was originally set up to administer a scheme of examinations on the behalf of the Kenya Ministry of Education and to act as a centre of professional activity for teachers. However, in 1968 it absorbed the former Curriculum Development and Research Centre (an amalgamation of the English Special Centre, the Mathematics Centre and the Nairobi Science Training Centre) and added to its list of duties the function of preparing educational materials.

*As from the 1976/77 academic year, all entrants to primary teacher training colleges must possess credit pass in maths and science in the EACE.

The work of the various sections of KIE is done through a system of subject panels. These panels consist of personnel drawn from the KIE, the Inspectorate Division of the Ministry of Education, the Kenya Science Teachers College (KSTC), the Education Department of the University of Nairobi and practising teachers.

The science panel played a central role in the development of the East African School Science Project, and has, since the early days of the Science Equipment Unit, provided professional advice to the work in the field of local production of equipment. Also, in addition to organizing in-service courses for teachers, the panel, from time to time, produces information sheets for schools, giving advice on science teaching materials. By mid-1975, over 500 publications had been produced by the KIE in conjunction with the Jomo Kenyatta Foundation, a non-profit making publishing organization.

The progress and evaluation of the materials produced are monitored by KIE. The necessary information is gathered through questionnaires, visits to schools, correspondence with the staff of teacher training colleges and at teachers' in-service courses.

All sections of the KIE are either broadcasting programmes to teachers and pupils or are planning to do so. The programmes in use and those envisaged are of three types: background materials for teachers, demonstration of how specific lessons should be taught, and specific help to teachers on how to teach individual lessons. It is hoped that increasing use of radio will be required as new materials are produced.

THE KENYA PRIMARY SCIENCE PROGRAMME

Overview

The Programme was initiated in the mid sixties. Aided by funds and personnel from the African Primary Science Programme (APSP), its first emphasis lay in the production of films and written materials. These materials were primarily in the form of guides for teachers, though a smaller number of science readers for children were also produced. Some 50 to 60 booklets, and five films, were produced, all of which received extensive fields trials in typical classroom situations.

Early on in the programme two subcentres for development were established, one at Kagumo Teachers College, and the other at Siriba Teachers College. Their basic purpose was to explore mechanisms for supporting teachers professionallly in primary schools. Both have subsequently been incorporated into the programme of Teachers Advisory Centres (TACs).

Recently the programme has produced a new set of Guidelines For Teaching Science in Primary Schools which will replace the former syllabus. These Guidelines outline the goals to be achieved through science education at each level in the primary school. The APSP booklets, as well as other materials, are referred to as resource materials to accompany the Guidelines. Research is being carried out to find suitable ways of evaluating the progress of children using the Guidelines. This includes consideration of the problem of writing questions for the primary school leaving examination which are both relevant to the new course and fair to the pupils and teachers in the schools.

Work is also going on which seeks to identify the most effective ways of giving professional support to personnel working in the field. In this connection KIE staff have co-operated closely with the Inspectorate in organizing workshops for Primary School Inspectors, TAC tutors and Assistant Education Officers. KIE staff also assist with in-service courses at the district level in an attempt to help to build up a core of local resource personnnel who can in turn assist in

the task of in-service training. Curriculum materials are being developed for use by students and tutors in teachers colleges. Finally, the staff of the Primary Science Section of KIE are from time to time making professional contribution to the primary science education programme at the University of Nairobi.

Aims and Approach

The Programme has three basic aims: namely to encourage and assist children to: (a) develop the manual and intellectual skills that are necessary to solve problems in a scientific way; (b) preserve and acquire the attitudes that are necessary to apply those skills effectively; and (c) acquire a deep understanding of the natural phenomena that take place in their environment. In order to achieve these aims, activities in the classroom are made to relate directly to the pupils' environment. This is accomplished by helping children first to acquire problem-solving skills and than to apply the skills in solving problems based on their immediate environment.

In recognition of some of the complexities of the intellectual and emotional development of chilren, three stages in the programme are given special attention in the development of programme materials. In the first stage - that is for the first three years of schooling - children are presented with a variety of opportunities to preserve, strengthen and develop those attitudes and skills which will enable them to approach and solve problems rationally and effectively. They are encouraged to continue to develop their natural curiosity and their willingness to explore and ask questions, and to gain as much direct experience as possible of their natural surroundings. During the two years that follow, children are introduced to the process of solving specific problems. However, the application of the process of scientific problem solving is at this stage restricted to relatively simple and concrete situations. Finally, in the last two years of primary school, the children carry out a series of investigations, each of which covers a range of scientific topics, concepts and skills that were previously treated as separate entities.

