LESSONS THROUGH THE AIR

R.P. HOARE

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MINISTRY OF OVERSEAS DEVELOPMENT
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LESSONS THROUGH THE AIR

Final Report of
The Commonwealth Educational
Television Project

R. P. HOARE

PREFACE

Each year the Overseas Development Administration (ODA) commissions a number of ex-post evaluation studies with two aims in mind; firstly, to assess the effectiveness of its aid activities and secondly, to learn lessons for improving the effectiveness of future aid activities.

This evaluation is one such study.

Evaluation studies are undertaken by individuals or by teams especially recruited for their particular knowledge with regard to the subject under study. Sometimes these teams will include personnel from ODA (increasingly teams are a mix of ODA and external personnel).

In all cases the reports and conclusions are attributable to the authors, who are finally responsible for their contents, and not to ODA.

Evaluation Unit
Manpower and Evaluation Department

FOREWORD

The important part that the mass media would play in education has long been recognised, but research into the best use that might be made of them in differing situations has lagged far behind.

At the 1964 Commonwealth Education Conference in Ottawa, the need was felt to investigate the possibilities of the media in the educational context of the developing countries. In the developed countries, educational broadcasting particularly was being used as enrichment to an already good lesson given by a competent teacher. But the main problem in the developing countires was, and still is, the chronic shortage of teachers, particularly in science and mathematics. Consideration was therefore given to the question of how far it was possible for the media to take the place of the teacher. Could television on its own, for instance, teach science to a class without the help of a teacher? Could teachers in developing countries be taught to meke progremmed learning programmes that could readily be understood in their own local schools?

Since little information was available, the only way to begin to answer these questions was to conduct experiments.

The United Kingdom offered to sponsor two pilot research projects in developing countries — one in direct teaching by television, and one in the training of teachers to write their own programmed learning programmes. Sierra Leone offered to help mount the first project in Freetown. Nigeria offered to co-operate on the second at Ibadan.

This report is concerned with the Sierra Leone pilot research project in direct teaching by television.

ACKNOWLEDGEMENTS

It is difficult to know where to start with the acknowledgements – perhaps with the students would be fairest. Not only did they work hard, but they showed great patience when reception conditions were difficult. Their monitors had considerable difficulties at such times, and the successful conclusion of the project was in no small way due to their efforts. The principals of the schools, also, were most co-operative and helpful.

I am most grateful to the Headmaster of Shrewsbury School, Mr. A. R. D. Wright, and the Governing Body for giving me leave of absence for two years to take part in the project. In Freetown I was appointed a Research Fellow in the Department of Education, Fourah Bay College, University of Sierra Leone. Its Acting Head of Department, Mr. Donald St. John Parsons, was made Director of the project, and carried this extra heavy responsibility without demur. He was very much involved and a frequent source of invaluable help and advice. The Principal, Dr. Davidson Nicol, and the Vice-Principal, Canon H. A. E. Sawyerr, also gave most useful support. Other members of the University assisted, particularly Dr. W. C. E. Young and Mr. Peter Scull.

At the Ministry of Education the project was most fortunate to have as the Principal Education Officer (Teaching Aids), Mrs. Olive Benjamin. Her help and advice were of great value. Many others at the Ministry were involved in one way or another and helped willingly.

Teaching the lessons on television was probably the most important job. Other teachers deserve credit as well, but the main burden fell on Mr. Arnold O'Brien. His industry, reliability and warm personality formed the prop on which this side of the project rested.

The responsibility for transmitting the lessons was borne by Mr. Abdul Khanu, the Acting General Manager and Chief Engineer of Sierra Leone Television. He and his staff in the Studio cooperated magnificently, and did far more than could reasonably be expected without complaint. Television production was in the experienced hands of Miss Caryl Doncaster.

Much of the administrative work in Freetown was done by the British High Commission, particularly Mr. N. MacPhee and his successor Mr. W. G. Doherty. The person most involved in Britain was Mr. A. D. Beaty, of the Ministry of Overseas Development. I am most grateful to them, and others in their offices who were involved. I am also much indebted, literally, to the Thomson Foundation and Mr. Tom Neil its Director, for they most generously covered my salary and expenses.

Two Peace Corps teachers, Jim Alexander and Ken Shewman, helped in setting tests, and Mr. R. D. Lambourne, of the School of Education, Birmingham University, kindly assisted in the analysis of the results.

Finally the willing services of many others involved, though perhaps only on the fringe of the project, must be mentioned. I trust they feel rewarded with its successful results.

R. P. Hoare.

CONTENTS

SUMMARY

For almost a year and a half students in five secondary schools in Freetown, Sierra Leone, received their entire instruction in General Science by television. In spite of troubles with poor reception at times, there was no significant difference in performance between these students and others in the same schools taught the same course by their normal teachers.

Part II of this report gives details of the methods used for lesson preparation and presentation. They seem to work well. The time taken in constructing a lesson was reduced to a minimum. Visual variety was maintained, and the concentration of the students was refreshed by drawing their attention away from the screen frequently. Class participation was encouraged, and written and oral responses and practical tasks in the classroom were introduced at regular intervals. Keenness and attention could thus be maintained throughout the lesson, and where reception conditions were good this continued throughout the project.

The results can be studied in Part III. Unsatisfactory conditions preclude much statistical analysis. Nevertheless it can fairly be concluded that in the schools where the conditions were best, even though they were still imperfect in many respects, the television students did just as well as they would have done had they been taught by their normal teacher.

If television is used in other developing countries for total teaching as a result of this experiment, conditions could be made much more satisfactory, particularly if these include adequate arrangements for the maintenance and repair of the sets. This and other suggestions are made in Part IV.

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PART I

THE HISTORY OF THE PROJECT

Its Origin

> *"We wish to record briefly our conviction of the great possibilities of the various forms of mass media, print, film, radio, tape recording, television, etc., for the education in developing countries of people who are unable to proceed for formal secondary school education. We think that these media, suitably adapted, constitute a means of providing further formal and informal education of great value. Furthermore, with shortage of skilled teachers in many countries, mass media may yet constitute the means of extending the services of one skilled teacher to a larger number of children at the same time."*

The Third Commonwealth Education Conference held in Ottawa in 1964 discussed the use of mass media in helping education in developing countries, and its conviction in their potentialities was expressed in the words above. But the possibilities were comparatively unexplored. Research into them had been very inadequate. How best could further research be undertaken?

The British Government offered to sponsor some pilot projects into the various media. This is the report of that which investigated the use of television, but others are taking place elsewhere to examine the effectiveness of different media. In each case Britain waited for requests from developing countries to act as hosts for the projects.

The Government of Sierra Leone asked for the educational television project to take place in Freetown, where a number of secondary schools lie within range of the television transmitter. The Ministries of Education and of Information and Broadcasting promised full support, and Fourah Bay College, University of Sierra Leone, agreed to be associated with the scheme, offering the active assistance of its Department of Education. Britain accepted this request, and agreed to bear the major proportion of the cost. Financial assistance was also offered by the Thomson Foundation.

So it was set up. Its terms of reference were to see how best television could help a developing country with a desperate shortage of skilled teachers. Some methods were already being tried elsewhere. With this new project a chance was given of trying others.

Background

Sierra Leone lies within 10° of the Equator on the coast of West Africa. Its climate is hot and moist; the annual rainfall is about 140 inches. It is approximately the size of Ireland, with a population of over two million.

Freetown, the capital, has a population of about 130,000, most of whom are Creoles. Overlooking the city is Fourah Bay College, University of Sierra Leone, which is the oldest centre for higher education in West Africa. Most of the English-speaking countries along the Guinea Coast have had many of their eminent men educated here.

In the Western Area, which includes Freetown and the peninsular on which it stands, there are 17 secondary schools, but less than half of these go above Vth form level. Comparatively speaking the Western Area is far better off for secondary schools than the rest of the country. It has been shown[1] that although less than 20% of Western Area children of secondary school age attend secondary school, the position in the Provinces is much worse than this. For instance less than 1% of the children attend secondary school in the Northern Province.

The shortage of schools and teachers is obvious to everyone connected with education in Freetown, and the difficulty of overcoming this shortage is of concern to them all. The project was welcome for this reason. Indeed the situation is worse than even those figures show, for of the existing teachers at least 40% are expatriate.[2] And when the qualifications of the teachers are taken into account, it is found that only 30% of the Science graduates in Freetown secondary schools are Sierra Leonean, and 91% of the non-graduates.[3]

Most of the schools, as with Fourah Bay College, were started by missionary societies. Perhaps because of this they remain internally very independent, even though they are now largely controlled by the Ministry of Education. The dates of school terms are controlled nationally, and appointments to the teaching staff need Ministry approval, 95% of the salaries being paid by the Ministry. However there is no inspection system at secondary level, and standards vary widely.

Nevertheless a certain measure of uniformity is imposed on the various schools by the examinations system. The students take the General Certificate of Education Ordinary Level of the West African Examinations Council and the Advanced Level of London. When the project began the W.A.E.C. ran a Third Form Examination at a lower standard than 'O' Level, but this was later cancelled.

Science Teaching

To many students, particularly perhaps from developing countries, Science is a strange subject, found only in books. It is a subject for hearing about, rather than seeing or investigating through experiments.

When the Research Fellow arrived in Freetown, it had been decided to teach General Science by television to students starting the second year at secondary school. He discussed with Science teachers of the schools concerned ways of covering the syllabus. He mentioned in passing that the big disadvantage television teaching would encounter would be the inability to supervise students doing practical work in the laboratories. However nearly all the teachers stated that their pupils did no practicals at all at this level. This is partly because of lack of apparatus. The schools are too short of money to buy enough of any item. Chemicals and other expendible items also are not easily available. In an early lesson monitors were asked to obtain some litmus paper, a little dilute acid, and a little dilute alkali In two of the six schools these were unobtainable.

One important point is that the students' homes just do not contain the scientific gadgets that Western children have Hardly any have television, and most children are not familiar with magnets, electric and heating appliances, mechanical devices or sciantific toys.

Science, then, can be for African students a textbook subject, sometimes having strange apparatus and phenomena described, rather than demonstrated, by foreign teachers. It is rarely an exciting study of the processes of life around them.

1 Young, Research Bulletin No 2 – See Bibliography. p.24.
2 Sleight, p.61.
3 Sawyerr, p 34.

Television System

The television station was opened in 1963, two years after Independence, and provides coverage of Freetown only. The technical facilities available include three vidicon studio cameras, two telecine cameras with provision for showing 16 millimetre film and 35 millimetre slides, and a main studio where the E.T.V. programmes were staged, of 2,500 square feet.

For this project, the station was in the capable hands of Mr. Abdul Khanu, fulfilling the role of both Chief Engineer and Acting General Manager. Due to the shortage of technical staff, Mr. Khanu being initially the only qualified engineer at the station, and the practical difficulties encountered in obtaining vital components to keep the service on the air, the burden of an extra three hours output per week of live educational programming placed an almost unbearable strain on the service.

There were many other problems. Two political coups took place during the eighteen months. Yet in spite of fears and uncertainties, the E.T.V. project ran its appointed course and was completed according to programme in May 1968.

Early Progress in the Project

By the middle of 1966 two technical assistants had been recruited in Britain for the project. In May, officials from Britain flew to Freetown to consult representatives of the Sierra Leone Government, and the general form of the project was mapped out. Among the decisions made were:

1. The subject taught should be General Science at Form II level of Secondary School.
2. The television lessons would be based on the Ministry of Education General Science Syllabus for the Form III Examination.
3. The transmissions should begin in January 1967 and continue for four or five terms with the same students, even after they had moved up to Form III.
4. At least four lessons should be transmitted weekly, each short enough to allow time for appropriate pre- and post-broadcast work in the classroom.
5. No trained Science teacher should be present in the classroom -- this was part of the purpose of the experiment.

The constitution of the Advisory Committee and an outline timetable for the project were also agreed. The question of local costs to be borne by the Sierra Leone Government was also raised, and the technical facilities of Sierra Leone Television. It had been hoped that three teachers would be released full-time for the project, but this was clearly out of the question when the local shortage of trained Science teachers was seen. It would not even be possible to send teachers to a course at the Centre for Educational Television Overseas in London, and instead of this a course in the studios was arranged, an officer from C.E.T.O. being released to fly out to help run it.

Training Course

This training course was held in August lasting eight days. Twelve teachers completed it, two having dropped out. On the course, the teachers learnt the grammar of television and had studio practice. They wrote and presented 10-minute scripts. And they enjoyed it.

However certain difficulties were pointed out which needed careful thought, the main one being the time factor. A 10-minute script took two teachers half a day to write. To put on even four 20-minute lessons a week, several teachers would need to be full-time.

The Research Fellow's arrival in Freetown was delayed until the end of September. The report of the training course was therefore considered by a meeting held at Fourah Bay College. The difficulties were appreciated, but at that stage nothing could be done. A decision was made, however, that there should be four lessons weekly, each of 20-minutes.

In practice, only one of the teachers on the course became a regular teacher throughout the project. There were several reasons for this, mostly to do with the selection of candidates for the course. When the Principals had been asked to select teachers for the course, they had acted in different ways. In some cases they had put up a general notice in the Staff Room asking for volunteers, and had then selected their own choice among the volunteers. In other cases they had only mentioned the chance to particular teachers. On what grounds the Principals selected it is difficult to be certain, but one can say that no principal was likely to suggest his best Science teacher if there was a danger of losing him full-time. In one case at any rate a Principal chose one man "as he seems to have no outside interest," which is not an ideal basis. One Principal chose two very good men, but then in November found it impossible to release them even for one morning a week. He had thought that the teacher would have needed only an hour or so to drive to the Studio, teach a normal lesson and drive back again, and that was that.

Such, then, were the ways in which the teachers were chosen. The Principals cannot be blamed for this. The idea of teaching by television was vague in their minds and untried, and at that time there was a chance the project might not be able to start for lack of money.

Total Teaching or Enrichment

The decision had to be made how the television was to be used. In Freetown education officials were obviously thinking of enrichment inserts, a teacher in the classroom doing pre- and post-broadcast work. Yet the teacher was to be a non-Scientist. Was this possible?

These two conditions appeared contradictory. Either one had to have scientists in the classrooms whose knowledge and techniques would be improved by taking part in the project and watching the inserts, or one had non-Scientists, and taught entirely from the screen.

Which was it to be – total teaching or enrichment inserts?

Freetown had many good Science teachers in the schools. Enrichment inserts would enable them to improve their own techniques, would make less demand on timetable adjustment, and would be easier. But was the project really meant for Freetown ultimately? The students there were not the ones in the Ottawa Report "unable to proceed for formal secondary school education". Also, it had to be remembered that there were ten or eleven other educational television schemes going in Africa already, all of them using enrichment inserts with the teacher in the classroom doing pre- and post-broadcast work.

So in fact it was decided to try total teaching. It would be a straightforward attempt to see if television could replace the teacher. Many felt it would be impossible and nearly all thought that it would be undesireble. A report on the XIth UNESCO General Conference, for instance, states:

> *"As for the replacement of teachers, the experts are for the moment categorical: the introduction of audio-visual aids in no way reduces the importance of the teacher. Delegates from widely different countries who met to study the new teaching aids and techniques, among others, at a conference organised by UNESCO in March, 1962, were unanimous in this respect."*

One delegation went further, stating:

> *"In our view, the education and instruction of the rising generation cannot be reduced to the mechanical transmission of knowledge, habits, skills and standards of*

behaviour. It is a complex, many-sided process, and the teacher is its keystone. Technical media are but instruments in his hand, making him better able to influence the child's mind. The potentialities of technical media as such are limited. As we see it, therefore, there can be no question of replacing the teacher by a robot instructor through the use of television or cybernetics." [1]

Yet was the aim really to replace the teacher? It was certainly not to displace an existing teacher. It was, however, to take the place of a non-existent one. No claim was made that teaching by television is as good as the skilled teacher. It was felt simply that this approach, if shown capable of covering a complete course almost as effectively as a normal teacher, was very much better than having no teacher at all. And having no teacher at all is the lot of the vast majority of African children.

The More Detailed Plan

The Research Fellow arrived in Freetown on September 18th, and soon after arrival was able to put the following points to the Committee of Principals, Ministry of Education officials, and teachers affected:

1. Since the aim was to see if, using television for direct teaching, the shortage of Science teachers could be alleviated, the fact that no Science teacher at all should be allowed in the form-room was an essential condition. In any case, if Science teachers saw the programme, their teaching of the control classes would be affected, and also they might be tempted to switch off, assuming that they could teach better anyway.

