Audio-visual aids in higher scientific education : report of the committee appointed by the University Grants Committee, the Department of Education and Science, and the Scottish Education Department in February, 1963.

Contributors

Great Britain. University Grants Committee
Great Britain. Department of Education and Science
Great Britain. Scottish Education Department

Publication/Creation

London : Her Majesty's Stationery Office, 1965.

Persistent URL

https://wellcomecollection.org/works/b8zquv3r

License and attribution

Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
https://wellcomecollection.org

UNIVERSITY GRANTS COMMITTEE
DEPARTMENT OF EDUCATION AND SCIENCE
SCOTTISH EDUCATION DEPARTMENT

AUDIO-VISUAL AIDS IN HIGHER SCIENTIFIC EDUCATION

LONDON:
HER MAJESTY'S STATIONERY OFFICE
PRICE 11s. 0d. NET

UNIVERSITY GRANTS COMMITTEE
DEPARTMENT OF EDUCATION AND SCIENCE
SCOTTISH EDUCATION DEPARTMENT

Audio-Visual Aids in Higher Scientific Education

Report of the Committee appointed
by the University Grants Committee,
the Department of Education and Science and
the Scottish Education Department
in February, 1963

LONDON
HER MAJESTY'S STATIONERY OFFICE
1965

DR. BRYNMOR JONES, (Chairman),
Vice-Chancellor of the University of Hull.
MR. G. BARCLAY,
Vice-Principal, Moray House College of Education, Edinburgh.
PROFESSOR A. L. D'ABREU,
Professor of Surgery, University of Birmingham.
PROFESSOR M. W. HUMPHREY DAVIES,
Professor of Electrical Engineering, Queen Mary College, University of London.
MR. D. J. JOHNSTON,
Adviser to Teachers, Institute of Education, University of London.
PROFESSOR H. LIPSON,
Professor of Physics, Manchester College of Science and Technology.
PROFESSOR E. W. PARKES,
Professor of Engineering, University of Leicester.
MR. C. W. TONKIN,
Vice-Principal, Battersea College of Technology.
PROFESSOR C. M. YONGE,
Regius Professor of Zoology, University of Glasgow.

Assessors:

MR. H. W. FRENCH, H.M.I.,
Department of Education and Science.
MR. R. C. GRIFFITHS,
University Grants Committee.
MR. A. J. MEE, H.M.I.,
Scottish Education Department.
MR. R. E. OVERBURY,
Department of Scientific and Industrial Research.

Secretaries:

MR. D. M. BASEY,
Department of Education and Science.
MRS. E. W. CAHAN,
University Grants Committee.

TABLE OF CONTENTS

PART THREE

FINANCE AND SUMMARY OF RECOMMENDATIONS

GLOSSARY

This list states briefly the sense in which we have used terms or abbreviations which may cause difficulty to the general reader. We have included cross references to terms more fully explained in the text of the Report.

AMPLITUDE MODULATION (A.M.)

A method of modifying a radio-frequency carrier wave, to enable sound and/or vision signals to be conveyed, by varying its *amplitude* in accordance with the sound or vision signals.

BRANCHING PROGRAMME

A form of programmed instruction in which at the end of each unit (or frame, *q.v.*) a question is asked and several possible answers are offered, each answer leading the student to a different part of the programme (para. 358).

CASSETTE-LOADED PROJECTOR

An instrument designed to project short films in loop form. When the cassette is inserted into a slot in the projector the film loop can be started and allowed to repeat itself as required (para. 254).

CLOSED-CIRCUIT TELEVISION (*cctv*)

The transmission of television signals to a restricted audience by means of a cable or microwave link between transmitter and receiver (para. 264).

DIASCOPE

An instrument which projects still pictures on to a screen from a picture in the form of a transparency (para. 235).

EPISCOPE

An instrument which projects still pictures on to a screen from an opaque picture or flat object.

EPIDIASCOPE

A combination of the diascope and episcope.

FRAME

A term used in programmed instruction to denote the unit of instruction.

FREQUENCY MODULATION (F.M.)

A method of modifying a radio-frequency carrier wave, to enable sound and/or vision signals to be conveyed, by varying its *frequency* in accordance with the sound or vision signals. (In general this method suffers less from interference than A.M.).

HEADSET

A combination of earphones and microphone in one piece of equipment.

INCOMPATIBILITY

In relation to video-tape recorders this term is used where tapes are not interchangeable between recorders.

KINESCOPE

A device which produces a filmed record of a television broadcast which can be shown subsequently by means of a conventional film projector.

LANGUAGE LABORATORY

See Chapter 9.

LINEAR PROGRAMME

A form of programmed instruction in which each unit (or frame) of the programme is small and so simply presented that wrong answers are rare, and in which the student progresses successively from one frame to the next (see para. 354).

MICROPROJECTOR

An instrument which projects highly-magnified pictures of microscopic objects on to a screen.

MICROWAVE LINK

A precisely-directed radio link between transmitter and receiver in closed-circuit television, using frequencies of about 10,000 megacycles per second.