This attempt to integrate the various scientific disciplines and use them to solve problems represents a significant change from the former approach which mainly consisted of learning unrelated pieces of information and repeating them in an examination. Moreover, this unified approach tends to bring the pupils' classroom experiences closer in line with real-life situations they will meet in the future.

Materials Available

No equipment is provided specifically for teaching science in primary schools. Teachers therefore make much use of ordinary things around them in the environment. In addition, some general equipment provided to schools can be used for science teaching. This equipment is purchased through the Ministry of Education Kenya School Equipment Scheme. Purchase is via the tender system, and deliveries take place to a central warehouse in Nairobi. Distribution is then to divisional warehouses located in 39 districts and seven municipalities, where Divisional Education Officers arrange distribution to the individual schools. Equipment lists are supplied by the Ministry, and schools make out their own requirements which are sent to the appropriate District Education Officer who submits lists to the Ministry for action.

Written material for the whole seven years of primary school and for teachers colleges can be summarized as follows:

Lower primary (standards I, II, III). About a dozen booklets have been produced which give suggestions to teachers on how to create opportunities for young children to gain the kinds of experience envisaged in the programme. The titles of some of these booklets reflect the close relationship of the suggested activities with the natural surroundings of the children: Plants in The Classroom; Water; Dry Sand; Woodwork; Exploring The Local Community; Construction. In all these booklets suggestions are given about

using local materials that are available around typical primary schools. The use of locally available materials is important, not only in the name of economy and feasibility, but to help to prevent young children becoming alienated from their home community and background. Currently a group is at work preparing a guide to help teachers to use these booklets and other resource material in as integrated a style as possible. Additional materials are planned specifically for the transition period for children in standard three.

Middle primary (standards IV and V). The Guidelines Programme is introduced in Standard IV. Guidelines for standards IV and V have been prepared, and several reference units are being printed by the Jomo Kenyatta Foundation in 1976.

Upper primary (standards VI and VII). The first draft version of the Guidelines for Standard VI has been tested. The Guidelines and supporting resource books are being prepared to help teachers with such topics as people around us; the shamba; ourselves; and metals.

It is intended that the materials for Standard VII will follow a similar approach. However, the topics for investigation will be concerned with applied science and technology with the expectation that pupils will identify and solve problems of real and practical significance in areas such as agriculture, health and village technology.

Teachers Colleges are supplied with all the materials undergoing trial within the programme. In addition to the Guidelines and associated reference materials, a document called "Handbook for Teacher" has been developed as part of an international effort, sponsored by the Science Education programme for Africa. This Handbook has been designed specifically for use in teachers colleges to help prepare teachers in the effective implementation of new approach to primary science education. A further document "A Sourcebook For Tutors" is also being developed.

A number of films have been produced as part of APSP, both from Kenyan primary schools and from other African countries. These films have been found to be extremely useful when introducing the programme to teachers and other educators who have not yet experienced this kind of approach to science education.

SECONDARY SCHOOL SCIENCE

Science is taught in secondary schools either as general science or as physics, chemistry and biology. Because the separate subjects are generally regarded as bing academically superior, they tend to be more popular than general science.

In 1965, a move for reforms in secondary school science curricula in East Africa was initiated in Tanzania. Subsequently a series of conferences, held in Nairobi, Dar es Salaam and Kampala, led to the inauguration of the East Africa School Science Project (SSP) in 1966.

Originally the SSP aimed at adapting the Nuffield science materials for use in East Africa. Later, however, a more imaginative approach was adopted "to produce the right courses for the first four years of the secondary school programme".* By drawing upon the Nuffield project material as well as material from the UNESCO Pilot Project for Africa, subject panels in chemistry, physics, and biology were able to develop the required courses. Membership of these panels included university professors and lecturers, practising school

*SSP Physics Panel, SSP Physics: Introductory Statement, Dar es Salaam, April, 1970, p.3.

teachers, and representatives of the various Ministries of Education and the UNESCO Science Teaching Project for Africa.

The courses were first tested at the East African Certificate of Education level in 1970 (chemistry) and 1971 (biology and physics). They seek to promote in pupils, understanding, lively enquiry, and interest in science. Emphasis is placed on scientific concepts and principles, and on course content that has obvious relevance and interest to East African countries.