   However there must be a teacher in the classroom to maintain discipline, collect and mark work, and set out apparatus. He must be a non-Scientist, called in future a Monitor.

2. Since the Monitor would not be capable of directing discussion or answering questions arising out of the television programme, all 40 minutes of the lesson must be directed from the screen.

3. The television teacher would not be a "talking face" at any time for more than five or ten minutes at the most. To maintain concentration the classes would, under his instructions, write notes, do simple practical work, do an exercise or answer questions orally, as frequently as possible during the lesson.

4. One stream from each school taking part would be taught by television, other streams being taught in the usual way by their normal teachers as control classes. The textbook for the television classes would be standardised, but control classes would continue with their customary ones.

5. Before each lesson the monitor would receive the following duplicated information:
   (a) what pages in the text book the programme aimed to cover,
   (b) what to do if reception were inadequate,
   (c) what apparatus to put out and when,
   (d) what homework would be set by the television teacher and how to correct it.

6. Homework and test questions would be of the objective type so that non-Scientists could correct them speedily and accurately.

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1 Cerych, pages 143-4.

7. Three full-time television teachers would be required. One would be for Physics, one Chemistry and one Biology. Usually they would appear on successive days in that order, so that at least two days would elapse between adjacent lessons by any of the teachers. There would be continuity for the children with the same face continuing the same topic. Some attempt at showing the interaction of the separate Sciences in General Science might be attempted in the revision period; for instance, when all three teachers might be revising allied topics on the same programme.

8. Each of these teachers would be responsible, with the Research Fellow's help, for preparing his lesson, aids, apparatus, objective tests and monitors' notes. He would rehearse for two hours on the morning of the broadcast. Lessons would not be scripted exactly; the teacher would work from brief notes showing the sequence of lessons, cues, aids and so on.

9. With only one of the teachers transmitting each morning, the other two and the Research Fellow would be free to visit schools to watch the lessons. They would be able to see the pupils' reactions, and which parts of the lessons were most effective. Each teacher would be able to relate his lesson to what the others had done. The team-spirit and mutual criticism resulting would help the teachers to improve rapidly. It would also mean that there would be no need for monitors to fill in postcards giving comment on reception, lesson content and so on. Feedback would be collected by the Research Fellow and the television teachers in the class.

10. Since the aim was to see if television could be used to teach where no teacher was present, the Research Fellow suggested that it would be an interesting adjunct to the experiment, and of considerable importance to public relations, if citizens of Freetown were invited to take part in the experiment. They could view in their own homes, or at public viewing centres, and the relevant paper-work would be supplied to them. They could then take the Form III examination after the course with the pupils.

That was the plan. The students would receive their entire instruction from the television screen. The monitor present should not instruct, but he should correct their work. The presence of a literate adult was assumed, therefore, but that was all. Indeed, if the student were strong-minded and did the work before looking up the answers, not even a literate adult would be necessary: only the "canned" lesson on television or film, and the corresponding paperwork.

This plan was accepted by the Committee unchanged. Three great difficulties lay before its implementation.

The first was obtaining the teachers for a reasonable time. The second was that if all 40-minutes were to be controlled from the screen, schools would have to adjust their timetables so that one lesson matched exactly. Lastly, was the television system reliable enough, and if not how could it be improved?

Supply of Teachers

Twelve teachers had finished the training course. The best five of these were recommended, and soon after the Research Fellow's arrival these five wrote specimen lessons, practised them and recorded them on the videotape recording machine.

While this was happening, negotiations were carried on with their Principals on their availability, and it took very little time to discover that the teachers could only with difficulty be released at all.

Certainly it was impossible for them to be released for a good proportion of the teaching week to work with the project.

Some desperate re-thinking was necessary. Any chance of having fully scripted lessons was out of the question. A method of keeping impromptu speech, yet with exact cues for aids or changes of emphasis was devised. This was transferring a lesson as simply as possible from the formroom to the studio, yet incorporating some of the inherent advantages of television in the form of aids. Even so the minimum requirement in time for the teacher was one morning for writing and preparation, and one for rehearsal and transmission. It was desirable that each teacher should be free from 11 – 12.15 on each of the other transmission mornings, to travel to a school to watch reception of a programme.

These requirements could not be met. The teachers could not be spared for anything like that long. Three might have been spared for barely one morning, but not definitely, so the project was left, in early November, with one teacher for five mornings and one for two mornings a week. They were the sole survivors of the training course.

There was no biologist. Eventually one was located in the Prince of Wales School, (which was not participating in the project), and her Principal generously agreed to release her for one morning a week, assuming she would give up free Saturday mornings for writing the lessons.

She wrote one lesson, and rehearsed it once. She recorded it on the VTR, and saw it. This was the sum of the training she had. Nevertheless she was from the beginning extremely popular with the classes and effective with her instruction. Another teacher who joined after one term had no more training, and started off very well too. Indeed from years of instructing in front of classes, most teachers have become used to having an audience, and the transition to an invisible, inaudible one is not too great. Imagination is needed, and methods must be altered, but once the business of looking at the camera, obeying signs and other simple studio techniques are learnt, it would seem that an effective teacher should be able to operate successfully on television.

In spite of what has been said, it is certainly not felt that training is unnecessary. Although a good teacher with little training is better than a bad teacher with a thorough training, a good teacher thoroughly trained is clearly the best solution.

Adjustment of Timetable

It had been expected that the difficulty of obtaining some timetable uniformity among the schools taking part would prove almost insuperable.[1] It was asking a great deal to suggest to Principals of participating schools that one of their classes must operate for an exact time at a definite hour for four days a week. Some of the schools had periods of 35 minutes, some of 40, and none coincided exactly.

Yet, surprisingly, this difficulty was one of the smallest. From the beginning the Principals showed astonishing flexibility and helpfulness in this matter, and none of them complained about the complications this request caused. Perhaps they realised how difficult the supply of teachers for television was proving, in which they felt themselves unable to help much, and they were willing to go to great lengths to compensate on the second issue.

Other Activities

The timetable was not the only item to be co-ordinated between schools.

The Form III examination, set and marked by the West African Examinations Council, was taken by pupils after three years study. The syllabus can be seen in Appendix A. This examination gave those

1 cf. Warblington, page 39,40.

who passed it their one academic qualification if they failed to gain 'O' level. To have deviated from the lines laid down might have handicapped the children taking part in the experiment when it came to the examination, and this had to be avoided. The syllabus had to be accepted as it stood.

But it was a syllabus for a three year course, and more than one year of it had been covered already by the schools. No one had asked the schools to cover the same topics in the first year. They had all gone their own ways. Each school was asked to send details of those parts they felt they had covered. The parts by no means matched. The only way to deal with this situation was to select the parts which had been done by most classes, and ask all the teachers to cover all of these by the end of the first term of the second year. The remainder of the syllabus was then split into specific items for each of the terms of the project.

The agreement of the Science teachers had to be sought for this and they were asked to come to discuss the matter after school one day. About a third of them arrived, and all were very co-operative, agreeing to follow the lines laid down to the best of their ability. Details were then sent to the others as well.

Liaison with the schools took a considerable amount of time, particularly when thirteen were hoping to participate. When it proved impossible to obtain the television teachers for the minimum time requested, it seemed advisable to cut down the number of schools taking part, for a journey round them could take two hours travelling. Also, because of the short time the television teachers were free, the Research Fellow would be the only person available for visiting during the transmissions. Thirteen schools meant it would be more than three weeks between successive visits to any one school. The number had to be cut down, to six at the most.

The six chosen to participate were:

Annie Walsh Memorial School
Albert Academy
Freetown Secondary School for Girls, (F.S.S.G.)
Government Secondary Technical School
Methodist Girls' High School, (M.G.H.S.)
West African Methodist Collegiate School.

All of them had three streams which could take part, the middle one being taught by television. Also they were all fairly easy to reach except Annie Walsh School, which lies beyond the centre of Freetown from the Studio.

In November some trial lessons were sent to specimen classes and the reactions of the children studied. Their participation when asked for written or oral answers was most encouraging.

By December the details were practically fixed, and all the students sat a pre-test. It was in the style of the Form III examination to be used as the post-test, with an objective section to begin with, and a shorter essay part at the end. The standard of knowledge was not high, but then the children were learning in a basically foreign language, which was particularly obvious when they tried to spell words like "photosynthesis"! The students had initiative, however. One, asked to give three examples of living things followed by three of non-living, said:

"Human being, animal and plant.

"Dead human being, dead animal and dead plant."

Several, asked to name four elements, put "Earth, Air, Fire and Water", which would indicate a good classical basis to their education.

Transmission and Reception

While lessons were being written and practised, attention was also given to the problems of television transmission and reception.

For the schools, television sets were supplied by Britain. Maintenance of the sets, however, was to prove a problem throughout the project, great difficulty being experienced in obtaining locally the services of a competent receiver maintenance engineer.

At the end of October, Mr. Philip Cohen, Technical Advisor of Thomson Television International, came out to assess the equipment requirements, to ensure that the reliability of the service be maintained despite the additional programme loading. On his recommendations, extra equipment and spares were made available to the service and financed by the British Government.

Reception difficulties were in the main due to picture interference from sources such as motor vehicle interference. Suppressors are not compulsory in Sierra Leone and schools close to roads, had "snowstorms" on their screens with each lorry that passed. Interference from other radio transmitters had to be tracked down and minimised with the co-operation of the appropriate authorities. Receivers also suffered from the heat and humidity, the insulation in the transformers being vulnerable to these conditions. In U.S. Samoa the problem has been solved by leaving sets switched on permanently and merely turning down the sound and brightness controls.[1] The current still flowing keeps the cabinets warm and dry. Unfortunately this answer was not discovered for the Freetown project, and, particularly after the rainy season holiday, a lot of trouble occurred in the sets.

When the transmissions are occasionally faulty and the level of contrast, brightness and volume not constant as transmitted, set adjustment can be made extremely difficult. A receiver engineer who attends, may blame all faults on the transmission and this is not necessarily true. Even if it can be proved that the set and not the transmission is at fault, the spare part may not be available.

Shortly after the trial lessons were transmitted in November the shortage of skilled staff in the Studios became apparent. Because of sickness the Station had to close down altogether for five weeks, and no rehearsals or practice transmissions were possible. Not until the week before the lessons were due to begin did it come on the air again, and only two rehearsals in the Studio were possible then.

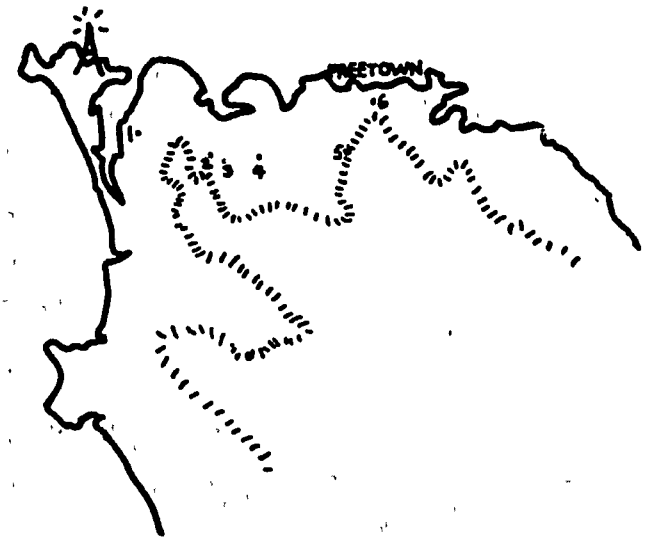
There were many worries, therefore, when the first lesson was transmitted on January 9th, 1967, the day planned.

The Participating Schools

The viewing conditions at the six schools were less than ideal. The sets installed were Bush 23" ones, but only one was in each classroom and the size of the classes varied between 28 and 43. In most cases a normal form-room was available. But in one school, Collegiate, there was only a laboratory, and stools had to be arranged on the far side of each of the practical benches for watching. In several cases it was difficult to raise the set high enough, and the crowded conditions in the classrooms meant the nearest students were only five feet or so from the set. Blacking out presented problems. The high temperatures meant that it became very stuffy indeed if the windows were covered with curtains or shutters. Some of the rooms had louvre windows, and painting these black could allow partial ventilation without letting in too much light, but in other cases the viewing conditions suffered as the draught was so essential.

From the viewing point of view the best school was Secondary Technical, for the seats were sloping and everyone could see the set clearly although there were 38 in the class. M.G.H.S. was also good, and then Albert Academy. F.S.S.G. had a very crowded classroom, and a lot of noise from outside, apart from frequent power failures. Annie Walsh had poor blacking out, unsatisfactory seating accom-

1 Educational Television International, March 1968, p.6.



Television Transmitter on Aberdeen Point

1. W.A.M. Collegiate School
2. Methodist Girls' High School (M.G.H.S.)
3. Government Secondary Technical School
4. Freetown Secondary School for Girls (F.S.S.G.)
5. Albert Academy
6. Annie Walsh Memorial School

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modation, and poor reception because of its distance from the transmitter and position. Collegiate had poor seating and virtually no black-out at all; the curtains which were provided repeatedly collapsed and were discarded.

The conditions, then, were not entirely satisfactory. Yet the difficulties caused by reflection of windows, uncomfortable stools, crowded conditions and distance from the screen, were largely ignored by the students. So, too, were troubles with reception caused by interference. They seemed fascinated with this new medium and keen to give it every chance to succeed. Their patience and tolerance were far greater than could have been expected

The hope that it would be possible to have a public viewing station where citizens of Freetown could follow the course was not fulfilled. Plans for publicising the project and offering viewing facilities for outsiders had to be held in reserve until too late. It was not certain that the first transmission would take place until the morning when it was due. However it did take place, and went without a hitch.

The course of the project

What can one say in retrospect? Looking back at the day-to-day records once transmissions began, most days had complications. Interference troubles, power cuts, set failure, lack of materials, troubles with personnel, shortages of money, these and other items come up time and again. Take for granted then the day-to-day frustrations a pilot project of this sort in the Tropics involves. One must expect them and live with them, and the hope is that the lessons learnt and recorded here will enable other countries setting up similar schemes to have a much smoother passage.

The beginning was extremely difficult. There was a very great deal to do actually getting things started. When the officials visited the schools, saw the effectiveness of the teaching and the enthusiasm of the pupils, good support was given And with experience things became much easier.

There was no doubt at all that the students enjoyed the lessons, and learnt a lot from them, when conditions allowed. But whether their enthusiasm would be sustained in view of the poor reception conditions remained to be seen. The first ten weeks of the first term, for instance, should have had 38 lessons transmitted. Three of these were eliminated completely, one because of a power cut at the transmitter and two because over-heating in the Studio equipment caused such distortion that all schools turned off. No school had a perfect record for the remeining 35 lessons. The best was Albert Academy, which had troubles for only five of them. But F.S.S.G. had no reception at all on another twelve days and poor reception for fifteen more. That means that only 8 of the 38 lessons were reasonably good. Hardly a fair test.

When there was no reception in a school, students studied work sheets, as will be explained later. If told beforehand a school was having trouble, the Research Fellow delivered the lessons exactly as it was being done on television.

In spite of these difficulties the children did not become bored and give up. Indeed at M.G.H.S. the mid-term break occurred on a day when a lesson was transmitted. It was agreed that any girl who wished to come to the school to view the lesson might do so. When the teacher entered the classroom at the time for transmission, every single girl was sitting in her place, and many had come quite a long way.

Due to the 1967 coup, the last planned week of transmissions that term did not take place, nor were control classes taught. However when they did go back just before their holidays, they sat a test paper and the results of it were much more promising than had been feared, and an attitude test showed that the enthusiasm was still there.

The second term went better. The one worrying item was that the public Form III examination was cancelled on economic grounds. This was to have been the Final Test of the project, and without it schools might have been tempted to leave the syllabus and go their own ways. However the principals met and discussed this point, agreed to continue with the syllabus for one more year, and if possible to use the test as a promotion examination to maintain its importance in the minds of the students.

Now came the end of the school year. Those successful in end-of-term examinations were promoted from Form II to Form III. Although streams were altered for other subjects they had to remain the same for General Science. It was only at this stage that the Research Fellow discovered that normally only one stream at M.G.H.S. continues with General Science at Form III level, and two at F.S.S.G. The other streams took Commercial Subjects. At M.G.H.S. it was agreed that the second stream could continue studying General Science by television to stay in the project. However Annie Walsh Memorial School had to drop out because of administrative and staff difficulties. The small number of girls who would have remained in their former streams were not worth the trouble they would have caused. Reception at the school had been very poor from the start because of its position, and the viewing conditions had been very poor in both rooms tried. So it was agreed they should opt out. It should be mentioned that in tests up to then the television stream had done at least as well as the others.