OPEN-CIRCUIT TELEVISION (*octv*)

The broadcast transmission of television signals to an unrestricted audience (para. 264).

OVERHEAD PROJECTOR

An instrument which projects pictures on to a screen from large transparencies placed horizontally.

RADIO FREQUENCY

When television picture signals are to be transmitted a distance of more than 1,000 ft., video-frequency signals are not satisfactory. The pictures are accordingly carried on a much higher radio or carrier frequency which may vary in practice from tens to thousands of megacycles per second.

REMEDIAL LOOP

A term used in programmed instruction to indicate a series of supplementary or corrective frames in a branching programme to which a student may be directed when his response to a previous frame shows that he needs additional information or guidance.

SCRAMBLED TEXT-BOOK

A form of programmed learning presentation particularly associated with 'multiple-choice' programmes in which the instructional sequences each occupy a page, but successive sequences do not appear on consecutive pages.

SINGLE-CONCEPT FILM

Generally an 8 mm film of short duration (up to 4½ minutes), in the form of a continuous loop in a cassette, which deals with a single educational concept and is normally silent, the teacher giving his own commentary (see cassette-loaded projector).

TEACHING MACHINE

A mechanical device for presenting instructional material, called a programme, which permits a student to progress at his own pace. The programme may be on paper or on film and the machine is designed to take a particular format of material. In general, machines accepting paper programmes are simple and cheap; those using film material are more complicated and expensive, particularly if they handle 'branching' programmes rather than 'linear' programmes (para. 362).

TELECINE

An apparatus for coupling a film projector to a television camera so that films can be shown over a television system.

VALIDATION

A term used in programmed instruction to cover the many testing and amending stages through which a programme must go during its construction (para. 356).

VIDEO FREQUENCY

The composite picture signal in television involves a range of radio frequencies from zero to about five megacycles per second. These are known as video frequencies.

VIDEO-TAPE RECORDER

An instrument which records television signals on magnetic tape. The tape is available for play-back through a television system immediately the recording is completed (paras. 324–325).

INTRODUCTION

1. We were appointed in February, 1963, with the following terms of reference: 'To survey the current use of audio-visual aids in teaching and research in the pure and applied sciences in institutions of higher education in Great Britain and, taking into account their use in similar fields in comparable institutions in selected countries overseas, to assess their potential usefulness and possible lines of development in Great Britain; and to report'.

2. In order to obtain at the outset as much information as possible about the use being made of modern aids in higher education in Great Britain, and to ascertain the interest taken by academic staff in these communication media, a questionnaire was circulated in March, 1963, to the universities and to other establishments of higher education. A summary of the results of this survey appears in Appendix 2.

3. Visits were made to a number of educational and other institutions. The choice was based partly on the answers given to the questionnaire, and partly on information gathered from various other sources. Details are given in Appendix 3. Members also attended several conferences where the use of modern communication media in higher education was under discussion.

4. Evidence, both oral and written, was received from representatives of national organisations in the educational field, from academic staff, from individual experts in communication, from students, from the trade, and from the Fulbright visiting professors from the United States who specialise in audio-visual methods of communication. We also received information concerning the position in France, Japan and Russia. The complete list of those who gave evidence to the Committee will be found in Appendix 1.

5. In order to see examples of the work being done in Europe, we visited the Institut für den Wissenschaftlichen Film at Göttingen in Germany, and the Technische Hochschule at Aachen. An assessment of what was seen and discussed at both these institutions is given in Chapter 3.

6. In view of the great progress made in America in communication media, the Chairman and four members went to the United States in March, 1964. Visits were made to a number of national organisations, universities, technical and teacher-training colleges, and to experts in specialist media as shown in Appendix 3. An account of what members saw in the United States and some comments can be found in Chapter 3.

7. In accordance with our terms of reference, Part 1 of the Report shows the present position with regard to the use made of modern aids, both in Great Britain and overseas, together with a survey of the existing arrangements for the co-ordination of expertise, research and information. Part 2 contains a description of individual aids, with an assessment of their value and recommendations for their use in higher education; together with chapters on proposed local and central units, their organisation and function, and on provisions for training both of teachers and technicians. Part 3 gives a summary of our recommendations, and includes an assessment of their financial implications.

8. Although language laboratories would not seem to be pertinent to the work of a Committee which is limited to the pure and applied science disciplines, because of the need for science students to read texts in languages

other than English, we decided to include language laboratories in our survey and our findings are in Chapter 9.

9. We were appointed before the changes which followed the publication of the Robbins Report, and we therefore refer throughout our Report to the colleges of advanced technology, the central institutions and the training colleges in these terms.

10. We have held meetings on 36 days.

11. We now submit our Report.

PART ONE: THE FACTS

CHAPTER 1

THE EVOLUTION OF MODERN AIDS

12. The pace of the technological revolution of our time and the closely related developments in communication are such that any attempt at a full discussion of the evolution of modern aids would be out of date by the time it were printed. In these circumstances it seems inappropriate to attempt a complete account of the evolution of every aid with which the Report deals. It may nevertheless be of value to point out some of the phases in this process.