Materials developed for the SSP course include pupils' books, teachers' guides, background readers, filmstrips, film data book, photographs and other teaching and learning aids. It is noteworthy that the teachers' guides include, for the many teachers with limited qualifications and experience, advice on ways of introducing certain individual topics, on getting apparatus to work, on making-do with local resources when equipment fails to arrive on time, and on how to keep a whole class mentally active.

KENYA SCIENCE EQUIPMENT PRODUCTION UNIT (SEPU)

Background

In the early 60s almost all the science equipment used in schools in Kenya was imported from overseas. The high cost of apparatus precluded all but a small number of schools from buying the necessary quantity. Other problems were that imported equipment often failed to arrive on time, and that many items tended to be inappropriate to the conditions in Kenya.

With the growing interest in Kenya of science programmes such as Nuffield, SSP, and PSSC that emphasised individual student experimentation, the shortage of equipment became increasingly acute. Efforts therefore got underway to make cheap, readily-available equipment.

Two of these were unfortunately unsuccessful. The first of these was undertaken at a technically-biased secondary school - Starehe Boys Centre. Simple items of equipment suitable for the first year of the SSP course were produced. However, neither development work nor large-scale production was envisaged. The other was undertaken by the Engineering Faculty of the University of Nairobi where a few school science equipment items made from wood and metal were produced during a period of two summer vacations. The summer courses were aimed primarily at giving technical skills to the university's first year engineering students and to giving students in the faculty experience of production problems and planning.

Though efforts at these two production centres lapsed, it is hoped that in the near future the Faculty of Engineering will set up an Industrial Consultancy Unit similar to that based in the Engineering Faculty at the Universtiy of Science and Technology, Kumasi, Ghana.

Another venture, however, proved very successful. In establishing the Swedish-financed KSTC in 1965, the Agreement between the Kenyan and Swedish Governments made provision for setting up facilities for the production of science teaching materials and for running workshop courses. Three years later, KSTC accepted a Kenyan Government request to set up an Industrial Arts Department, and in March 1968 this Department began to run workshop courses for students. A small beginning was also made in the design and production of low-cost teaching materials for secondary schools. This early production effort was pioneered by the senior technical physicist, and the kit was therefore essentially a physics one. A special characteristic of this physics kit was that it was not linked with any particular teaching philosophy. In other words, the kit system was as such that it could be adapted easily to any of the "learning by doing" programmes mentioned above.

To make the efforts more successful, a production unit was set up within the College. It aimed at being both independent and economically self-supporting. A workshop occupying an area of 265m^2 was completed in 1970. Since then it has been expanded and it now occupies an area of 960m^2.

The principal machine tools supplied for the KSTC Production Unit are:

Metal Work: three lathes, one milling machine, one pillar drill, one band saw, one hack saw, two grinders, one oxyacetylene welding set, one arc welding set, one sheet metal roller, one manual guillotine, one bending machine.

Wood work: one circular saw, one band saw, one planer (3m), one thicknesser, one large belt sander, one spindle moulder, one bench mounted drill.

General: Compressor (a recent addition).

Science Equipment Production Unit Subscribers

Towards the end of 1971 a KSTC Policy decision led to the expansion of staff and the appointment of a full-time head of the Production Unit.

In 1972, a production unit Executive Committee was formed to help the understaffed unit in its management and design work. The five man committee comprised of the principal and administrative secretary of KSTC, the head of the unit (the SEPU Manager), a representative of the Kenya Institute of Education (KIE) and a representative of the Ministry of Education. The head of the unit left in July 1973, and due to difficulties with recruiting staff, the unit did not start functioning again until December 1973. During the period of closure, the unit was run as part of the Industrial Arts Department. In January 1975, SEPU became fully staffed and consequently the Committee was dissolved.

Currently SEPU is run as a company under a seven-man trusteeship. The trustees are the Director of Education, Ministry of Education; the Permanent Secretary, Ministry of Finance and Planning; the Kenya Science Teachers College; the Kenya Institute of Education; the National Council for Science and Technology, the Jomo Kenyatta Foundation; and the Kenya Technical Teachers College.

According to a Kenya/Sweden agreement signed in June 1976, the Swedish government will continue to provide financial aid and technical know-how to the company until 30 June 1979 when it is hoped that SEPU will be completely self-supporting.