The next term had its crises. One of the three television teachers left to become principal of a school in the provinces with only three days notice. Another teacher, Mr. Arnold O'Brien, took over her work as well as his own, and had to teach three of the four lessons weekly. Then reception troubles became worse. Eventually a more competent Lebanese engineer took over receiver maintenance, but his English was as non-existent as the Research Fellow's Arabic. However ardent gesticulation usually achieved its purpose in time, and reception improved.

But the transmission side was deteriorating. In the Studio the lights had been failing and no replacements were available. To provide additional illumination two spotlights on stands were installed in January, but they shone at the teacher at eye level and were rather blinding. There were complications at the transmitter too, and its effective power was down to about 20 watts.

Matters were really bad for the first three weeks of the last full term, but then came an improvement. One of the main sources of interference altered its frequency slightly. Some spares arrived. Finally Mr. Keith Dunford arrived as television engineer attached to the project. He was able to improve reception by siting the aerials properly and adjusting the sets, and he also made the transmitter more effective.

The Final Test was set by the West African Examinations Council, and marked by them. It was fixed for the schools to take it on April 29th, and there were four days, April 22nd – 25th, for final transmissions just after the beginning of term. But on the night of April 17th there was another coup. The last week's transmissions were understandably not to full classes, though schools did operate. Doubts arose as to whether a sufficient number of students would sit the Final Test, but in fact nearly all did.

And then only the winding-up was left to be done.

PART II

THE METHODS USED

Total Teaching

This project was of course not the first to attempt total teaching by television. In Italy it has been done for years, and many other countries have tried it, for instance Peru and Algeria. But "total teaching" has not always been 'total'. Personal contact with teachers has been introduced by residential week-ends, or by telephone, or by correspondence. Every case is different, and the various problems that arise bring diverse solutions. As far as is known, this was the first project to teach entirely an academic course in Science, at secondary school level, for a prolonged period of time. What then were the problems, and how were they tackled?

When considering using a mass medium like television for the entire teaching of a Science course to secondary school students, even granted that difficulties over time-tabling can be met, two snags are immediately apparent. The first difficulty is that of maintaining concentration over forty minutes, the second that of correcting the students' work with no scientist present in the class-room.

How can concentration be maintained?

A student in a normal classroom does not concentrate on the teacher every minute of the lesson. His attention moves from the teacher to the room, the apparatus on the bench, or even out of the window! If he were forced to watch the teacher the whole time he would soon get tired. But then the teacher does not expect it. The teacher himself can only look at one student at a time.

Not so the television teacher. When he looks at the camera he looks directly at every one of his students, and they feel a compulsion to look back at him. Twenty minutes of concentrating on the screen is more than enough, and many have noted the way that concentration drops at about that time if not earlier.

To maintain attention when controlling the lesson for forty minutes attention must obviously be directed away from the screen at regular and frequent intervals for concentration to be refreshed. This could only be done by letting the students participate in some way in their classrooms – do a practical experiment or write an answer on paper – before returning their gaze to the screen. Would this be possible?

According to Russian experience it would be unwise:

"Educational television programmes in which the pupils themselves take part, replying to questions asked by the teacher-announcer, should be organised with due discretion and should not become the accepted rule." [1]

We wanted to make it the accepted rule. In Warblington it had been found that:

"Mathematics lessons of up to 40 minutes, containing time for exercises and questions, can be successfully presented." [2]

This was much more hopeful. Experience at Hagerstown, Maryland, was also encouraging:

"There is a prevalent notion that television leads to passivity of viewing and listening. Skillful development of methods adapted to television have led, however, to exactly the

1 Cassirer, pages 232, 233.
2 Warblington, page 46.

opposite result. The music teacher will address the children, ask them to sing along with her, to beat the rhythm, play simple instruments or even dance or march to music. Under the supervision and encouragement of the classroom teacher, children respond enthusiastically and the classroom is transformed into a group of singing, drumming and dancing children without the need for a piano or other musical instrument." [1]

Would Sierra Leonean children respond enthusiastically? Perhaps they would. They are more used to giving answers in unison to a teacher, and repeating after teachers, as one hears when passing the windows of a school, and if this is true for a teacher in the flesh why not a teacher on the screen?

This, then, was the aim in keeping concentration. As often as possible the attention of the students should be directed away from the screen, usually for written or practical work. Classroom participation of all sorts should always be encouraged, including oral responses to the screen.

As for correction, with non-Scientists in the form-room there was only one solution. All questions asked must be of objective type, so that with an answer sheet any literate adult could mark the student's work, even if he had no idea of its meaning.

Lesson Construction

The shortage of teacher-time available eliminated any hope of scripting each lesson exactly. For a good University television lecture as much as 200 man-hours of work might be required in the United States of America[2], while a normal ½ hour televised school lesson of elementary school science was estimated to take 91 man-hours, 22 by the teacher[3]. In our case the teacher had only one morning for preparation.

Yet lessons could suffer from being exactly scripted. Mr. G. A. Richardson said of Hagerstown:

"It was observed that many of the programmes were well prepared, but the teaching was impaired by too great an attention to the script, resulting on occasions in a carefully rehearsed talk being presented too rapidly in a monotone. The most successful programmes were those where the teacher brought to the television camera and microphone his own well tried mode of exposition." [4]

But his own well tried mode of exposition needs adaptation if advantage is to be taken of the aids and methods of television The teacher can no longer instruct entirely impromptu, for others work with him in the Studio. He is no longer a one-man band. The Director and Cameramen must know what he is doing and will be doing, so exact cues are needed every time e change of emphasis is required or an aid has to be introduced How can these cues be incorporated?

Now for teaching in school the teacher often has notes of some sort in front of him. They are usually exceedingly brief. They do however help him to follow the line of argument and bring in every example he wishes to mention They are often only a list of headings, to be clothed with his own words in the lesson, but numerical examples or laws and definitions occasionally are written in full.

The clothing with words constitutes his own well-tried mode of exposition, and it is more effective by far than a script, as those who have heard lessons read by a teacher who writes them out in full can testify. The unscripted, impromptu speech is more genuine, and the search for a word, when none comes immediately, can often compel attention by a short pause in a way that a well rehearsed script cannot.

Now about the headings in front of him: if he inserts among them the twenty or twenty-five exact cues needed for the director, he will make his notes unwieldy. The flow will be interrupted as he searches for the place, and he will look down at his notes taking his eyes off every one of his students. The whole effect would be spoilt

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1 Cassirer, page 32
2 Brynmor Jones, page 12
3 Diamond, page 45.
4 Warblington, page 14.

The solution to this problem lies in the splitting of the notes into very small sections, so that the way cannot be lost. In fact the method devised at Freetown splits it so much that the lesson, instead of being crammed on one piece of paper, is constructed on a series of postcards, a new postcard being used whenever the emphasis is changed.

At the top of each card it tells the teacher what the camera is viewing. In the middle are the headings he needs to follow, as in his normal lesson notes, and at the bottom the cue for the director.

An example will explain this best. The first card after the introduction for a lesson on convection of heat might read:

TEACHER AND BLACKBOARD

Greetings
Homework tasks

Now we will see another way heat can be transferred.

When he is cued in at the blackboard he says "Good morning, class" and pauses for the students to return the greeting.

He may then continue "Last time we studied the conduction of heat. Do you remember the homework? (Pause for "Yes" or "No".) There were two experiments you were told to do. In the first....."

And so on. Questions are brought in frequently, and pauses left for the answers. When the homework is dealt with, a quick glance at the bottom of the card tells him at once the cue words at the bottom:

"Now we will see another way heat can be transferred."

The light above the camera directed at him goes off. He puts aside this card revealing the next:

EXPERIMENT

Beaker being heated on one side
Crystals of potassium permanganate dropped in
Diagram A on Lesson Sheet

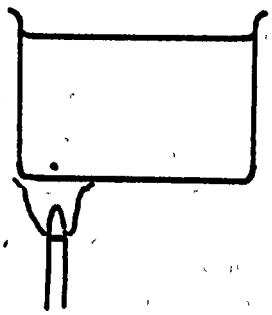
Draw arrows showing how the colour moves

The camera is now on the experiment. A beaker full of water is being heated on one side by a gas flame.

He explains what is happening. Then, "Where is the water getting hot? On this side. How can we see what is happening to that water? Let's drop in a crystal or two which will colour the water there. Watch."

He drops the potassium permanganate crystal down a tube to where the water is being heated. Each student has in front of him a "Lesson Sheet", which has spaces for written answers and diagrams.

Diagram A looks like this:



He continues:

"Look! The colour is moving, isn't it? (Pause for "Yes") Watch it carefully. On your lesson sheets Diagram A shows this apparatus. There is a dot showing where the crystals landed.

"Draw arrows showing how the colour moves."

Here is a task requiring a pause. The next card will be slightly different, therefore.

CLOSE-UP EXPERIMENT

Pause 20 secs.

Cue teacher

The Director times the pause and then tells the floor manager to cue the teacher who now has the next card on top and has moved back to the blackboard.

TEACHER AND BLACKBOARD

Answer
Reason
Shall we see if this is true?

Let's try another experiment

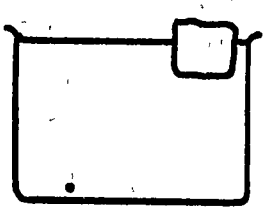
Next Card.

EXPERIMENT 2

Beaker and warm water
Ice on one side
Crystals
Diagram B

Draw arrows on your lesson sheet showing how the colour moves this time.

Diagram B shows



It is quite a good idea to do a second, similar experiment. Those who were not sure what was wanted in the first can enjoy doing the right thing on the next one.

And so on through the lesson.

This method works well. Teachers do not lose the place, and the cards are completely unobtrusive. Even after a hundred lessons or so students were found to be entirely unaware that there were any cards on the desk. They thought the lessons were remembered exactly and well-rehearsed.

There are other advantages. Preparing the lesson in this way, the need for variety is always obvious. If three headings for talking points in the middle are put down there is only room for a cue below, so a change of emphasis must be made. Also alteration is extremely simple, for cards can easily be inserted into or removed from the sequence.

When the lesson is completed satisfactorily the Director's Notes are typed. Given the cards, this is a simple matter for the Secretary. In the example mentioned, for instance, the Director's Notes would start:

306	DIRECTOR'S NOTES	16 Nov. 1967.-
1.	SLIDE Transmission of Heat 2 Presented by Arnold O'Brien Cue teacher.	

2.	TEACHER AND BLACKBOARD Greetings Homework tasks Now we will see another way heat can be transferred.
3.	EXPERIMENT Beaker being heated on one side Crystal of potassium permanganate dropped in Diagram A on lesson sheet Draw arrows showing how the colour moves.
4.	CLOSE-UP OF EXPERIMENT Pause 20 seconds Cue teacher.
5.	TEACHER AND BLACKBOARD Answer Reason Shall we see if this is true? Let's try another experiment.
6.	EXPERIMENT 2 Beaker and warm water Ice on one side Crystals dropped in Diagram B Draw arrows on your lesson sheet showing how the colour moves this time.

There is one further advantage of having impromptu speech but exact cues. If something goes wrong, if apparatus breaks or an experiment does not work quite as expected, there is no difficulty in carrying on with the plan. Should the script be exact throughout, a sudden deviation caused by anything unexpected means that it is difficult to leave the script and then return again. This difficulty does not occur in the same way with this method. The main plan must be followed still, but alterations and improvements in small details make no difference.

Paperwork

Lesson sheets were mentioned. At the beginning of every lesson each student was given a piece of paper by the monitor for use during the transmission only. This was called the lesson sheet.

The lesson sheet was normally divided into sections. Often the top portion had numbers and spaces for the answers to the revision questions with which the lesson started. Lower sections may have had tables for taking down readings in an experiment, diagrams to be labelled, incomplete sentences to be filled in, or numerical examples to be completed. They were made on duplicating stencils, and it was found that quite good diagrams could be included if a "Signature Kit" were used for the purpose -- ballpoint pens were not good enough.

Once the lesson was over the lesson sheet was discarded. It had served its purpose in the learning process. As the transmission ended further pieces of paper, called work sheets, were distributed by the monitor. Now the work sheet had two functions: to summarise what was covered in the lesson, and to give tasks to be done out of school. The main points generally had to be copied into their notebooks by the students. The tasks out of school included perhaps pages in the textbook to be read, numerical questions to be completed, or perhaps experiments which could be done at home.

There were two other functions of the work sheet which should be mentioned. Firstly it ensured that if reception was inadequate in a particular school, or if students were absent, the main points in the lesson were nevertheless learnt, even if they would have been better understood had the lesson been received. Absenteeism is quite a problem there, and pupils may also be kept out of the school for non-payment of fees or faulty uniform.

The second point was that, working mainly with a skeleton of headings to be clothed by the teacher in his own words, the length of the lesson could not be judged exactly. The aim was to fill 35 of the 40 minutes, and usually the broadcast lasted within three or four minutes either way. When the transmission ended there was still a little of the lesson left, and this was used by the pupils to start copying the notes from the worksheets into their notebooks.

There was one last piece of paper concerned with each week's lessons -- "Instructions to Monitors for the Week". This went to the non-scientist teachers in the classrooms, some time in the previous week, together with all the lesson sheets and worksheets. In it the monitor was told what the lessons would be about, how to correct any of the tests in schools or homework, what apparatus to place in the form-rooms before the lesson, and what to do if reception were too poor.

Examples of the Director's Notes for a lesson, the lesson sheet, work sheet and the relevant Instructions to Monitors can be seen in Appendix B.

Monitors

In each class taking the lessons, there was a supervising, non-Scientist teacher called the monitor. His duties sound simple enough, and have been mentioned already. Most of the time he just needed to be there, even if not paying any attention to the programme. In fact it sounds almost a sinecure. Nevertheless, as in Telescuola, Italy, a large-scale project using mainly total teaching by television and correspondence course, the organisers report:

> *"We have repeatedly had the opportunity to notice that the benefit which pupils derive from Telescuola corresponds directly to the zeal and education of the monitor."* [1]

So in Freetown the character of the monitor played a large part.

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1 Cassirer, page 219.

Perhaps this was emphasised more than it should have been by the standard of reception. On several occasions power cuts struck suddenly, and the monitor found himself unexpectedly in charge of a class when perhaps he had hoped to do corrections quietly in one corner. If the picture were poor, or there were an apparent mistake to sort out, it could place an additional strain. Also if the transmission ended ten minutes before the end of the lesson, the class with the poor monitor would not do the work set silently.

At one school in particular, the record of reception was appalling, partly due to the electrical installation in the building. Fortunately the monitor was astonishingly keen and enthusiastic, and through her efforts the class maintained its interest and did very well. Another school, as well as having excellent viewing conditions, had a monitor who studied the course with the class. It followed that she found occasions of poor reception more annoying than the other monitors, and her remarks and advice on improvements were the most detailed and valuable.

What, then, did the monitor do?

The paperwork, including "Instructions to Monitors for the Week", arrived on the previous Thursday or Friday. He or she had to check that the papers were in order, and that there were no obvious mistakes. Apparatus might be needed on two days, and the monitor had to check with the Scientists on the staff that it was available. If not he had to telephone the Research Fellow.

Before the lesson began, the case protecting the set had to be unlocked and the set switched on. Any homework questions were then collected if they needed marking, and lesson sheets distributed.

With luck all went well then for a bit. Perhaps the marking could be done there and then, the marks entered into the markbook and the papers left ready for the pupils to collect on the way out. Such quick marking was very much appreciated by some students, and was of course very valuable for their understanding of errors.

Sometimes students would have to be selected by the monitor to perform experiments under the instructions of the TV teacher. Otherwise, if reception were good, there was nothing vital for him to do until the transmission ended.

Work sheets would then be handed out, and the monitor then had to make sure the students got on with the tasks set until the bell for the end of the period.

The Form of a Lesson

The method of lesson construction devised affected the form of the lesson considerably. Variety was bound to result when the lesson had to be split into such small sections, and the author's thoughts were constantly directed to the need for visual change.

The television system imposed practically no restrictions on the lessons. One that did arise, however, was that the use of two slides on the telecine in succession with nothing in between was not successful. It was very much better to come back to the presenter in the Studio momentarily while they were changed.