13. The audio-visual aids dealt with in this Report are aids to communication. In the context of higher education they are aids to learning, to teaching, and in some cases also to research.

14. From the earliest times in western civilisation to the Renaissance, communication by teachers was oral. It was supported by libraries of manuscripts and incunabula. Oral communication has always been, and in some circumstances is today, supported by physical demonstration. The teacher has from time immemorial been able to say 'Do it like this' and the learner has been able to apprehend a completed physical movement. When an operation to be imitated is so complex that its component parts can be identified, demonstrations first of each part and then of the whole have helped both teachers and learners.

15. Oral description was probably first supported by three-dimensional models, or by two-dimensional illustrations of more complex movements or relationships. These aids were used first by those teachers who understood something of their students' difficulties in learning. Initially their use required the learner to be in the presence of his teacher. With the production first of manuscripts, and later of books, illustrations were eventually incorporated in the text in the form of line drawings, lettered and figured diagrams and later still photographic reproductions. At this stage the learners could be remote in both place and time from the teacher and as a result their numbers increased greatly.

16. Outside the formal educational setting so far implied, 'teachers' throughout the ages have influenced conduct and behaviour by presenting even to largely illiterate followers verbal and visual embodiments of abstract, moral, ethical and religious principles. The visual presentation of abstract qualities in narrative sequences has ranged from elaborately-carved rood screens to cycles of Mystery Plays. Some of the greatest artists—including those painting before perspective was understood—succeeded in offering to a mainly illiterate public a pictorial interpretation of moral abstractions.

17. The academic has rightly tended to revere the book and has accepted it as the means for recording original thought and as the epitomiser of knowledge. It is argued that the ability to record on discs, magnetic tapes, films and video-tapes is simply an extension of this facility. As a mode of fixing

expression it is as much the property of the scholar and teacher as is the use of the printed word. The most recent developments involve record players, tape recorders, language laboratories, radio and television sets as well as still and moving pictures with or without accompanying sound. They have been harnessed by those anxious to communicate with their fellows in order to provide entertainment, instruction, and education and also, of course, to further political or commercial ends. The academic has tended in the past to be suspicious of them for a number of reasons. He may have been so busy and preoccupied with books and with learning that he has been denied any real opportunity to assess and to enjoy them. He may fear that they intervene, as books do not, in the interplay between personalities. He may even believe that they are less accurate than printed or spoken words as means of communication. He may be convinced that their use demands a technical skill he does not possess. He may doubt that there is any aid either to learning or to teaching; in short he will teach as his teachers taught him and his students will learn as he did.

18. Audio-aids may logically be considered as fitting into the same kind of communication as books. Instead of a graphic symbol on a page being converted into a connotation and carrying, incidentally, the equivalence of sound, the indentation on a disc or the magnetic or optical reorganisation of particles on an emulsified tape can be converted into sounds which communicate meaning. Thus discs, broadcasting techniques, tapes and films can as properly be used by academics as books. Indeed, there are obvious cases in which society as a whole, as well as special interests within society including the academic, may find that there is an intrinsic economy in the use of audio-aids.

19. A visual aid enables a teacher to present at will a pertinent illustration large enough for a class of students to see easily. There are three main types of visual aids: those which are attached to some flat surface like a pegboard, a blackboard or chalkboard, magnetic or simple, or to a clinging material as used in a flannelgraph; those which use some source of illumination and lens system, and sometimes a mirror, and which project a picture on to a screen in a darkened, partially-darkened or normally-lighted lecture room; and those which present the required picture on a television monitor screen, or on a number of monitors simultaneously.

20. The first kind of visual aid may result in the presentation of a prepared diagram or picture, to which the lecturer may add additional details or superimpose transparent layers. It can be introduced when required, removed easily, or retained indefinitely, long after the oral references to it have been made. Projected images increasingly originate on film; diascopes and overhead projectors either use illustrations selected by the lecturer or project his own writing or drawing. The picture seen on a television monitor almost invariably demands the use somewhere of a television camera. Projected images may be of still photographs or of diagrams or they may be of moving pictures as in films or on television monitors.

21. Visual aids may illustrate a reference and sustain an elucidatory picture through a lengthy oral exposition. A dynamic theme presented on a television screen may support an argument as clearly as speech, the printed word or recorded sound. This view of the controlled and disciplined utterances of

film and television may lead to the realisation that these media have a significance for us comparable with that of El Greco, Titian and Michael Angelo in a much less literate world.