Production Strategy

In developing the various items in the physics kit, no special strategy was adopted. However, to ensure economic viability and efficiency of the project the following approach has been followed, as far as possible, in the production of the chemistry and biology kits. To begin with, a list of the most acute apparatus needs of schools was produced by the Manager and the Designer in consultation with the chemistry and biology panels of the KIE. A questionnaire was used to probe the apparatus market prior to embarking on the development of the kits. It appears as Appendix 1 on page 26. The needs were then matched to the availability of raw materials, the amount of design work needed and the difficulty of production. At this stage an order of production priorities was agreed.

For each item the Designer produced one or more prototypes and calculated an order of magnitude cost. The costing procedure adopted was as follows: Cost of materials + 10%; cost of labour + 20%; running cost of machines + 40%. (The additions to the raw costs were to account for the cost of materials lying on shelf awaiting use

or of finished items awaiting sale, the higher salaries paid to supervising and development staff, sales costs, and the wear and tear of machines.)

When the prototype was ready, it was vetted by the Manager who then determined the size of the batch, taking into account the relevance of the item to current syllabuses and likely sales. The Designer prepared the jigs needed for production with the help of the Manager, and arranged the sequence in which operations should occur. Once production started, continuity and quality remained in the hands of the Manager. At various stages in the production of a batch, items were subjected to tests devised by the Manager and the Designer. Any items failing these tests were either reworked or thrown away. In the early stages of 1972, the initial failure rate was sometimes as high as 80% although the final wastage in a batch, after reworking, was usually of the order of 7%.*

Prices: Local versus imported items

Table 2 below shows the prices in K.Sh. of some of the SEPU physics items and those of imported equivalents as of August 1973:

TABLE 2: COMPARATIVE PRICES

Item	Local Price	Imported Price	Type of Design
A. C. tuner	45	160	Local
Dynamics trolley	90 (per pair)	165 (per pair)	Local
Wheatstone bridge	80	202	Conventional
3-d Kinetic model	85	430	Local
Ray optics kit (including cylindrical lenses)	53	110	Local
Optics lamps	30	84	Local

SEPU Science Kits

Kits have been developed to allow students to have experience in as much individual practical work as possible in physics, chemistry and biology.

The items contained in each kit are accompanied by materials for students and teachers written by teachers with teaching experience in Kenyan Schools. Recently these have been strengthened by slides and tapes supported by leaflets. Still more recently radio programmes have been prepared to support the biology kit.

Whereas formerly most items (including electrical meters and lenses) were imported and assembled as part of the kit system, now the majority of the items in the kits have been developed locally. Since the three spearate kits have certain items in common, schools are able to cut down costs by buying a box containing, say, a physics/chemistry kit.

The chemistry kit can be used to illustrate the usefulness of the kits in teaching. The basis of the kit is the pegboard stand. This is a board drilled with small holes at regular intervals and supported

*These details were obtained from J.M.S. Whittell's article "Local Production: Principles and Practice", in The School Science Review, June 1975, pp. 675-76.

stand by means of a special stainless steel clip. The clip has a base which can be fastened on a stand with a screw and nut, and its diameter can be adjusted to hold all the pieces of glassware from the thermometer up to the beaker. Compared to the more conventional retort stand, the pegboard is stable and light. Moreover it possesses many features which allow flexibility. For instance it is possible to mount apparatus anywhere on the stand and at the same time see where one piece of apparatus is in relation to one another. More important for work in chemistry, the apparatus can be mounted away from the stand when heating is required.

About 50% of the kit consists of items of glassware. These are bought mainly from local companies, most of which represent foreign firms. The Ministry of Education lists local companies in the Inspectorate Circular Letter No. INS/76/3 of 10 January 1976 as: Instrumentation Limited, Nairobi; Westco Limited, Nairobi; Howse and McGeorge Limited, Nairobi; E.T.: Monks & Company Limited, Nairobi; Anant Limited, Nairobi; Philip Harris Limited, Nairobi; Sciex (East Africa) Limited, Nairobi; Achelis Limited, Nairobi; Cross Chemist Limited, Kisumu; and Anpi Pharma, Nairobi.