Each lesson usually began with a reminder of the previous one. More often than not there was a short revision test with several written answers, and this could be used to lead on to the next topic quite naturally.

Often an experiment would follow, and if possible it would be done in the class-rooms at the same time by students called up by the monitor. This meant that the attention would be drawn away from the screen, and they would see the experiment in three dimensions and colour. Drawing the apparatus

might follow, and calculations or completing sentences giving deductions from the experiment. With more descriptive lessons and harder experiments, models, apparatus and aids were restricted to the Studio, and the students quite often had to draw them from the screen, the television teacher helping them on the blackboard.

There was a difference at the end, however. Originally a short verbal summary closed the lesson. It was soon plain that the words "To sum up ...." gave an invitation to students to switch off concentration, so after a while no summary was given. Instead the students had to write out a summary from the work sheets into their notes afterwards, and this was adequate.

Thus the "telelesson" was very like a normal lesson, yet much harder to write. It was the variety that was the strain. After the first few lessons had been written with the Research Fellow, the teachers wrote their own before bringing them to him for discussion. Generally his contributions were small ones; suggesting aids which could be incorporated, or places where the approach should be altered. The one point he had to keep in mind continually with two of the teachers was to make them relate their lessons to everyday occurrences and objects from the children's lives. To them, as with their students, Science was a textbook subject and they tended to forget its applications. To give an illustretion; the solubility of gases in water is just a fact to be learnt, but it can be made an interesting topic to be enjoyed and understood if the students' favourite fizzy drink is studied, and an experiment carried out to see whether the bubbles come out faster or slower when the drink is heated.

The Teacher-Student Relationship

The television teacher is basically blind and deaf to the classes he teaches. Communication is in fact only one way. Nevertheless it is most important that imagination should provide the other way. Then, to the students at any rate, it is a normal personal relationship. In Freetown, not only could they hear the teacher and see him, but they felt that he could naturally see and hear them. So they responded to him. They answered him orally when required, and carried out his instructions for written and practical work. And when at the end of the project they were asked to list some of the advantages and disadvantages of television teaching, the disadvantage reckoned by far the least important was "the television teacher is less real than one in the classroom". This is a measure of the success of the method.

The main ways the teacher encouraged class participation were in oral and written responses. The former are possibly easier to obtain in Africa than some places, as has been mentioned. When the television teacher started off with a "Good morning, class", the students gave an answering "Good morning" quite naturally. They were always willing to answer in unison: getting individual responses was not so easy.

There was a considerable difference in ability among the various classes taught. Questions asking for unison responses had to be fairly simple therefore, and the teacher could never assume they had all said the answer. Often he would do a series of incomplete sentences, similar to a linear programme, leaving pauses for them to answer before he did.

For example:

"So we see that water is a compound of two elements, the elements being hydrogen and ....."

A pause for the students to answer before he says "Oxygen".

He could not say, "That's right! Oxygen.".

He would be assuming they had all answered correctly, and this sounds very foolish in a class where the right answer had not been given.

A teacher in a class can use a similer type of question and answer process, of course, but his method could be in some respects more like a branching programme, elaborating only those points where the class has given the wrong response. In this way, gauging on the spot the understanding of his students, he should be able to move much faster. Being able to ask individuals questions is another important advantage he possesses.

In the televised lessons the best approach was to combine oral and written responses. This made most of the pupils think, even if they followed the others in spoken replies without reasoning for themselves.

"Now here's a picture of a familiar tree. You can recognise it, can't you?"

"Yes."

"What tree is it?"

"The Cotton Tree."

"The Cotton Tree here in Freetown. Now look at its roots. Can you remember what name we give to that sort of root?"

"Yes."

"Right. Turn over your lesson sheet and write the name on the back."

After a pause of ten or fifteen seconds, he would continue with the standard pattern:

"Have you written it down?"

"Yes."

"What have you written?"

Here they called out their individual answers, sometimes splitting into opposing camps with two different answers:

"Well, they are buttress roots."

And those who had it right would cheer on occasions.

Visitors to the Television Studio during a transmission, hearing only the teacher's side of the conversation, were generally unimpressed. It seemed almost a bit embarrassing: similar to overhearing a man talking to himself. In the classroom, however, it was a different story. The medium was live. Here was a conversation, an interplay between teacher and pupil more invigorating than that met in many a normal classroom.

But it needs a particular personality for projecting itself into the room with the students. One teacher in particular was universally liked by the students, and, though this was partly due to the fact that she was just herself when televised, there are one or two other points that might help if reported. The first is her chattiness. Whatever was in view, she would chat. If there was a slide, a blackboard drawing or a speciman the students were copying she would still chat. She never left them to do any task in silence, but would say a few encouraging comments at intervals of quarter of a minute or so, and this was much enjoyed.

A second point was her spontaneity. This was such that she found a fairly full rehearsal an imposition – she could not repeat spontaneity at short intervals. She saw the need for cues. She would run through the sequence of the Director's Notes quite happily. But she refused to fill in the parts in which the Studio would not be involved as repetition would have lost some of the sparkle.

One other point: she could picture the students as if they were in front of her. On one occasion the students were provided with three seeds in a tin lid for dissection later in the lesson.

"Don't touch them until I tell you," she said at the outset.

She gave some revision questions and then started talking about seeds. After three or four minutes, right in the middle of a sentence, she suddenly snapped, "Drop those seeds!"

In each of the classrooms there was a noise like hail on a tin roof as the more curious students, who had just at that moment picked up the seeds to examine them, guiltily dropped them back in the tin lids.

One other teacher developed some interesting techniques which produced very effective active responses. His revision tests at the beginning of a lesson had perhaps ten questions in.

"Right," he might say. "Did any of you get more than seven right?"

"Yes," came the answer from most in the brightest classes and a few in the slowest.

"Stand up then so that we can see you."

They stood. Sometimes he would get the others to applaud them. This sort of response was most effective when first suggested and at rare intervals, but it appeared to be less effective with the brighter students after a time.

His deliberate mistake method was very successful. It helped the interplay on a lot of occasions.

"Now these are the three tubes. One has water which is soft, one has water with temporary hardness and one with permanent hardness.

"Watch. Into each tube I put four soap flakes – four in this one, ... four in this one ..... and lastly four in this one."

He then talks for a moment on what the experiment is investigating.

"Now, to return to the tubes. You remember I put three soap flakes in each of them."

"Four", call the students in every class.

"Oh, yes. How silly of me. It was four wasn't it?"

And the students are relieved and pleased to have corrected him.

More often the deliberate mistake method merely corrected the student who replied "Yes" to everything. Perhaps the students had been asked to circle three alloys in a list of metals written on their lesson sheet.

"Now you circled Bronze, didn't you?" he says.

"Yes," replies the class, enthusiastically.

"That's right. And then did you circle Brass?"

"Yes."

"And lastly did you circle Aluminium?"

"Yes," say some of the students automatically.

"If you did you're wrong", says the teacher. "What should the third one have been?"

They call out their answers, this time genuinely.

"It was Solder," he tells them.

It is astonishing that the teachers were so successful in surmounting the limitation of having no audible responses from a class. It had been hoped that one could be arranged, but the electronics men were worried about 'wow' or some such complication. Whether that can be overcome by some means, for instance using a tape recorder to delay responses a fraction of a second, would need expert advice. It would be invaluable if successful. Perhaps the brightest class should be connected in this way: then the duller students would associate themselves with the responses even if they had replied differently. A watcher at home is helped to enjoy a comedy programme by the laughter from the studio audience. Association with heard response does help.

As for the manner of the presenter, an economy in gesture and slowness of movement are important from the television point of view. Wagging the head from side to side while talking makes it oscillate on the screen alarmingly, and although a cameraman can follow a smooth, gentle walk from the desk to the blackboard, a sprint is impossible

Speech must be clear, and can suffer from being too slow as well as too fast. Reference should not be made to television apparatus: "Here is a slide," "Now on this caption ....." or "Now on the telecine ....." mean nothing to the student.

But perhaps the main points are the warm personality, natural manner and sense of humour of the teacher.

Experiments

Three methods of carrying out experiments in class were used.

The first and best was for each student to perform the experiment at his desk as instructed by the television teacher. This worked extremely well, but there were not many occasions when it was possible. Biology offered the main scope. For instance flowers, seeds and fish were provided to each student for dissection, and there was no difficulty in controlling this from the screen.

Other experiments allowed only one set of apparatus to be sent to, or collected in, each school. To begin with the experiment was performed on television and then the monitors were asked to repeat it with their classes after transmission. This was not successful. In some cases monitors did not attempt to do the experiment at all. In others they did not recall correctly what to do, and the experiment failed.

The last method worked very well where only one set of apparatus was in each classroom. Volunteers from the class came out and did the experiment at the same time as the television teacher.

For complete success a lot depended on the materials. Each school had to have the same as the studio. In Chemistry in particular this was important. For this reason, even where a school might have been able to supply a material from its laboratories, nearly everything expendable was despatched to the school, only the hardware being requested. Items such as seeds, fish, fruit, nails, candles and soap were bought in the market. Fourah Bay College provided many others, particularly the chemicals.

Monitors could not be expected to carry out many of the experiments which Science teachers should do in front of the class. These were done by the television teacher in the Studio, and the students could only see them on the screen. The lack of colour was noticed very often indeed, but could not be helped.

Apparatus for use in the Studio was not always easy to obtain. To begin with it was always borrowed from schools or Fourah Bay College, but quite a number of crises occured when items broke in transit or some small part, such as a cork, was left behind. After two terms a portable laboratory, the 'Matex', was bought, and most of the problems were solved.

In future applications, it is worth suggesting that for use in the total teaching of Science up-country, each participating school or viewing place would need to be provided with a portable laboratory of this sort exactly similar to the one used in the originating Studio.

Aids

Every lesson needs quite a number of aids. Originally it was thought that the written ones would need to be captions on the caption board, and it was hoped that the Studio artist would be able to help make these. However it was found on arrival in Freetown that he had gone to the United States of America for a course, and neither the personnel, nor the materials, were available.

Up to thirty or more captions might be required every week. A simple, quick, and cheap method had to be devised.

Fortunately good photographic facilities were available at the Audio-Visual Centre, and Mr. Norman Mein, a Peace Corps worker, offered to help. The caption words were therefore typed using a typewriter with as dark a ribbon as possible, and when the thirty-six had been done they were sent for photographing. A single lens reflex 35 mm. camera with extension tubes was easily capable of copying items down to the size of about a postage stamp, and the strip of negatives was then cut into separate frames and mounted in plastic transparency holders. These could be fed into the projector on a telecine machine, and in fact they were usually kept as negatives – white letters on dark background – though the telecine could have reversed them electronically.

Although this method was much cheaper than making captions would have been, it was the saving of time that was most important. The secretary did not take long to type the captions – perhaps half an hour at the most. Photographing them took a quarter of an hour and processing another half hour. The frames could be mounted by the secretary in another half hour or so. For thirty six captions this was good going. There was an advantage in the Studio which should also be mentioned. Use of the caption board at frequent intervals ties down one of the cameras in the Studio. However this does not happen when the telecine is used.

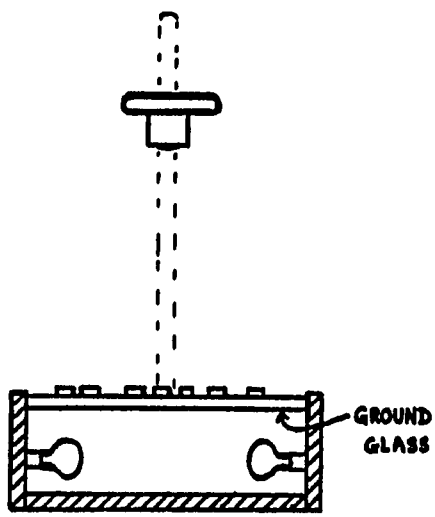
To begin with the shortage of time and personnel made this method imperative. The results were quite good, but there was insufficient contrast, and also the typed letters were rather too thin. If more than eight or ten words were included on one slide, students at the back of the classroom found it difficult to read.

Contrast was improved enormously when a quantity of microfile film arrived from Britain. It was capable of really crisp black and white results, though initially experiments had to be made to determine the best exposure and processing combination. The slightest difference in temperature of the developer can lessen contrast considerably.

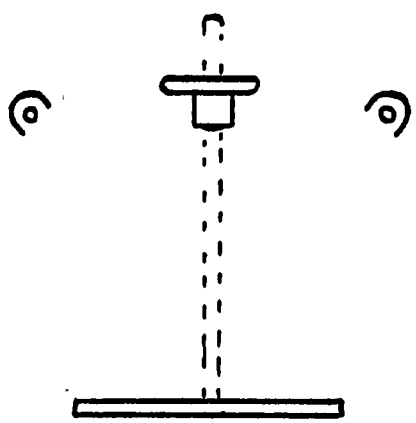
With the contrast problem solved, a clearer form of lettering was required. A typewriter with large, thick letters was discovered, but it had only a light blue ribbon, and no others were available. A black carbon copy was used for photographing, and this worked quite well. A bulletin faced typewriter with a black ribbon would certainly answer the purpose normally.

In Freetown, to use the large-face typewriter involved the secretary in quite a journey, so a set of UNO stencil kits was purchased and these letters were very satisfactory. UNO ink is very black, and capitals and normal letters as well as numerals are written quickly, neatly and clearly.

Other possibilities were suggested by this method, but were not put into practice because of the distance between the secretary and the photographer. Assembly of a caption with thick plastic letters would have given even clearer results. If not enough contrast is obtained, transmitted light can be used, and this gives very clear results. The apparatus would look like this:–



For normal copying by reflected light the set up is simply this:–



With the lights permanently in position the exposure is constant from time to time. This can also be used for copying diagrams of all sorts, and it is generally easier to make small diagrams quickly and neatly than large ones the size of a caption board. Colour presents no problems, if colour television is available, and Kodachrome artificial light film gives astonishingly good results with two photofloods providing the source of light.

About three months after the start of transmissions the Studio Artist returned to Freetown. By this time the speed, cheapness and convenience of the photographic method made it unnecessary to start making the captions in the usual way.

However the caption board was used occasionally, but only when the teacher needed to use a pointer to indicate small points on the diagram. Had a rear-projection screen been built into the set, this might have been used instead, particularly for photographs taken locally. But then the film would have to be printed as transparencies for this and negatives would not do.

Photographs taken locally were used on quite a number of occasions. The applications of the principles learnt in examples around them helped to make the students realise that Science is not just a textbook subject. Taking these photographs was simple. Provided the subjects wanted were known before setting out, in one afternoon twenty or so would be taken in a quick journey round by car. That evening they could be developed, and the negatives, when cut separate, mounted in plastic transparency holders. The telecine machine reversed these electronically and the results were most effective.

When taking photographs on 35 mm. care had to be taken to avoid including anything important at the sides. The negative has different proportions from a television screen: it is too long for its height. A better solution might be to use a half-frame camera, which has negatives half the size of the 35 mm. transparencies. It uses the same film, but pictures are taken athwartships instead of fore-and-aft on the film, and the proportions are exactly those of the screen. When projected there is a black margin all the way round, but this in no way detracts.

Half frame transparency holders were necessary for film-strip frames. Permission to use these had to be obtained by the Research Fellow before leaving Britain, but then odd frames cut out and projected in the telecine machine provided some very professional diagrams cheaply and quickly.

It was unfortunate that circumstances prevented the production of cine films as aids. This was a handicap frequently felt. Live film can show material not available to the normal teacher because of inaccessibility, unsuitable size whether too large or microscopic, or too fast or slow in reaction. It needs a good photographic department to record such items on film, but without them full advantage cannot be taken of the medium.

On three or four occasions commercially produced films were used, but not always successfully. There were difficulties in obtaining them and then the suitable parts were infrequent.

The last aid to be mentioned, but probably the most frequently used, was the well-established blackboard.

Feedback from Schools

For every lesson the monitors were asked to fill in Reception Reports. Apart from giving details of the vision and sound reception, they were asked to indicate by means of ticks what they thought of the speed and the level of the lesson, and the time given for student participation. Written comments were invited on the lesson sheet, work sheet, the ways in which students participated and any other relevant details.

Most of the monitors did this conscientiously, but their reports were too general and too flattering to be of great use. The speed of every lesson was exactly correct, according to them, and when the classes were of widely differing ability and experience this was hard to believe. Also it was in the small details – did that method of getting response work? was this slide effective? how many got the right answer? — that most help was needed. These were never mentioned in their reports.