22. During this century audio-visual teaching aids have made three main advances. The first was the result of a near revolution in illumination—from the earliest use of gas in a magic lantern to the fan-cooled lamp house of a modern electric projector. Images are clearer, the apparatus is neater and present-day teaching techniques have enveloped the aid more completely than early advocates of the 'illustrated lecture' could have foreseen. The second major advance was in the educational application of film. The technique of communicating movement, triumphantly showing the departure and arrival of a train, rapidly advanced into a special branch of entertainment and teachers were not slow to realise how the dynamic element both in physical movement and in the growth of ideas could be communicated on film. The use of time-lapse and slow-motion photography revealed further educational application and the sound film, the use of colour, and the magnetic striping of sound track added additional stimulus. The electronic revolution is responsible for the third leap forward. Communication has been almost completely reshaped by the application of electronics. The academic possibilities here, however, remain largely unexploited.

23. These developments may also be used to illustrate the ways in which audio-visual communication is expanding and growing. Clearly, as with manuscripts, palimpsests and books, the use of increased illumination, film and television leads to an increase in the size of the possible audience. This may well have consequences both upon the internal organisation of higher education and upon the general dissemination of learning.

24. Although there remains a tentative element in broadcast television and a measure of experimentation in *cctv*, the best exponents of these media are convinced that they have raised the efficiency of communication almost in proportion as they have increased their audiences. The skill and expertise in the presentation of some programmes rest on especial care in preparation, meticulous selection of relevant data, and on an understanding of the educational load as well as the pace required in a particular unit of communication. The required follow-up also weighs with those who plan and execute such programmes. These are all elements which the conventional lecturer undoubtedly also considers. Yet those who communicate through film or television are encouraged by the knowledge that most of those who view their work have already a considerable experience of viewing. They rely to some extent on the 'picturacy' of their audiences almost as an author does on the 'literacy' of his readers. This is an additional factor which the academic has to keep in mind: any group of students today will tend to be almost as 'picturate' as they are 'literate' and will be more accustomed and probably more receptive than their mentors to visual communication.

25. With the increase in the size of audiences and the improved efficiency of communication has come a growing complication in the apparatus, in its installation, and in its use. The types of aids which are being developed for educational purposes tend toward group rather than individual use. It is unlikely that the individual student will have his own *cctv* system; the institution on the other hand may use such an installation not simply for primary

communication. It may, and probably ought to, plan to use such developed aids to record and so to establish a library and to discover archival possibilities in the most significant work now being presented. Ultimately the use of video-tape recorders may revolutionise the preparation of text-books. In much the same way retrieval techniques in existing libraries may be radically modified by the application of *cctv*.

26. It is difficult not to believe that the communication of ideas can be greatly helped by the use of audio-visual aids. A mode of communication which makes both an aural and a visual appeal, with the lecturer selecting the aid most helpful to him and to his students, promises to be more successful than simple oral communication.

27. This Report deals with each of a number of aids in turn. The information it offers clearly shows that conventional aids (films, filmstrips, slides, epidiascopes, tape recorders) are in wide use but there remain, sometimes even among their users, many lecturers who do not realise the full potentiality of these aids. The newer aids, including television, *cctv*, overhead projectors, 8 mm loop projectors, language laboratories, video-tape recorders and teaching machines, are slow in winning acceptance although they may ultimately prove to be far more valuable than traditional aids used at present.

CHAPTER 2

THE POSITION IN GREAT BRITAIN

28. The Committee's first task was to find out the extent of the use of audio-visual aids in Great Britain and with that aim in mind a questionnaire was sent in April, 1963, to all universities and colleges of advanced technology, to training colleges and to some of the larger technical colleges. The questionnaire was designed to discover the *variety* of aids used by different departments but not the *number* of individual aids possessed. Our enquiry was therefore qualitative rather than quantitative in nature.

29. The response was good: in all, 1,137 questionnaires were completed by science and technology departments of universities, colleges of advanced technology, central institutions and technical colleges, and by university departments of education, institutes of education, training colleges and, in Scotland, colleges of education.

30. In this Chapter we deal in general terms with our enquiry. The results are shown in the tables of Appendix 2. In later chapters individual aids are dealt with in greater detail.

RESULTS OF SURVEY

31. When the information from the questionnaires had been tabulated it showed a greater use of aids than had been expected. Their range was so wide that it was not feasible for all of them to be shown in the tables. These have therefore been restricted to the better-known (but not necessarily more widely-used) conventional aids, and to some of the more specialised and newer aids.

Universities

32. A substantial proportion of departments in the universities possessed the more conventional aids—epidiascope, tape recorder, 16 mm film projector, filmstrip projector, slide projector, still camera and cine-camera (Appendix 2, Table 2). The proportion of those using a particular aid varied from 24 per cent (cine-camera) to 68 per cent (epidiascope). The use of the newer aids—closed-circuit television, video-tape recorder, language laboratory, 8 mm cassette-loaded projector, overhead projector and teaching machines—was, however, very slight. Of these closed-circuit television was used most, in 8 per cent (63) of the departments. The pattern of use for research was broadly the same as for teaching, but on a smaller scale. As was to be expected the aid most widely used in research was the still camera.