A notable characteristic of the kit is that there is no bent glass tubing. When collecting a gas over water (an exercise that is done frequently) the gas is led into the collecting test-tube through flexible plastic tubing. This type of arrangement does away with the rather cumbersome process involving the use of beehive shelves, gas jars, and thistle funnels. Further, despite the standard nature of the glassware involved, each component of the kit has been designated to be compatible with as many other items in the kit as possible. Thus the rigid plastic tube used as the electrolysis cell can be converted into a drying chamber for gases. With many other items fulfilling more than one function, it is estimated that at least 100 simple experiments can be performed with the set of apparatus contained in the kit.

When not in use the apparatus can be stored in a plastic mould or inside a cardboard box but there is also a wooden box designed to store the apparatus of several kits.

In terms of the cost and approach, the kit has considerable advantages. However, a few problems have been noted in connection with its use. One of these is that the kit is relatively small and therefore not suitable for demonstration purposes. Another is that because many of the items in the kit are small, they are easily lost. Practical work has therefore to be carefully organized. A further problem is that although the chemicals required for the experiments are listed, they are not provided. It is hoped, however, that in the near future a "chemical kit" will be developed containing all the chemicals required for the experiments in the EACE Course. Finally, the pupils' sheets do not contain any reading materials other than that directly related to the experiments. Consequently pupils need additional support in the form of a text or other suitable background reading materials.

Production Figures and Sales

As early as 1972, it was found that sales promotion based on distribution leaflets alone was unlikely to prove successful. So a KSTC graduate who was then teaching in a secondary school was seconded by the Ministry of Education to SEPU and given responsibility for promoting sales and arranging demonstrations to schools. The result was immediate: during the first six months of this new appointment, sales were six times the estimated figure.*

*J.M.S. Whittell, op. cit. p.677.

Table 3 below shows numbers of kits that had been delivered to schools in Kenya up to April 1976.

TABLE 3: KITS DELIVERED TO SCHOOLS

Period	Physics	Chemistry	Biology
1969-1972	547		
Jan-Dec 1973	443		
Jan-Dec 1974	381	162	
Jan-Dec 1975	436	353	13
Jan-April 1976	159	152	112
TOTAL	1,966	667	125

Prices of kits as at 1 May 1976 are as shown in Appendix 2.

Future Plans

With the completion of the new building, plans are under way to make use of the increased storage facilities to buy chemicals in bulk and repack them in smaller packages for distribution to schools. Lecture room facilities in the new building will also allow SEPU to hold in-service courses for teachers in the use of the kits.

SEPU is considering the possibility of designing a special kit in science for primary schools, and hopes to begin exporting equipment in the near future. A detailed evaluation of the kits is expected to be carried out soon. It is hoped that, among other things, this evaluation will find out the extent to which the SEPU project has affected student attitudes to science and the style of science teaching in secondary schools in Kenya.

TEACHER ADVISORY CENTRES (TACs) IN KENYA

Following the establishment of the Primary School Inspectorate Service in 1969, it became clear that local centres were needed in various parts of the country where short courses could be provided for groups of teachers or individual teachers seeking advice or help. Thus in 1970, 20 Teacher Advisory Centres (TACs) were established and equipped with basic constructional tools for making audio-visual teaching aids, books and other printed materials for reference purposes.

There are at present 43 TACs of which eleven are situated in primary teacher training colleges, (these tend to be better equipped), 15 in primary schools, four in secondary schools, and twelve in other community centres. These TACs are distributed throughout the country with at least one in each of the 39 districts in the country. In addition there are sub-centres situated among a cluster of schools in an area where teachers can easily get together for a meeting.

Siting of TACs in teachers colleges allows college tutors and tutors of Centres to interact in pre-service and in-service courses. Again when residential in-service courses are held for practising teachers,

existing college facilities are an asset.

The Centres are currently manned by tutors who also work closely with a number of "example schools", usually to be found within a radious of 8 km of the Centre. In these schools the TAC tutor acts as a supervisor, encouraging teachers, assisting them to improve their competence, keeping a progress report of each teacher, and informing KIE of work in the field.

Teachers for the position of TAC tutor are carefully selected. Once appointed they collaborate with the area assistant primary school inspectors and principals of the primary teachers colleges where the Centres are situated. These personnel provide the Ministry of Education with a record and an evaluation of the tutors' work.

KENYA SCIENCE TEACHERS ASSOCIATION

The Kenya Science Teachers Association (KSTA) was inaugurated in Nairobi on 7 April 1952. The idea to establish a professional body of science teachers was conceived by a group of expatriate teachers who, being scattered all over the country, hoped that such a body would help promote communication among them.