Fortunately the Research Fellow was able to be at one school or other every morning during transmission time. The observations he made then were of considerable use to the television teacher, and alterations and improvements in technique resulted from this. Ideally the television teacher should be able to record the lesson and watch its reception himself, but this was not possible at Freetown.

With only five or six schools in the project it should have been possible for the Research Fellow to visit each school once every week and a half. Standards, including the regular filling in of reception reports, could have been kept high. Unfortunately some schools started having reception troubles right from the beginning. When possible, the Research Fellow had to teach the lesson in any school not receiving the transmission, and when one or two schools were having persistent troubles, it was occasionally difficult for him to visit one of the others for three or four weeks at a time. Sometimes it was obvious that standards fell as a result. The monitor might be late in some schools, or even not turn up at all. The students wandered in late for the lesson, or the apparatus was not out ready. Regular visiting is most important.

The passing of information and questions back from the students to the Studio through the monitor did not succeed. Such questions were invited by the television teacher, but none came through. The students were remarkably passive. On three occasions competitions were announced. They were quite simple – one was for drawing an optical illusion and another for making a pinhole camera – but no entries were received.

The Programme of Lesson Production

A quantity of shoeboxes was obtained from a shoe firm in Freetown, and each box contained the material for one week's lessons.

The teachers brought to the Research Fellow his teaching cards, lesson sheets and work sheets for each lesson when ready. These were gone through carefully, discussed, and altered where necessary. Notes were made of any special aids to be collected or made, and on a separate piece of paper were listed any instructions to be sent to the monitor – apparatus to be collected, answers to homework – for that particular lesson.

The monitor's sheet was put at the bottom of the shoe-box, and the cards with the lesson sheet and work sheet wrapped round with a rubber band were placed on top.

In her own time, the secretary typed six copies of Director's Notes from the cards, and made the duplicating stencils for the lesson sheets and worksheets. These were placed back in the box. She also had to copy out the "captions" for photographing.

When the lessons were completed five copies of the Director's Notes were sent to the Studio. One week early the "Instructions for Monitors for the Week beginning ....." were typed out, the special instructions for the week's lessons being found in the bottom of the box.

The next job was the duplication. Two hundred and fifty copies of each lesson sheet and work sheet were needed, and then exact numbers for the six schools were sorted out into large envelopes ready for distribution. Sometimes some materials for practicals were added at this stage. One copy of the Monitors' Instructions went in as well.

The slides were sorted into the boxes when complete. The teachers took their cards a week in advance for final study. The boxes now held only one copy of the Director's Notes and the slides needed for the week.

On the morning of transmission the teacher picked up the slides and went to the Studio at about 9.30 a.m. From 9.30 to 10 the lights and sound adjustments were made. The Research Fellow then came to the Studio and the rehearsal went on till about 10.50. After this small improvements could be made provided they did not affect the televisional personnel's routine. Then came a break. The programme went on at 11.20, and ended just before 12 noon. The slides were returned to the box, with one copy of the Director's Notes, and these were stored for further use if necessary.

Cost in Time and Money

The financial cost of programmes such as these depends on local salaries and prices. The time, labour and materials will be specified for translation into local terms.

To construct a lesson is probably about one morning's work. To rehearse and transmit is another. The financial arrangements with the teachers may take several forms, but in Freetown a lump sum (£10) was paid for constructing, rehearsing and transmitting each lesson, and this debarred any other claim, for instance for travelling expenses.

To advise and organise, a Coordinator in a similar position to the Research Fellow's is needed. He should be full time, and his secretary should also be full time during terms. With occasional help on photography they can cope with the paperwork for at least one lesson a day, assembly of aids, collection of apparatus and materials, correspondence, liaison with schools and so on.

The television side has to be dealt with separately. The lessons involved use of the Studio floor from 9.30 to 12 on each day, but no doubt other demands on time were made in preparation for this.

The cost of materials was very small. Most were borrowed from school laboratories or Fourah Bay College. Occasionally odd items for practicals had to be bought, but the bill was rarely more than a few shillings and it did not happen often.

Paper is another item. For each lesson two duplicating stencils were needed, and two sheets of paper, often foolscap, for each pupil. Also all students had the same textbooks issue on loan.

Perhaps the sets are best hired, arrangements for the maintenance and repair being made clear at the beginning.

If another 10% is added for extras a realistic estimate can be obtained.

PART III

RESULTS OF THE EXPERIMENT

Problems of Research

For statistical research purposes the circumstances of the experiment were anything but clinical. Strict separation of the experimental and control groups was not possible because it was stipulated by the principals that the streaming in the schools should not be interfered with. Therefore no division into exactly matched groups was permissible.

In the circumstances, this was a justified condition. This was a pilot project. Its effectiveness was uncertain, and there was a chance of complete failure.

Now parents pay for their children to attend the schools in the project, and, since the rewards of obtaining 'O' levels are large, they might well object to anything interfering with normal work.

The principals wanted to co-operate as much as they could. They saw the potentialities of television for helping to solve the perennial shortage of Science teachers. But their responsibility to parents made them insist that as little alteration in the course of study should be introduced as possible. The streaming had to be accepted, but particular streams could be chosen for television teaching. Also the Research Fellow had to test control and experimental groups regularly to make sure that children were not being handicapped through inclusion in the experiment.

Each of the schools involved had three classes at Form II level taking General Science. Although theoretically streamed by ability on the results of the Form I school examinations, the ranges of intelligence and attainment in General Science were very large, particularly as fluency in English was often a major factor in progress. The difference in age in any one class was wide as well. The range was four years in most, but two classes contained children from 11 to 18 years old. Lastly the difference in standards from school to school was very marked.

This all posed an extraordinarily difficult problem. Eventually the Research Fellow decided to treat each school as a separate entity. If the middle of three streams were taught by television, the top and bottom streams by their normal teachers, some comparison between the experimental and control students should be possible. It meant that the five television classes would be of widely differing ability, but that could not be avoided however it was done.

As has been mentioned, it was not till the end of the Form II year that the Research Fellow was told that only the top two streams at one school do General Science in Form III, and only one at another, the others doing Commercial Subjects. At the latter school the principal agreed to let the second stream continue doing General Science by television. At both schools, however, the control students were in the top stream only.

Another disturbing feature was interaction between the two groups. The main way this occurred was in control class teachers watching the programmes or studying the paper work issued to pupils. Students also gained information. When the answers to tests were pinned up in TV classroom walls control students could, and did, study them on occasions. This was a less frequent interaction, but equally difficult to stop.

Tests

A major difficulty was the lack of suitable tests. No suitable attainment tests in General Science were available which had been standardised in West Africa. To construct and calibrate one would have been impossible in the prevailing circumstances.

The students were being prepared for the Form III examination set and marked by the West African Examinations Council. Each question paper for this examination had a section of objective questions, and a slightly larger part consisting of essay questions.

It was decided to use this as the Final Test. In fact this was an examination which was most important in the eyes of the students, so the motivation was there. It was also obviously impartial. Construction of a more exact test, consisting entirely of short objective questions, might possibly have given more valid results. Nevertheless it would have meant less to the educators and children there, and it could have invited the criticism that although the television students might do well in that sort of test, they would fail in a normal examination which required essay-type answers and examined ability in drawing.

With the post-test agreed on as the 1968 Form III Examination, the pre-test had to be in the same style. Two Peace Corps teachers quite independent of the project produced an examination answering the purpose. It tested only those parts of the syllabus the classes had covered in the four terms before the experiment began. Probably it was a bit simpler than the Final Test. The scores were rather higher generally, possibly reflecting the more stable political climate at the time.

At the end of the Project a test of intelligence was also applied. Once again none standardised for West Africa was available. Because the fluency in the English language varied among the students a test in non-verbal general ability was used, the N.F.E.R. Calvert No. 3 being chosen. Raw scores only were recorded, the ages of the students being disregarded.

Numerical Results

The three schools having three streams throughout were Albert Academy, Secondary Technical School and W.A.M. Collegiate. The standard deviations are in brackets after the means in the table below. Students from the top and bottom streams were combined to form the control group. In Collegiate the Final Test was not used for grading promotion, so the motivation was not so great.

	No. in group	Calvert No. 3	PRE	POST
ALBERT ACADEMY				
Television	19	45.6 (12.8)	39.7 (7.1)	32.4 (7.9)
Control	48	45.9 (13.7)	43.1 (15.1)	30.5 (14.0)
SECONDARY TECHNICAL				
Television	16	43.6 (12.9)	55.1 (10.2)	38.6 (9.1)
Control	22	44.4 (12.5)	54.4 (10.5)	37.4 (15.4)
W.A.M. COLLEGIATE				
Television	11	30.0 (13.0)	34.0 (8.7)	21.2 (6.1)
Control	27	44.7 (17.8)	48.7 (15.4)	26.4 (11.1)

The two girls' schools had all their control students in the top stream only. This mattered. On an occasion at the end of the second term when the top stream viewed a television lesson at F.S.S.G. the monitor attached the following comments:

> "Last Biology lesson the 'A' class came in to share TV lesson due to absent staff:— 'A' stream very much more interested – due to novelty no doubt – but showed more intelligent approach altogether suggesting lessons would be of greater benefit to the more intelligent stream."

Mathematical ability in the two girls' schools did not seem as great as in the others. But the main trouble at F.S.S.G. was poor reception. Otherwise the result at this school would have probably been far better.

Neither school used the test for considering promotion to Form IV, so that the importance of the test was not as great as could have been wished.

	No. in Group	Calvert No. 3	PRE	POST
F.S.S.G.				
Television	20	44.1 (12.5)	46.7 (7.6)	22.9 (8.4)
Control	19	58.2 (13.7)	43.3 (9.4)	26.9 (13.3)
M.G.H.S.				
Television	16	45.3 (10.6)	32.3 (6.6)	19.1 (6.8)
Control	11	46.3 (12.2)	42.3 (12.9)	30.1 (7.1)

Analysis of Variance

It was assumed that the Non-Verbal Test was an aid in estimating the students ability, and could be used to reduce the amount of unexpleined variables.

ALBERT ACADEMY

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Mean	45087.475	1		
TV v Control corrected for regression	2.260	1	2.260	N.S.
Regression	18.365	2	9.183	N.S.
Error	13464.900	55	244.816	
Total:	58573.000			

SECONDARY TECHNICAL SCHOOL

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Mean	43273.489	1		
TV v Control corrected for regression	169.153	1	169.153	N.S.
Regression	259.222	2	129.611	N.S.
Error	3955.139	29	136.384	
Total:	47657.000			

W.A.M. COLLEGIATE SCHOOL

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Mean	18981.286	1		
TV v Control corrected for regression	84.005	1	84.005	N.S.
Regression	517.811	2	258.906	N.S.
Error	7446.969	28	265.927	
Total:	27029.070			

F.S.S.G.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Mean	20692.568	1		
TV v Control corrected for regression	3.684	1	3.684	N.S.
Regression	982.016	2	491.008	5.22
Error	3102.734	33	94.022	
Total:	24781.000			

M.G.H.S.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F
Mean	14452.654	1		
TV v Control corrected for regression	376.830	1	376.830	7.629
Regression	498.975	2	249.487	5.052
Error	1088.542	22	49.388	
Total:	16415.000			

Reception Conditions

Lessons should have been received on 167 days during the course of the project. Records are reasonably complete for three of the five schools, and these include the ones with the best and worst conditions.

	Secondary Technical	Albert Academy	F.S.S.G.
Good Reception	106	92	64
No reception at all	22	22	43
No reception for part of lesson	6	10	6
Very bad vision	6	11	20
Small faults with vision	10	1	13
Sound troubles	2	4	12
	152	140	158

Even assuming the missing reports were for days when reception was good, the best school had good reception for 72.5% of the time, the worst for less than 44%. This was a big handicap.

School by School

ALBERT ACADEMY

This very good school for boys is built a little way up Mount Aureol. Because of its height it has a clear path to the television transmitter, so that very little interference marred the picture quality.

The class viewed in the Geography room on the top floor, the louvre windows of which were painted black. It was rather hot and airless but quite good. However, one unfortunate result of this arrangement was that the key had to be obtained from the teacher in charge of Geography, and on some occasions lessons were missed altogether because of this, and on others the boys were let in late.

The attitude to work in the school seemed very good, and the principal watched lessons on several occasions with the students.

The control students at Form III level had six periods weekly to four of the television class.

There was no significant difference in performance between those taught entirely by television for a year and a half and those taught by their normal teacher. With similar results in the intelligence test, the means of the groups were:—

	PRE	POST
Television	39.7	32.4
Control	43.1	30.5

THE GOVERNMENT SECONDARY TECHNICAL SCHOOL

Here the viewing conditions were best. The students had single desks and they were stepped up so that everyone had a clear view. The desks at the back were, however, rather hot and airless.

The principal looked in on lessons quite often, and the monitor followed the course with the students.

For the whole course of the experiment the control students were taught six periods and the class four periods weekly. Had it not been for the happy circumstances of good viewing conditions, monitor, principal and comparatively good reception, the television stream would have been unlikely to have kept ahead.

There was no significant difference between the performance of the two groups. Nevertheless it was quite an achievement of the television class to have the highest mean score of any group in the Final Test.

	PRE	POST
Television	55.1	38.6
Control	54.4	37.4

W.A.M. COLLEGIATE SCHOOL

This was the nearest school to the transmitter, and the picture was generally very clear. Unfortunately the viewing conditions were the worst. The room used was a laboratory, and the boys sat on uncomfortable stools. Also the room was very light indeed, having windows down both sides so that the majority of the boys had worrying reflections. Attempts to hang curtains failed, nor were the louvres painted black.

It was not clear how the television lesson fitted into the timetable of the school. It appeared to start after about half-an-hour of a double period. That half hour was spent watching whatever programme was on television beforehand, often a film. Also, as soon as the television lesson finished, the class left to pursue some other topic, whether there was an experiment to do or not.

Exact records were infrequent and inaccurate at the beginning, but probably the school had as good a record of reception as any.

There was no significant difference between the performance of the two groups. The control students had a considerably higher mean in the intelligence test.

	PRE	POST
Television	34.0	21.2
Control	48.7	26.4

FREETOWN SECONDARY SCHOOL FOR GIRLS (F.S.S.G.)

An excellent girls' school with an outstanding monitor and two good principals in the course of the project. Results here would have been far happier had reception been reasonable.

To begin with the trouble was the electricity supply to the classroom block. Installed only a year before, it seemed to find the current to a television set too much for it, and expired more often than not as the lesson was switched on. Also troubles occurred partly because the aerial had been erected just above a corrugated iron roof, and was not pointing in the right direction. Even on days of reasonably good reception, the last ten minutes of the lessons were largely spoilt because the junior section of the school enjoyed playtime just under the window.

This, then, is a tale of frustration. However the monitor, Miss Edwards, managed to keep up the girls' interest. After a reasonably good finish to the project, with the aerial repositioned and the set repaired, their comments showed an astonishing keenness still remaining.

And in spite of their trouble with reception the difference between the performance of the two groups was not significant. The control students in the top set did considerably better in the intelligence test.

	PRE	POST
Television	46.7	22.9
Control	43.3	26.9

METHODIST GIRLS HIGH SCHOOL

Viewing conditions here were quite reasonable, but reception suffered from being slightly shielded by a hill. The monitor was very good.

Perhaps it was the fact that the girls were only continuing with the subject because of the project that affected the girls' attitudes. Long before the end it was noticeable that keenness was falling off.

Probably because of these factors the television group did significantly worse than the top-stream control group.

	PRE	POST
Television	32.3	19.1
Control	42.3	30.1

Attitude

The students were asked questions and opinions on the television lessons after one term, two terms and at the end. Generally speaking there was not much difference from time to time. The answers to the final questionnaire, which was more detailed, are listed below.

However, just how short memories are is illustrated by comparing F.S.S.G.'s answers on the three occasions.

They were asked the following question after 1 and 2 terms:–

"On occasions there has been interference and poor reception. Taking the term as a whole, has this been a big nuisance, a minor nuisance, or has it made no noticeable difference as far as your learning and enjoyment of the programmes is concerned?"

After one term the answers were as follows:–

Big nuisance	92%
Small nuisance	8%
No difference	0

The second term reception was little better than the first. The line-up was then :–

Big nuisance	81%
Small nuisance	19%
No difference	0

The third term was a slight improvement. They had good reception for just over half the lessons. The last term started terribly, but then improved a great deal for the last half. They had really settled down at the end.