Colleges of advanced technology, technical colleges and central institutions

33. In colleges of advanced technology use of conventional aids for teaching was similar to that in universities but appreciably more use was made of the newer aids. For example, overhead projectors were used in 11 per cent of departments, language laboratories in 12 per cent and *cctv* in 17 per cent. In research, the still camera was again the most-used conventional aid, and,

among the newer aids, the value of language laboratories was being investigated by 11 per cent of the departments.

34. The same broad picture was true of central institutions in Scotland where, for teaching purposes, the most-used conventional and newer aids were the filmstrip projector and *cctv*. Among the departments of the five technical colleges we circularised a very high proportion used the epidiascope, filmstrip projector and 16 mm film projector, and over two-fifths of them used *cctv*.

University departments and institutes of education, training colleges and colleges of education

35. Conventional aids were used much more in teaching by the institutions concerned with education and with the training of teachers than by others. This also applied to the 8 mm cassette-loaded projector and to teaching machines and programmed learning. The tape recorder was said to be the most useful aid in research.

Type of department

36. The same situation that obtained in all types of institutions—substantial use of conventional aids but, with a few exceptions, little use of the newer aids—was also found in the different types of departments (Appendix 2, Table 1). After education, the figures for engineering and technology were generally higher than those for other faculties, even than for medicine, where our impression had been that as a faculty it had led the way in the use of audio-visual aids. But as has been pointed out in paragraph 28 the questionnaire did not enquire about the *extent* of the provision in individual departments: subsequent visits to various institutions showed that this can vary substantially from one department to another. In a number of the medical departments the standard of provision was very high indeed.

Utilisation of aids

37. The mere provision of aids is not in itself an adequate indication of their use, and in the questionnaire we tried to find out how often the various aids were used, and by what proportion of the teaching staff. The results are summarised in Table 3 of Appendix 2. There were wide variations in the answers received and several points of interest emerged. For example, departments differ greatly in the frequency of their use of the epidiascope and of the tape recorder and there is no clear pattern to be noted: the most frequent use of the slide projector was 'more than 30 times a term' and that of the 16 mm film projector only '3 to 10 times a term'. In the majority of departments using both slide and film projectors, slides were used by over 75 per cent of the staff—films by only about 50 per cent. This is no doubt due in part to the fact that the slide projector is more portable and is more easily operated than the film projector. Such a difference points to the need for teachers to be trained in the use of the more complicated aids. This aspect is dealt with in Chapter 11.

38. For 9 out of the 10 aids shown in Table 3 of Appendix 2 the most frequent reply was that the aid was used by less than 40 per cent of the staff. This too has implications which are discussed later in the Report.

39. There was a wide divergence of opinion in the answers to the question about the optimum size of class for a particular kind of aid. Apart from

projection aids, where the majority of replies favoured classes of 20 to 60 students, there was no unanimity. From some of the comments made it appears likely that, in answering this question, some lecturers were influenced by the size of class they normally taught. Nevertheless the replies indicated clearly that audio-visual aids can be used effectively for a wide range of audiences.

Increased provision

40. In order to find out whether or not the present provision was considered adequate, departments were asked to indicate what additional aids they would like to have. The replies are summarised in Appendix 2, Table 5, and, apart from showing a substantial and widespread demand, they reveal several interesting points.

41. More than 20 per cent of the replies indicated a desire for a film projector or a cine-camera, and about 12 per cent for a tape recorder. These were for teaching, but it is significant that the demand for these two pieces of equipment for research was almost as great.

42. Although the institutes of education and university departments of education, and over 90 per cent of the training colleges and colleges of education, already possessed film projectors, more than a quarter of the former and about a third of the latter expressed a desire for more projectors. In the majority of instances the existing machines used 16 mm film and a need was expressed for machines to show 8 mm film. Many institutions already possessed both.

43. The demand for some of the newer aids, in particular closed-circuit television, was proportionately very high. In all, no fewer than 331 institutions or departments want *cctv* installations for teaching. These include 228 university departments and 55 training colleges and colleges of education. If the demand were satisfied, taking into account existing installations, the prospective users of *cctv* would range from nearly a quarter (central institutions) to three-fifths (colleges of education) of the institutions or departments which completed the questionnaire. Moreover, nearly half of those who want *cctv* for teaching would also like to use it for research. It is clear that as far back as April, 1963, the value of closed-circuit television was becoming apparent throughout the field of higher scientific education.

44. Less than 10 per cent of those who completed questionnaires expressed a desire for the overhead projector, the language laboratory or the 8 mm cassette-loaded projector, whereas about 20 per cent expressed an interest in teaching machines and programmed instruction. In the institutions concerned with the training of teachers the proportion was very much higher. These newer aids are dealt with in more detail in Chapters 6 and 8.

EVIDENCE

45. This, then, was the factual background to the enquiry. The impression formed from it was that conventional aids were fairly generally available but that they were not used as often, or by as many members of the teaching staff, as might be hoped. The newer aids were as yet little used, and we suspect this might be attributed to a general lack of organised provision of these aids and to the natural conservatism of university and college teachers.