The Association which is exempt from registration by the Registrar of Societies, exists (a) to promote good teaching of science at all levels of the educational system, and (b) to afford means of communication among members and also between the Association and other bodies. Membership is open to all teachers and any person interested in the teaching of science. Thus it includes primary and secondary school teachers, science student teachers, tutors of teacher training colleges, inspectors of science, and university lecturers and professors.

The Association enjoys good working relations with the Ministry of Education, the Kenya Institute of Education, Science Equipment Production Unit and other bodies. Its activities are restricted to matters concerning the teaching of science. These include organizing conferences, seminars, workshops and student science congresses, and publishing a journal. The student science congresses have been held at the national level since 1964 and continue to be popular. Of the many conferences dealing with various themes, one which deserves particular mention is the School Science Apparatus Conference held at the University of Nairobi in August 1973. The conference looked critically at the problems of equipping school science laboratories in Kenyan schools and explored ways of easing some of the frustration experienced by science teachers.

APPENDIX 1: QUESTIONNAIRE FOR PROBE OF APPARATUS MARKET

Part 1

1. Name of school:
2. Name of person to whom correspondence should be addressed:
3. Telephone number:
4. Type of school:
5. Number of pupils in school:
6. Level to which pupils are taught:
7. Number of parallel streams:
8. Are the following subjects taught separately? physics; chemistry; biology:
9. Is general science taught as well as, or instead of, above separate subjects?
10. Average number of pupils per class:

Part 2

11. How much money, if any, is spent at present on apparatus annually for (a) physical sciences? (separate into physics and chemistry, if possible) (b) biology sciences? (c) general science?
12. Are you interested in the samples of apparatus shown?
13. At the prices aksed, how much would you buy?
14. How much would you spend annually if told/shown what was available?
15. Is there any particular time of year when it is easier to buy apparatus because of availability of funds?
16. If there were an apparatus fair at some accessible centre once a year, would you (a) find it useful? (b) attend?
17. Could you, under any conditions, pay cash on delivery? If not, what period would be needed for payment?
18. Would you welcome, and use, a periodical pamphlet saying what apparatus is available and outlining its uses, and giving prices and availabilities?
19. For expensive apparatus which is beyond your financial reach, would you welcome the establishment of a pool of apparatus at some local centre from which you could borrow?
20. For the use of the pool outlined in 19, would you be willing to pay a small annual charge to cover the cost of maintenance?

Part 3

Comments and additional information:

APPENDIX 2: PRICE LIST

Kits	Shs.
1. One physics kit in one box	395.00

2.	Two physics kit in one box	745.00
3.	One chemistry kit in one box	295.00
4.	Two chemistry kit in one box	545.00
5.	One supplementary chemistry kit in one box	235.00
6.	One physics and one supplementary chemistry kit in one box	585.00
7.	One empty box	45.00
8.	Biology kit	210.00

Manuals

9.	Science kit manual	5.00
10.	Mechanics and general physics	5.50
11.	Heat	5.50
12.	Chemistry kit pupils sheet yr. I & II	10.00
13.	Chemistry kit pupils sheet yr. III & IV	8.00
14.	Chemistry kit teachers guide yr. I & II	10.00
15.	Chemistry kit teachers guide yr. III & IV	8.00
16.	Biology manual	8.00

Physics Slides

17.	High voltage electric fields	66.50
18.	Difference between sounds	66.50
19.	Electric charge and electrons	66.50
20.	Cassette tape for the physics slides	16.00

Chemistry Slides

21.	Making soap in Kenya	47.50
22.	Soda ash from Lake Magadi	47.50
23.	Making salt in Kenya	47.50

Biology Slides

24.	Sorting out living organisms	66.50
25.	Savannah ecosystem	47.50
26.	Man and nature	47.50

Geography Slides

27.	Physical geography slides	167.50

Others

28.	Friction drums	250.00
29.	Min-Max thermometer	40.00
30.	3-D Model	120.00
31.	Ammeter	110.00
32.	Voltmeter	110.00
33.	Galvanometer	110.00

34.	Meter bridge	120.00
35.	Trolley	80.00
36.	Timer	80.00
37.	Ticker tape	1.20
38.	Stroboscope	15.00
39.	Optic lamp	35.00
40.	Statistics board	25.00
41.	Wall thermometer	15.00
42.	Test-tube racks	13.00
43.	20 ml syringes	10.00
44.	50 ml syringes	15.00

*£1 = Shs. 14.50