Memory is so short that looking back over the project as a whole, as can be seen below, 37% of the girls at F.S.S.G. did not think poor reception had spoilt their learning.

The questions and their answers were as follows:–

		AA %	FSSG %	TECH %	MGHS %	COLL %
Because you were in the television class are you	very pleased	55	42	60	50	55
	pleased	30	26	33	33	18
	don't mind	10	32	7	17	18
	displeased	0	0	0	0	9
	very displeased	0	0	0	0	0
Do you think that on the whole poor television reception spoilt your learning	a lot	15	26	7	0	20
	a little	45	37	27	72	30
	not at all	40	37	67	28	50
Compared with a normal teacher do you learn from television	much more	15	32	13	22	27
	more	75	11	67	6	45
	the same	5	53	20	72	18
	less	5	5	0	0	9
	much less	0	0	0	0	0
When given homework by television are you	more likely	50	42	60	61	73
	the same	45	53	40	33	18
	less likely	5	5	0	6	9
to do it than for your normal teachers.						
You were asked to copy notes into your notebooks frequently. Do you do this	always	55	68	87	33	73
	usually	25	16	13	33	9
	sometimes	20	16	0	33	18
	never	0	0	0	0	0
Would you like to be taught Science by television in future?	Yes	70	37	80	72	73
	No	15	11	0	0	0
	Don't mind	15	53	20	28	27

In another section of the questionnaire the students were asked to grade some of the advantages and disadvantages of television for teaching.

Very disappointing was the fact that the advantage considered most important overall by the students was that "Notes are issued to show the important points in the lesson." This was followed by:

"There are films and slides in the lessons sometimes."

"The lessons are interesting and the teacher is good."

"There are experiments in the lessons not usually seen at school."

"The lesson always takes place at the time stated."

"There are no interruptions from the other students."

"It is easier to concentrate."

"The teacher looks straight at you and tells *you* things."

and lastly the subjective opinion, "I like the teacher."

The most important disadvantage was, "Bad reception spoils the lesson."

This was followed by:

"He cannot be asked questions."

"He cannot hear the answers to the questions he asks."

"There is not much practical work."

"The teachers go at the wrong speed."

And finally, with considerably less estimated importance than any other disadvantage or advantage,

"The teacher is not so "real" as in the room."

The inability of the students to ask questions was the second most important disadvantage in the students' eyes, coming after bad reception conditions. This has been found before, but the installation of talk-back facilities is unlikely to improve achievement, nor would it be used much. It is not worth the expense.

As Kumata records:

"It has become clear in recent studies that availability of facilities for TV students to interrupt the TV teacher and ask questions is something which the students desire but does not affect achievement scores. It is also clear that talk-back facilities are very rarely used by students .....

"In all the studies in which talk-back facilities have been investigated, ... no significant differences have been found in achievement. Almost all report that when such facilities are not present, student evaluation of TV is unfavourable." [1]

The Background of the Students

Some information on the domestic circumstances of the students was obtained.

69% lived in Freetown, the rest regarding themselves as coming from the provinces. Some boarded, but others stayed with relations or friends.

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1 Kumata, H., p.181.

Information on fathers' and mothers' professions was not easy to put into classes. A large number of "Don't knows" occurred, and in other cases the knowledge was vague, terms like "civil servant", "works on railway" and "trader", covering a wide range in the social scale.

The education background was a bit safer. This resulted as follows:–

	Father %	Mother %
Higher Education	14	7
Finished secondary	22	19
Started secondary	12	14
Primary	12	11
None	19	29
Don't know	21	20

Other Questionnaires

Questionnaires were also completed by the principals and the monitors.

The attitude of the principals varied from great enthusiasm to indifference, and little change occurred during the project. Minds were perhaps made up before the start, but whereas the more enthusiastic principals had watched eight or ten lessons the indifferent one had not seen more than one, so had less chance of changing his mind.

Their main suggestions for improvement was in the electricity supply and the dependability of the television system.

With regard to the future, generally speaking the principals welcomed the idea of total teaching for lower forms only. They would prefer it to be an aid for their teachers.

The monitors with whom the project finished – and in three of the five schools they were unchanged from the start – had all been enthusiastic at the beginning and remained so to the end with minor reservations.

All thought discipline easier to maintain. This was borne out by the Research Fellows' observations for on more than a few occasions he found the monitors absent from their classes who were continuing working quietly and correctly. Indeed, one of the schools was so short of teachers that for quite a while the monitor was timetabled to teach another class at the same time.

Lastly the monitors were unanimous in thinking that, provided the technical difficulties could be avoided, television has a great future in helping where there is an acute shortage of teachers. Some added they would prefer to see it used as an aid if teachers of sorts existed, rather than for total teaching.

PART IV

RECOMMENDATIONS FOR DEVELOPING COUNTRIES CONSIDERING THE INTRODUCTION OF ETV

To establish a successful ETV system the following conditions are desirable:

1. All concerned – ministers, education officers, principals and teachers especially – should feel the need for ETV.
2. They should also have faith in it.
3. Sufficient financial support should be available.
4. The television system must be reliable, or can be made so. Otherwise an efficient transmission system must be installed.
5. There should be efficient electronic engineers for the maintenance of sets.
6. The electricity supply should be reliable.
7. The number of students to receive the lessons must be great enough to make it worth while.
8. There must be a measure of authority over the schools so that good television teachers can be obtained, timing agreed and standards of viewing conditions imposed.

These conditions are desirable, but not essential.

Perhaps the seventh condition should be amplified. As the pilot project scheme was conducted in Freetown a very large number of students was not necessary or advisable. With permanent establishments the greater the number of students the better. Indeed the initial magnitude is extremely important.

A UNESCO book has this to say on the Concept of Critical Mass:

"Both economically and educationally, the concept of a critical mass is an important one for the effectiveness of the mass media. They are likely to be economically feasible and advantageous only after a certain critical point of size has been reached when their distributive efficiencies can justify their relatively high initial cost. Although a small amount of supplementary aid from the new media may improve the effect of what a teacher or field officer is doing at present, the media are most likely to justify themselves only when used on a sufficient scale and intensity of programme and audience, and on a problem of sufficient importance, to ensure a noteworthy impact on the learning of many people.

"Our observation has been that the broadcast media, in particular, are more often under-used than over-used, and are frequently spread too thin over too many audiences and learning objectives to achieve a significant impact on any one. In many cases, too little is invested in their programming and in delivering a usable signal and keeping receivers operating. They are often used too tentatively – so few programmes concentrated on

any one group of learners, so few receivers – that the unit costs are unbearably high, and therefore no one takes their value very seriously. They are frequently used to give minor help in a class-room when with greater concentration they could in fact provide major help. Unless they are given important enough tasks, used in sufficient mass, made full partners in solving real educational problems, supported strongly enough to make their impact felt with adequate technology over a considerable part of the system, they are unlikely to justify themselves, or to be taken very seriously by the persons expected to use them." [1]

Another point to emphasise is that the financial provisions for introducing E.T.V. should be adequate from the beginning. As the same UNESCO book emphasises:

"Shoestring projects breed constant anxieties, divert too much energy to sheer survival, and too often fail in the end." [2]

Starting an ETV system is a big undertaking, and there is a booklet written specially for developing countries considering this step. It is called "Educational Television in Developing Countries – A Report of an On-The-Spot Survey", and it was compiled by Nippon Hoso Kyokai and the Australian Broadcasting Commission. Copies can be obtained from:

The Director,
Education Department,
Nippon Hoso Kyokai,
2–2, Uchisaiwai-cho, Chiyoda-ku,
Tokyo, Japan.

The steps to be taken in assessing the need and commencing the service are detailed from pages 61 to 64, while advice on purchasing equipment is given between pages 71 and 82.

However the plans found there are perhaps more grand and expensive than is necessary or desirable. Before lavish outlay is contemplated reference should also be made to the mini-studio, details of which can be obtained from:

The Director,
Television Research and Training Unit,
University of London Goldsmith's College,
Lewisham Way,
London, S.E.14.

Advantages of Using a Mass Medium such as Television

1. It can do an efficient teaching job where no teachers exist, or help to raise the standard if teachers are of poor quality.
2. It can provide experiments and show sights that a class cannot normally see, particularly if the school is poorly equipped.
3. It provides a stimulus and outlet which may keep good teachers in the profession.
4. Monitors and classroom teachers absorb information and gain techniques.
5. Above a certain number of students it can be an economy.

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1 UNESCO. The New Media: Memo to Educational Planners, p.98.
2. UNESCO. The New Media: Memo to Educational Planners, p.170.

A decision has to be made on how to take advantage of the medium. Should it be for total teaching or just enrichment?

This depends primarily on the teacher shortage. If it is critical in the subject concerned, total teaching as at Freetown could be attempted. The number of students at which it becomes an economy is much less. If teachers are available but of poor standard then enrichment inserts into the lesson are probably better, particularly in non-scientific subjects. Less administrative problems result, particularly as the timetables of receiving schools do not need to be synchronised exactly.

Supply of Programmes

In the Freetown project practically all the material for lessons was produced locally. This was partly because of the expense of importing films and aids from overseas, partly because of administrative difficulties in so doing, and partly because imported material is less relevent to its audience.

It is believed that, as stated in the Santiago Plan of 1962, programmes for educational expansion must be based on the genius of each nation and must respect sovereignty. [1] Nevertheless neighbouring states enjoying the same climate and conditions and using the same language, may produce recorded lessons largely compatible throughout the group. The English-speaking states in West Africa are a case in point.

In such cases a single agency, such as the National Educational Television of the United States of America, might be set up.[2] Each week the NET supplies 7½ hours of programmes on film or kinescope to each of the stations. It acts as a clearing house for locally produced programmes, and local stations rely on NET for about 30% of their transmitting time.[3] As an example a West African version of the NET could spread the load of producing the lessons of different subjects at different levels among the best teachers from several countries.

Selection of Teachers

The following guidelines may help in this process.

1. Find out those with the best reputation as teachers.
2. Enquire whether, if suitable, they would like to teach on television, and would be able to do so.
3. Go to one of their classes unannounced.
4. Judge whether they have a love for, as well as a thorough knowledge of, their subject.
5. See that they display an economy of speech and gesture, with clear diction.
6. Choose, in preference, those who illustrate their lessons with experiments and visual aids, wherever possible.
7. Check that the lesson has a logical thread running through it.
8. A good sense of humour is important.
9. A teacher relying too much on notes should be avoided.

Whether his personality will transmit on television is a matter only time and trial can solve.

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1 Conference on Education and Economic and Social Development in Latin America, Santiago, 1962, quoted Cerych, p.20.
2 Cassirer, pages 18 and 19.
3. Schramm, Lyle and Pool.

Training of Teachers

Provided the teacher has a natural flair, he can give successful television lessons having had only a brief introduction to the methods and signs used by the Studio Staff. However more thorough training is highly desirable, so that the teacher can have an easier and more polished introduction to the medium.

The length of the training course may vary from a morning to many months. Two of the Freetown teachers had only one morning. For comparison, the ILEA course consists of the following. [1]

1. Two-day course -- a practical introduction to television equipment.
2. Seven-day course -- more detailed explanation of techniques, writing scripts and the production of a short teaching programme.
3. Advanced training course for selected teachers lasting three months.

In many cases developing countries would be wise to send their most likely teachers on courses overseas, such as those run by C.E.T.O., before starting.

Television Teachers and the Classroom

If the teachers are taken on full time, it is important they should be able to visit classrooms during transmissions, particularly when their own lessons are being sent out from videotape.

1. They can criticise their own mannerisms and modes of expression.
2. They will maintain direct contact with the children.
3. They will see how classes participate, and what sort of response questions get.
4. They can note the effectiveness of each part of the lesson and its paperwork.
5. They can note which parts of the lesson are not fully understood, and alter following lessons accordingly.
6. Meeting the students and monitors after the lesson promotes good relations between the Studio and the class.
7. Suggestions for improvement may arise in discussion which could be of great value later.
8. In the case of failure of reception the teacher can help by teaching the lesson, if the fault is in the school set, or, if the fault is in the transmission, by going over difficulties from previous lessons.
9. Administration may be helped if the teacher can collect reception reports or deliver other papers to the school.

Method of Production

Where television is the sole means of distribution, and storage of lessons is not required for longer than a few weeks at the most, a small ETV studio recording lessons on videotape is probably the best answer.

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1 Times Educational Supplement, April 14, 1967.

To produce 16 mm. film, for distribution through the television and projectors in schools, an educational film unit or ETV unit could be established. The advantages seem to be:

(a) E.T.V.
1. The lesson is shot in sequence.
2. The teachers would not be required for so long.
3. Practically no editing, sound synchronisation, or cutting is required.

(b) Film
1. The equipment is much less expensive than the telerecorder and normal electronic apparatus for a TV Studio.
2. The result is more polished.
3. Errors in timing or detail can be corrected by shooting again.

Whose Responsibility is Production?

Whether film or television production techniques are used, the question arises as to who is in control.

In Freetown, since the production was in the national studios, two Government Departments were concerned, Information and Education. In most circumstances a split responsibility of this sort has dangers. Neither body is happy in submitting in part to the control of the other, nor is it easy to establish exact details of who does what to the satisfaction of both parties. This applies to costs in particular.

It must be stated at once that in Freetown relations between the Studio Staff and the teachers were excellent throughout. The maximum co-operation had been promised, and it was received.

Divided responsibility of this sort can and does work. There are obviously possibilities that it might not. For this reason it is probably wiser for one body to be primarily responsible. This body can be the broadcasting side, as in the B.B.C. for instance, or it can be the educational body.

Particularly as television is unlikely to be the only way of distributing the lessons, the Ministry of Education is perhaps the wiser choice in developing countries. The Ministry responsible for broadcasting will probably be involved, for it will be required to transmit the lessons from the videotapes or films produced by the educational unit. This is most unlikely to cause any friction, however.

There is another point, arising from the staffing of the Studio. It can be difficult for a producer from broadcast television to fall in with the educational aims of the teacher. As Mr. Clive Hewitt points out:

> *"Firstly there is the question of who is the 'boss'. The broadcast producer is lord and master of all that his audience surveys and his is the final responsibility for all those decisions from which will emerge the synthesis which is the television programme. In the educational context any producer of a television lesson would be improperly assuming the rights of the teacher. In truth there must be no question of 'authority' belonging to one or the other when a teacher and a producer sit down to work out their television lesson."* [1]

This may not be easy for a professional, broadcast Television producer to accept.

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1 Television at the University of Leeds, page 19.

There is another point. The producer or director must be an expert in the use of the medium and in what it is being used for. From which avenue should he have come? Probably the educational one.

> *"It is difficult to make ironclad rules where the talents of people are concerned, and the following admits of exceptions. But it is generally salutary that an instructional television director has had actual teaching experience on the level and in the subject matter field of the lesson he is directing. Also it is probably easier and more sensible to train educators in the techniques of the medium of television (for our future supply of directors) than it is to attempt to train commercial directors to become, in the last analysis, educators."* [1]

And this view is echoed elsewhere.

But whether the body in authority is the Ministry of Education or the broadcasting council, and whether the producer of the programme has come from education or from television, the control should be in the hands of educators. This was emphasised at the Third E.B.U. International Conference on Education Radio and Television:

> *"It was the opinion of the Conference that in the final analysis educational television and radio were worthwhile instruments only if the educator were given a special and almost privileged place in the structure of the organisation developing broadcast education."* [2]

The production, therefore, should probably be under the wing of the Ministry of Education. The producer, who is an educationalist trained in production techniques, and a team including the necessary technicians, co-operate with teachers to create the lessons and written matter.

The Studio

1. The background set should be as simple as possible – preferably of plain panels rather than curtains.
2. Inserted into the background should be
   (a) a blackboard, preferably reversible, surrounded by concealed strip lights,
   (b) a caption stand, also with lights around,
   (c) a rear projection screen on which slides and films can be projected.
3. The bench should be covered with a stain resisting, heat proof, smooth surface, which can easily be marked with Chinagraph pencil for the positioning of apparatus, and quickly cleaned. A sink should be inserted in one end, with a cover if possible, and there should be provision for water, electricity and gas.
4. Neck microphones for the teachers would probably be ideal.
5. One of the cameras should be capable of extreme close-up work. A zoom lens would be useful on another.
6. For viewing experiments and specimens from above a tiltboard should be available as well as a mirror which can be fixed at 45^{o} above part of the desk.

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1 Costello, pages 75, 76.
2 Singleton, page 112.

Studio Audience and Feed Back

There are three big difficulties in the way of having a Studio audience drawn from pupils.