46. This conservatism was borne out particularly in the evidence received from the Association of University Teachers. They wrote:—

> 'With some notable exceptions among individuals and groups of enthusiasts, most university staff seem apathetic towards, and even unaware of the potential use of such aids at least of the more sophisticated kind: it is often assumed that their chief value and proper place are confined to elementary, secondary and, perhaps, adult education.
>
> Amongst those members of staff who are neither enthusiastic nor apathetic there is a great deal of (often, but not always, ill-informed) suspicion of "devices" and "machines" as substitutes for, and hence a threat to, the university teacher. Over the centuries the spoken and written words have been the main vehicles of university teaching, to which the older-fashioned visual aids—the blackboard, the printed diagram, and latterly the still photograph and the slide projector—have been mere adjuncts. Because of this the average university teacher thinks of the audio-visual aid as a useful but minor auxiliary to the lecture and seminar, and tends to overlook the arrival in recent years of audio-visual aids such as the film, closed-circuit television and the teaching machine, which are, or may be, media of communication in their own right.'

47. Although this is a severe criticism we became more and more aware during our visits that the development of audio-visual media was in effect in the hands of small groups of devoted enthusiasts. In most instances the enthusiast was working alone, and it was evident that if he were to leave his present department there would be no one left who would be qualified, or willing, or even interested to carry on the work. We saw some excellent material produced by these enthusiasts despite a scarcity of resources, and it became increasingly evident that special measures were needed to ensure that their energy and talents were used to the best advantage.

48. By contrast we saw several audio-visual aids sections which had developed beyond the initial stage of the lone enthusiast to a self-contained unit providing services for a whole department, a medical school or even a university, and here the benefit to the institution as a whole was very clear. It was from these experiences, and from our subsequent discussions during oral evidence, that our proposals for central service units and for a national centre arose. These are discussed in detail in Chapter 10.

49. Evidence was also given by representatives of the Association of University Teachers who stressed what was already apparent to us, that it was important to plan for the installation of audio-visual aids in the early stages of new building. This special aspect of the provision of aids has been given much prominence in the United States and is discussed briefly in Chapter 3. An investigation into the architectural implications of audio-visual aids in university lecture theatres is at present being carried out by the architects of the University Grants Committee and the results will be published early in 1966. We have not therefore dealt with this matter in detail but, in Appendix 8, we have pointed out some of the obvious requirements and have made a few practical suggestions.

50. One final point should be made in this Chapter. The figures derived from our enquiry in April, 1963, cannot, of course, truly reflect the position today. In the last two years interest in audio-visual media has grown steadily and

in several universities and colleges aids desired in 1963 are now in use. The growing number of conferences on audio-visual aids has helped to focus attention on their potential to such an extent that a number of universities and colleges have themselves set up committees to examine their use.

51. Nevertheless, we believe that the basic conclusions we have drawn up are as true today as they were in 1963. What we hope has been gained in the meantime through these various activities is a more favourable climate in which our recommendations may be viewed.

CHAPTER 3

THE POSITION OVERSEAS

UNITED STATES

52. Our itinerary in the States enabled us to visit some of the more progressive institutions recommended to us by the Education Department of the American Embassy and by the visiting Fulbright professors. For financial reasons our schedule was limited to approximately twelve days: a list of the places and institutions visited will be found in Appendix 3.

53. Although the use of audio-visual aids is more highly developed in the United States than it is here, several of those to whom we spoke said that their actual use was small in relation to their total potential. In the area we visited there was much suspicion of teaching aids, especially in the humanities, and many members of Faculty either knew little about the value of audio-visual aids or were disinclined to spend time on them. Of the aids which were used, television was said to be the most readily acceptable, no doubt because of its extensive use in American schools.

Television

Open circuit

54. In the United States, out of approximately 2,400 available very-high-frequency channels, about 700 are reserved for educational television. There are at present about 145 educational television stations, and the number is growing at the rate of about one per month. To quote from a Federal Communications Commission bulletin* of December, 1963:—

> 'Non-commercial E.T.V. stations serve a total area encompassing more than 110 million persons and reports indicate that over 30 per cent of the T.V. homes within the range of E.T.V. stations watch educational programmes. More than $50 million is invested in non-commercial E.T.V. stations and their operating costs exceed $20 million annually.
>
> Though the cost of constructing a high-power T.V. station usually exceeds $200,000, low-power E.T.V. stations have been built for from $50,000 to $70,000 depending on the extent of the equipment desired. E.T.V. authorities have been established in nearly every state, and more than half of the states have developed State E.T.V. plans. Many states support E.T.V. with appropriations. In addition, a score of state universities partially or wholly finance E.T.V. station operations. Financial assistance has been given by various Foundations. In some instances commercial broadcast stations and networks have donated funds and equipment to enable E.T.V. stations to get started.'