1. Transport and administration is very complicated.
2. The audience distracts the teacher's attention from the screen, so thet the television pupils feel they are only looking in on a class.
3. The audience gets in the way of the Studio personnel.

Yet without an audience the teacher has only his imagination to help him judge the participation of his pupils.

This situation would be improved if it is technically feasible, in decreasing order of effectiveness:

(a) for the responses of a class in one of the schools to be sent back to the Studio and heard by the teacher as well as transmitted with the lesson.

(b) if the responses from one class can be sent back and fed into an earpiece on the teacher.

(c) if, for very occasional use, a walke-talkie or direct line contact can be established between one monitor in the classroom and someone in the Studio.

AIDS

1. A photographic department close to, or incorporated in, the ETV Studio building is very desirable.
2. In the absence of a complete photographic department, a copying stand and facilities for developing should be easily available.
3. If an audio-visual centre is set up, there should be very close contact between it and the ETV Studios.

Viewing Conditions

The ideal conditions to aim at are generally:

1. The receiver should be 21" – 24".
2. Up to 22 children can be served well by each set.
3. No student should be closer than five feet, or further than fifteen times the width of the picture.
4. The set should be at least six feet above the ground.
5. It should be tilted slightly downwards.
6. The windows should be darkened. With the louvre windows many tropical schools have, the glass can be painted black.
7. Separate desks for the students are highly desirable.
8. The aerial wire should be out of the way of the students.

Maintenance of Receivers

1. The set must be kept locked when not in use.
2. The key must be in the building so that the absence of a class teacher does not immobilise the television reception.
3. Strict rules should ensure that there is a teacher present whenever the set is unlocked, and no student should touch the set.
4. If the conditions are humid, a bulb should be left burning in the bottom of the case or cupboard in which the set is stored, or sets should be left permanently switched on, brightness and sound controls being turned down when not in use.
5. Responsibility for maintenance of the sets must be clear. Often it is with the supplier of the sets or the ETV station.
6. The responsible technician should inspect the adjustment of the sets at regular intervals.
7. A number of spare sets should be kept as substitutes for cases of breakdown.
8. During holidays the sets should be withdrawn, if there is any danger of their theft from an empty building.

Finance

To establish a studio of any sort costs a lot of money. The trained personnel attached to it also represent important assets and both should be kept working to be worthwhile. If compelled to be idle by force of circumstances, they would represent a shocking wastage.

The first point to realise is that the unit should be as self-sufficient as possible. Repair facilities, means of making aids and of processing film should be on the premises. The same applies to the written matter — a duplicating machine and typewriter should be included in the establishment for this reason. As many of the skills and apparatus required as possible should be contained under one roof. Indeed the Studio might well be part of a National Audio-Visual Aids Centre, so that the skills can be shared by others.

Some materials are required for the running of the unit — film, chemicals, paper, duplicating stencils, boards and paint, for instance — and a healthy stock of these items must be kept and replenished as used.

However machines of all descriptions break down. The whole unit could be brought to a standstill if a television camera, film processing tank, or other piece of essential equipment failed, and money were not available for bringing them into commission again as soon as possible. It may cost e 'ot to order a vital spare part from overseas by air, but a reserve fund should be established so that this can be done at once to keep the unit working.

A mass medium should only be used for education if those in charge have faith in it and are determined to make it work or allow it to work. These systems represent a fairly large capital expenditure, and they can only be an economy in the long run if used the whole time. Apart from the financial aspects, there are bound to be many critical of their introduction, and forced inactivity because of inadequate provision at the beginning allows critics to do a great deal of harm, shaking the faith of those willing to give the methods a try.

With a fair trial the methods will almost certainly succeed handsomely, but it must be fair.

APPENDIX A

WEST AFRICAN EXAMINATIONS COUNCIL

SYLLABUS FOR FORM III EXAMINATION

GENERAL SCIENCE

The syllabus has been subdivided into three sections for convenience. It is intended to be taught as an integrated syllabus and not as a parallel set of courses in Physics, Chemistry and Biology.

BIOLOGY

Living and non-living things.

Flowering plant – parts of a flowering plant.

Flowers – parts of a flower and their functions.

Pollination – study of two simple flowers found locally.

Dispersal of fruits and seeds.

Germination of seeds.

Vegetative propagation.

Plant physiology – elementary study of Absorption, Conduction, Photosynthesis, Respiration, growth and tropic movement.

Simple study of Fish, Amphibie and Birds.

Insects – external features, life history of the mosquito.

PHYSICS

Volume and Density.

Air pressure – Barometers and pumps.

Heat and expansion.

Transmission of heat.

Temperature and Thermometers – Scales of Temperature and Conversion.

Rectilinear propagation of light, shadows, eclipses and the pin-hole camera.

Introduction of laws of reflection.

Magnets and Polarity – Properties of Magnets.

Methods of magnetising and demagnetising.

Properties of iron and steel.

Electromagnets and their uses – Electric Bell.

Simple voltaic cell – Dry Leclanché cell.

Introduction to sound – production, transmission, pitch and frequency.

CHEMISTRY

Chemical and physical changes.

Elements, compounds and mixtures.

Air – constituents – composition by volume.

Air – a mixture – burning and rusting.

Air occupies space – has weight.

Preparation, properties and uses of gases found in air.

Combustion of elements in air.

Solution and solubility, Filtration, Distillation.

Evaporation and Crystallisation.

Water – Natural Sources – impurities – hardness of water – water of crystallisation.

Reactions of metals with water – Test for water.

Acids, bases and salts.

Calcium carbonate – mineral forms, quicklime and slaked lime.

Differences between metals and non metals.

Hydrogen – preparation, properties and uses.

The paper will be in two parts consisting of an objective test and a choice of three other questions. Candidates will be advised to spend not more than 40 minutes on the objective test. Time allowed – 1¾ hours.

APPENDIX B

PAPERWORK FOR 3C1

INSTRUCTIONS TO MONITORS

For week beginning September 25th 1967.

MONDAY	September 25	3C1	Magnetism 1
TUESDAY	September 26	3O1	Calcium Carbonate
WEDNESDAY	September 27	3M1	Birds
THURSDAY	September 28	3O2	Quicklime, Slaked Lime and lime water.

Please issue lesson sheets at the beginning of each lesson and work sheets as the transmission ends, unless special instructions to the contrary are given below.

If there is a complication at your school which will prevent your class receiving the lesson, please notify Mr. Hoare, at the Department of Education, 6312. Also he should be told if any papers seem to be missing or there is any other query.

Once the programme has started, if reception is hopeless hand out work sheets, and ring the Studio 3997 and Bahsoon's 2039.

SPECIAL INSTRUCTIONS:

3C1 The following will be needed:

1. Two bar magnets
2. A piece of soft iron
3. A glass rod
4. An ebonite rod
5. A stirrup for hanging each of the above in so that it is free to turn
6. A quantity of iron filings.

3O1 Please obtain the following:

1. 6 small test tubes
2. A cork carrying a delivery tube. The cork should fit into the test tubes.
3. Some dilute hydrochloric acid.
4. Some lime water.
5. One or two test tube racks to hold the six test tubes.

These should be set on a table at a convenient spot from where the screen could be seen so that the pupils performing the experiments can be instructed.

Some marble, chalk, limestone and acid should come with this.

302 Please obtain the following:

1. 2 crucibles.
2. Some quicklime, unless some comes with these papers.
3. Some water in a 250 cc. beaker.
4. A test tube.
5. A short piece of glass tubing.

In case of difficulty please inform Mr. Hoare (6312) as soon as possible.

DIRECTOR'S NOTES

3C1

1. MAGNETISM

Presented by

Edmund Cole

---

2. TEACHER

What is a magnet?
Recognised by what it does.
Experiments in class
(1) Magnet. Does it attract iron filings?

I will do it here as well

---

3. EXPERIMENT

Magnet and Iron Filings

Fill yes or no on your lesson sheet

---

4. TEACHER

Now with non-magnet 1

Does it attract iron filings?

---

5. EXPERIMENT

Glass rod and iron filings

Let's try another non-magnet

---

6. TEACHER

Second material

I'll do this here

7.	EXPERIMENT	non-magnet 2 Now you can fill in the rest of the first column
8.	TEACHER	Another experiment Put the magnet in the holder and let it swing I'll do it as well
9.	EXPERIMENT	Magnet in stirrup Does it set in one direction?
10.	TEACHER	Fill in lesson sheets Incidentally direction is North and South Now first non-magnet I'll do it too
11.	EXPERIMENT	Non-Magnet 1 Fill in the space on your lesson sheets
12.	TEACHER	Non-Magnet 2 If you can't see clearly I'll do it too
13.	EXPERIMENT	Non-Magnet 2 That should fill the last space in your table 1

14. TEACHER

Seen experiments
What conclusions?
From first column? No. 1.

Pause 20 seconds

Cue teacher

You should have written something like this

---

15. SLIDE

A magnet attracts pieces of soft iron

Teacher reads twice

---

16. TEACHER

Second column gives second conclusion

Pause 30 seconds

You should have said something like this

---

17. SLIDE

A magnet points North and South when it hangs freely

Teacher reads twice

---

18. TEACHER

First discovered by Greeks
Lodestone

We'll do these with a lump of lodestone

---

19. EXPERIMENTS

1. With pins
2. In stirrup

Here we have a natural magnet

---

20. TEACHER

Now rub magnet in iron filings
Are the filings equally spaced on the magnet?

You may see it better if I do it.

---

21. EXPERIMENT

Magnet and iron filings

The places where the filings cling thickest
are called the 'poles' of the magnet .....

---

22. TEACHER

Two poles. Are they the same sort?

Let's support the magnet again.

---

23. EXPERIMENT

Mark north-pointing pole with chalk. Call north-pointing pole the NORTH pole. Do same with second magnet.
Two norths together
What does one observe happening?
Write in lesson sheets. Other experiments

You should have filled in all four cases now

---

24. TEACHER

What can you conclude from these experiments?

Pause 25 seconds

Cue teacher

You should have written this

---

25. SLIDE .

Like poles repel:

Unlike poles attract:

After reading with students cut to

---

26. TEACHER

All
Repeat Experiments

Goodbye

LESSON SHEET

25th SEPTEMBER, 1967.

3C1

Table 1. Observations

	Iron Filings?	One Direction?
Magnet		
Non-Magnet 1		
Non-Magnet 2		

Conclusions.

1. A magnet .....

2. A magnet .....

when it .....

Table 2.

Two poles	Attract/repel
North – North	
North – South	
South – North	
South – South	

Conclusion

Like poles ..... : Unlike poles .....

WORK SHEET

3C1

A REMINDER

Experiments seen in lesson which can be repeated if there is time before the end of the lesson.

Only the magnet picks up iron filings.

Only the magnet always points North and South when freely suspended.

The like poles repel, unlike attract.

COPY INTO NOTES

MAGNETISM

Two basic Properties of Magnets

1. A magnet will attract pieces of soft iron;

2. If it is freely suspended will point North and South.

The attractive forces are not distributed evenly through the magnet, but are concentrated at the "poles". The poles are always found in pairs.

The north-pointing pole is simply called the north pole of the magnet, and the pole that points south the south pole.

LIKE POLES REPEL, UNLIKE POLES ATTRACT

Have you a magnet at home? Have you a pocket compass? See how the compass behaves near the magnet.

How many pins can your magnet hold? Do all the pins have to touch the magnet or can they hang in a line below the magnet?

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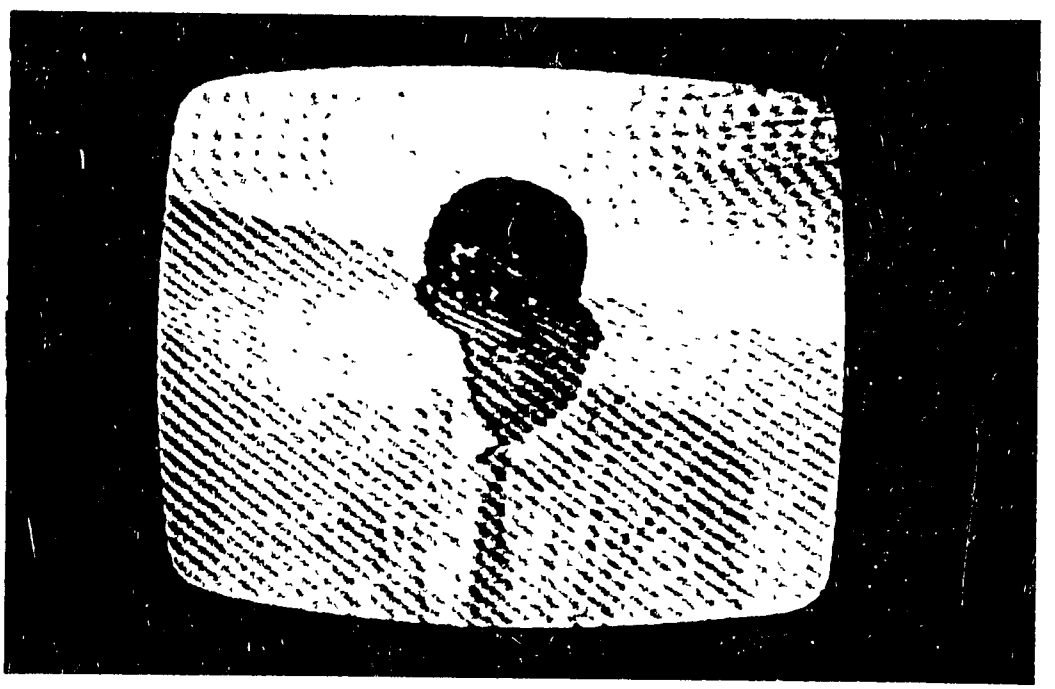
Mr. Arnold O'Brien, who taught most of the television lessons, sitting at the Studio desk.

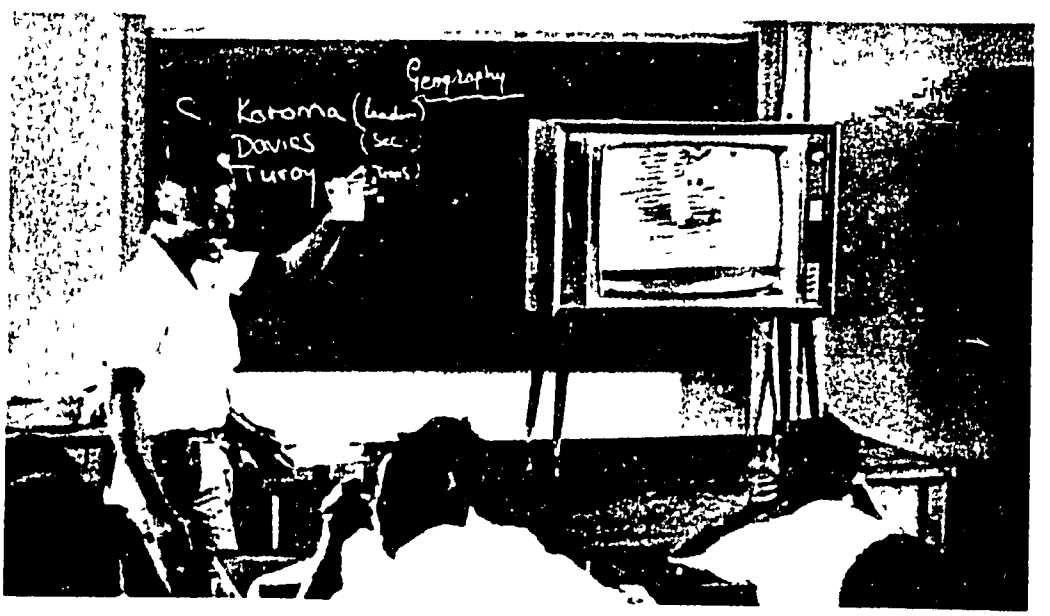


How he appeared when the vision interference was bad at F.S.S.G. The "herring-bone" pattern of interference was bad at three schools usually — M.G.H.S., Secondary Technical and F.S.S.G. — but particularly so at F.S.S.G. before the aerial was moved.

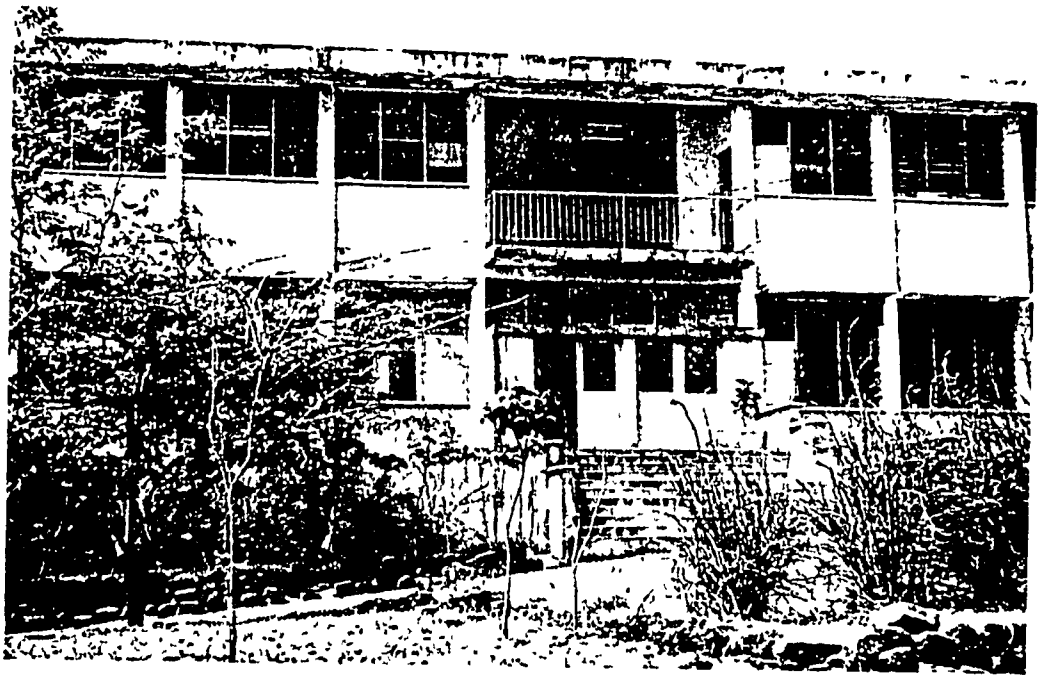
Government Secondary Technical School.

The desks were stepped up and all the students had a perfectly clear view. However the desks at the back were rather hot and airless.

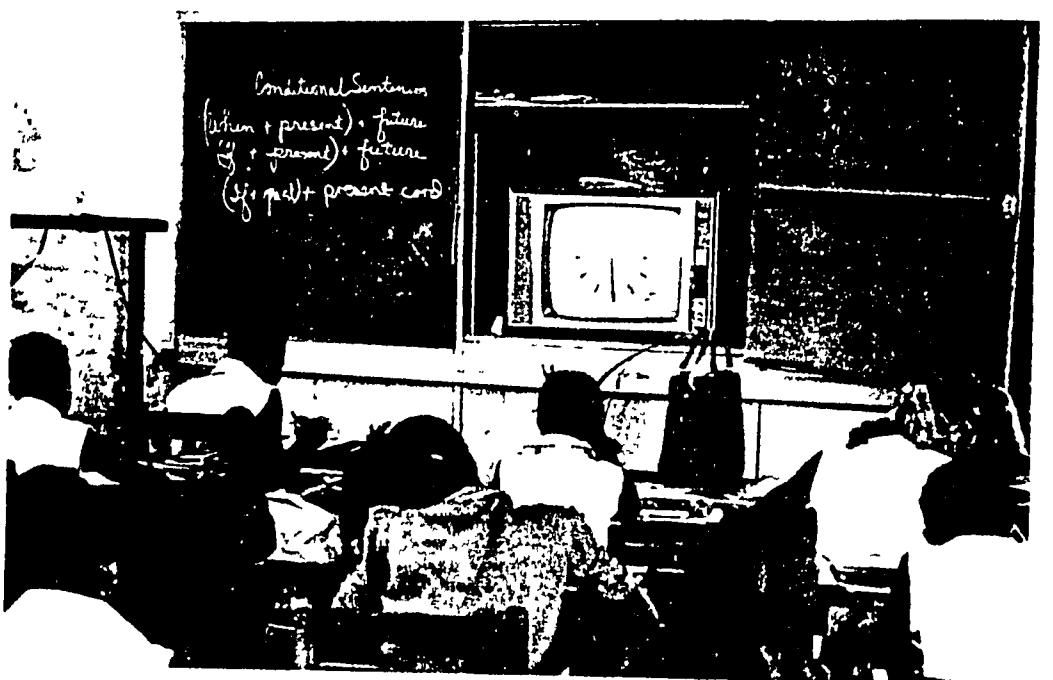
Mr. Edmund Cole teaching a Physics lesson in the Studio.



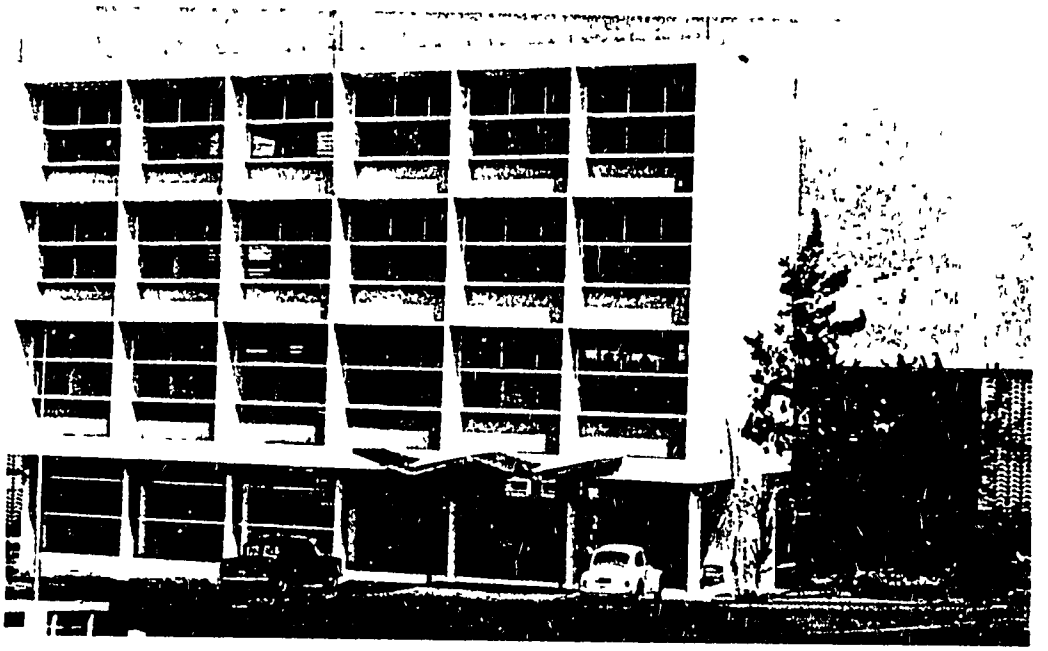
Success! A student called up to do the experiment in the classroom shows the results to his form at the same time as it appears on the screen. His demonstration is in three dimensions and colour, and avoids the interference pattern and picture slipping of the one on television.



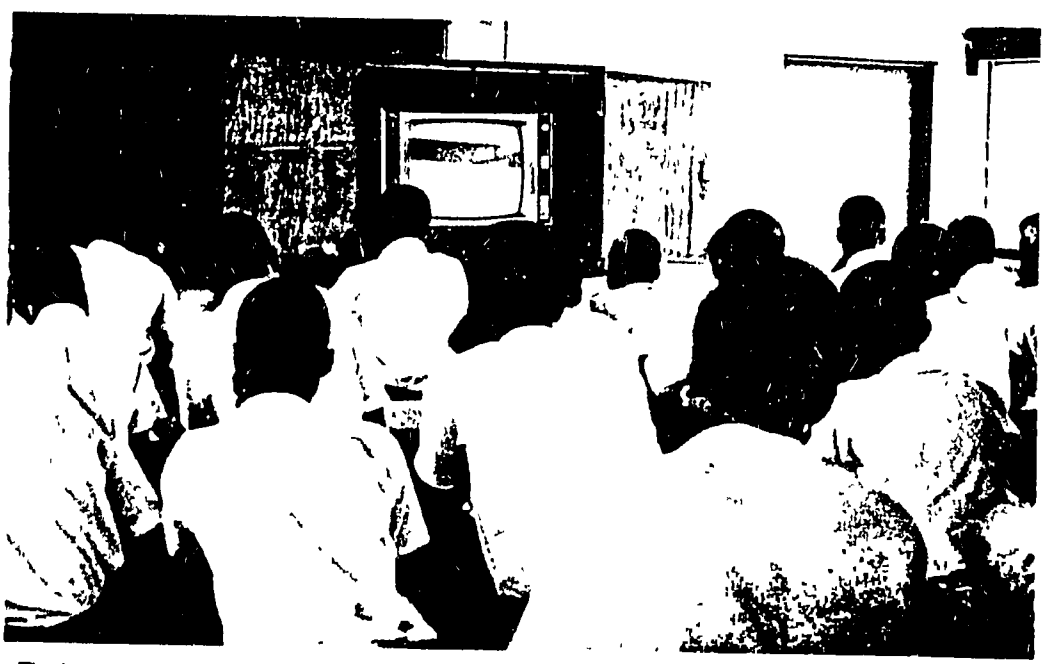
Methodist Girls High School.



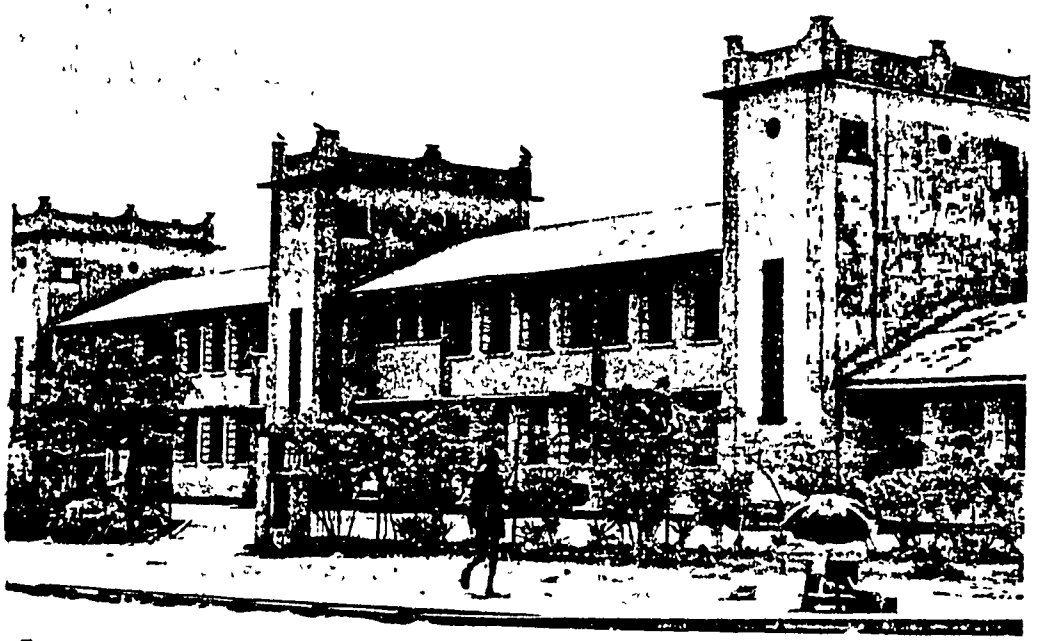
The set was well placed, but a bit low. When the students had a long task, for instance several test questions, the screen showed a clock in the Studio.



W.A.M. Collegiate School.

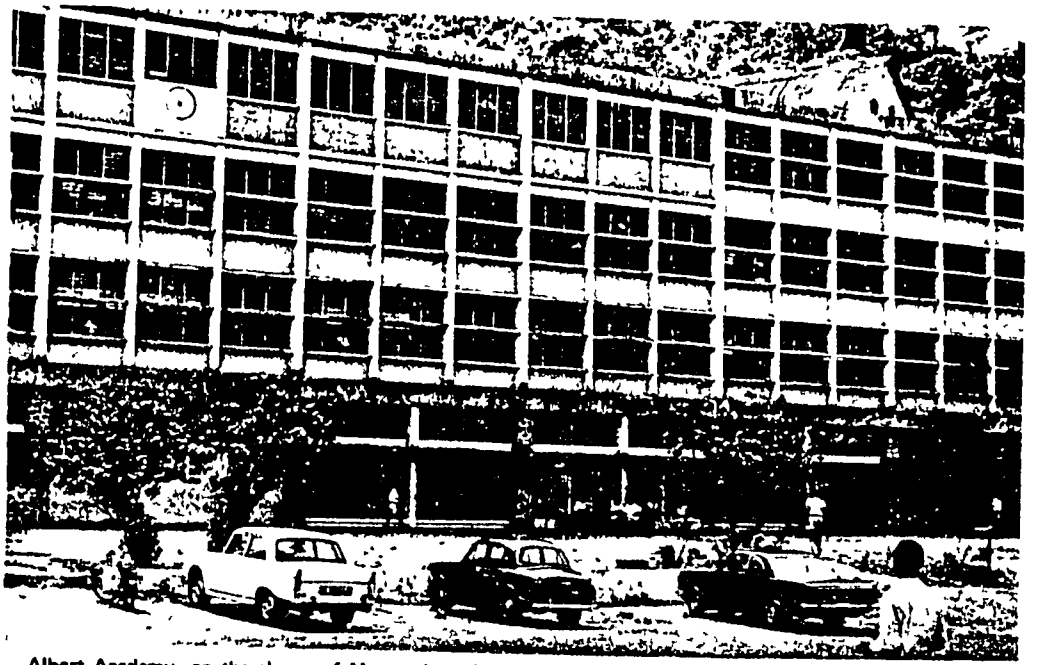


The boys were on laboratory stools in rather uncomfortable conditions. However one of the worst troubles was the reflection on the screen of the wide windows. No successful attempt at cutting out the light was made, and the formroom was much too light for clear viewing.

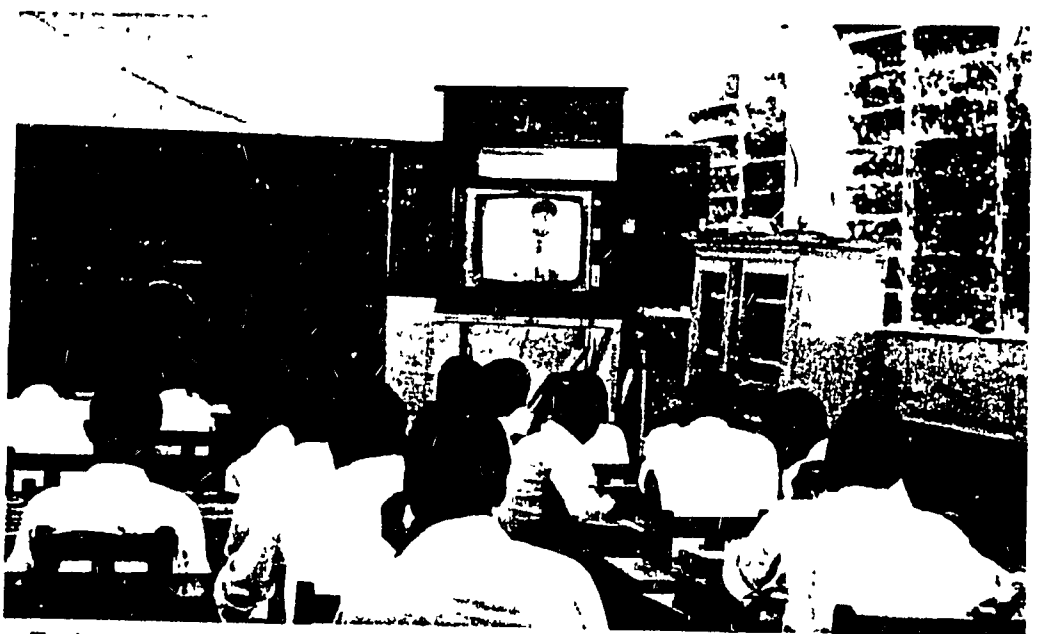


Freetown Secondary School for Girls. The aerial was finally moved to the top of the tower on the right: for more than a year it had been fixed a few feet above a corrugated iron sloping roof.

The familiar "herring-bone" interference pattern can be clearly seen. The blacking out was sufficient, with curtains, but the set was too low for many students to have an uninterrupted view.



Albert Academy, on the slopes of Mount Aureol.



The louvre windows were painted with blackboard paint. This proved very effective and darkened the room adequately, but it did get rather warm.