55. In addition to the considerable amount of educational television broadcast to schools and to the general public, about one third of the educational television stations broadcast courses for degree credits, organised by universities. The number of *bona fide* students receiving these courses, however,

* INF. Bulletin No. 16-B, December, 1963.

is small. For example, out of a receiving audience of 110,000–116,000 in New York for the 'Sunrise Semester', only 30–40 were matriculated university students. There is some attempt at personal contact between the university and its television students, and examinations are held in the university.

56. According to the Educational Broadcasting Division of the Federal Communications Commission at Washington, much of the educational television broadcasting from universities comes from the State Universities, and some of them broadcast a considerable number of their courses. Of the four-year course at Chicago Teachers' College, for example, the first two years is available on television, and with the additional help of tutorials, about 45,000 student credits have been obtained this way. Since the lectures are broadcast for only a few hours each day, it generally takes more than two years to complete the first half of the course. Comparative tests have shown that there is little or no significant difference between the results attained by these 'television students' and those attained by students who followed the conventional course at the College.

57. Two main reasons were given for the setting up of educational television stations by universities, first that they replaced extra-mural work, and second that they compensated in some measure for teacher shortage. Occasionally such a station enabled a university to enlarge its student population without new additions to its buildings.

58. Much of the university educational television work has been recorded on video-tape or on film available from three libraries at New York, Boston and in Nebraska. These libraries, which receive a grant from the Federal Government and revenue from hiring charges, are expected to pay for themselves eventually. Recorded lectures, particularly in foreign languages, do replace the teacher to some extent, and the teaching is often much better than can be found locally.

59. Open-circuit television has also been found to be of value for remedial purposes, for bringing students up to university level and for filling in gaps for those students who have missed part of a course.

60. It is generally accepted that both teachers and production personnel who take part in educational television should be trained to do so. To achieve this, there are both special summer courses and degree courses at the universities. Educational television is a new career and the students normally take a preliminary degree, majoring in a variety of subjects including speech, English, and economics. They then follow courses on the techniques of programme production; and some may carry out researches in the field of educational television.

Closed circuit

61. Comparatively few attempts have been made in the United States to link up universities by television in order to make wider use of the best teachers. Where it has been tried success seems to have been restricted by inter-university rivalry. It is more satisfactory where 'satellite' colleges (generally not offering the full university course) have been linked up with the main university.

62. Its most extensive use so far has been in medical schools, and in science and technology departments where clear demonstrations of operations, of

small and intricate objects and of detailed skills and techniques can be given to many students at the same time, or recorded for future use.

63. Where *cctv* has been used as a means of increasing the size of classes this has been done because of the shortage of staff, or because of the lack of large lecture rooms in sufficient numbers for a rapidly-expanding university. It was in the freshmen years that *cctv* was used most extensively since this was where congestion was greatest. Again experiments have shown that there is no significant difference in academic achievement between students who followed courses on *cctv* and those who attended conventional lectures. We were frequently told, as we had expected, that television lectures were usually better prepared than the conventional ones, and that by making use of a greater variety of aids the quality of teaching was improved. Varying estimates of the economics of television were offered, and the general view was that *cctv* does not save teaching time unless classes exceed 250 students, although this position could well change. Members of the National Education Association at Washington stressed that the production of a good university television lecture was very time-consuming and involved many hours of work on the part of academic staff in its preparation and presentation. We were told that it could take as much as 200 man-hours of work, but it should be borne in mind that much of the manpower involved is technical and that, once classes exceed 250, the time of academic staff may be saved.

64. Opinion in the United States seems to be divided as to whether the lecture should be given before a live audience or not. Dr. John Beeston, Director of the Academic Communications Facility, University of California, has found that many lecturers, especially when they begin to use this medium, insist on a live audience, but later, some, as they acquire confidence in the use of the new technique, are able to dispense with it. His own view is that when there is a group of students in the studio or in a lecture theatre with the lecturer, there is an almost compulsive tendency to talk to them and not to the camera, with the result that students following the lecture elsewhere feel left out. To many this disadvantage far outweighed the lack of student participation where there was no audience. Others would disagree with the view that students not actually in the studio feel left out, but this depends greatly on the personality and skill of the teacher.

65. It was generally agreed that it was necessary to choose lecturers for television teaching most carefully and, according to their aptitudes, to provide special training for this kind of teaching. Where we saw *cctv* in operation in mathematics and history, the lecture was immediately followed by discussion by smaller groups led by graduate students who had been previously briefed, with the lecturer himself visiting each group for a short time. In one case, each group was in the charge of a senior student, who answered questions at the end of the lecture and reported difficulties to the lecturer. A few systems had 'talk-back' facilities, but these appeared to be cumbersome in operation.

66. At the Walter Reed Army Medical Center in Washington, television facilities were available in three sections of the Center—the Armed Forces Institute of Pathology (AFIP), the Army Hospital, and the Army Institute of Research. All could be controlled from AFIP. Here the installation consisted of a studio, with three colour-T.V. cameras, associated control rooms, and links by cable with 100 receiving points in the hospital. There

were links too with other medical centres, the furthest of which was 15 miles away. The Center rented microwave equipment from the Telephone Company, who maintained it at a cost of about $100,000 a year. The system worked for thirty-six hours a week, using mainly taped material. Scripts were written by the doctors and many of the telerecordings were available for world-wide distribution, dubbed when necessary. The television staff consisted of five professional cameramen, six technicians and two maintenance men.

67. We were very impressed by the compactness and the economy of staffing at this installation. Although the fidelity of the colour was adequate it was not always good.

68. We were especially recommended to visit Pennsylvania State University to study its Division of Instructional Services, whose main function is to improve the quality and standard of instruction in the University. The work of the Division will be described more fully later in this Chapter (paras. 120–122) but much of it is concerned with television. This is mainly transmitted by cable, but broadcasts are also carried out over two microwave links. One of these is to a commercial station and the other to one of the associated junior campuses of the University, some 40 miles away. (During our visit we were told that the University had just received permission to set up an educational television station which would provide courses for credit.)

69. One of our most interesting experiences at Pennsylvania was to hear and see a lecture in first-year mathematics being given over *cctv* to a class of 600 students, half of the total class. The other 600 were being taught by conventional methods and students were allowed to choose whether they attended the television or the conventional lecture. The students who were following the lecture on *cctv* were in groups of 50 in 12 ordinary classrooms. In each room there was a graduate or a final-year student to answer questions or to help in post-lecture discussions. The lecture, which lasted for 50 minutes, was given by the professor in a studio with no audience other than two cameramen. After each lecture, 25 minutes were allocated to discussion.

70. Some history lectures were given in the same way. Again there was a senior student to lead the discussion, but here the professor himself visited each group in turn, joining in the discussion if he thought this desirable. Before each lecture he held a 'briefing' session with the discussion leaders. The professor stressed the importance of this preliminary session and of the visits which he paid to each group.

71. There have been a number of instances where a department has used television for a period of time and has then discontinued its use. This has been because of changes in personnel. In one instance a new head of department was appointed who was not in favour of television; in another a member of staff had left the university and the faculty had reacted against his practices. There were also several instances of faculty members who had been very successful with television having been attracted to another university, and the departments had been unable to find replacements who were enthusiasts and competent to teach by the use of television.

72. Aided by a grant from the Federal Government, the University has produced a film on the use of closed-circuit television in university teaching. The following is a summary of the statement made on the film:—

Television teaching was begun at the University in 1954, with three objectives in mind:

(a) to enable the University to cope with increasing student numbers;
(b) to improve the quality of instruction; and
(c) to find out in which faculties television could most effectively be employed.

73. Where experiments have been carried out to compare *cctv* with conventional lecturing subsequent tests have not revealed any significant differences in learning and retention. *Cctv* was found to be efficient, effective and economical for large numbers of students, and to have a stimulating effect on both students and lecturers. The latter prepared their lectures more carefully and made much more effective use of visual and other aids. *Cctv* also allowed the University to make the services of the most able teachers available to a wider audience.

74. The patterns of use of *cctv* at Pennsylvania State were illustrated in this film. Some courses were completely televised, others partly; for instance, some included two television lectures a week with a third period devoted to either practical work or discussion. A team of skilled television lecturers has been built up, each giving 6–8 lectures a week. The remaining time was devoted to the extensive preparation required and to research.

75. The film showed an example of a 'talk-back' system enabling the lecturer to answer questions from students in other rooms, question and answer being heard by students in all the rooms.

76. The advantages and disadvantages of a decentralised system of *cctv* within one university were discussed on the film. The advantages were said to be that a system located in their own building was more acceptable to the staff than an external broadcasting station, and that it was easy to add a studio to each new building. The disadvantages were the possible duplication of effort and equipment between various buildings and the difficulties of movement of technical staff. The reliability of the system was of primary importance.

77. We discussed this film with members of the academic staff. We were told that television capital investment at the University was $250,000 for three studio units and that it was necessary to have a large number of students to make the system economic. Although the system provided less flexibility in students' programmes than conventional teaching, it had enabled the University to expand without increasing the number of lecturers. The only additions were a number of final-year and graduate students who served as ancillary teaching staff. It was claimed that the quality of instruction was often improved.

78. Future development in Pennsylvania State University is to include:—

(a) increased wiring of buildings;
(b) broadcasting to schools; and
(c) video-tape recordings.

In addition a new lecture-hall system is being planned to make the fullest possible use of audio-visual techniques. It is to be a circular building, with a radial depth of 50 feet, each of its four sectors accommodating 395 students. Drawings of this building will be found in Appendix 5.

79. New York University has concentrated more on educational television than on *cctv*, in particular the early morning programme referred to in paragraph 55, the 'Sunrise Semester'. Because of the location of the University most departments have had no difficulty in finding staff, and they have not therefore needed to use *cctv* for extension classes. Some members of staff used it in an attempt to improve the quality of teaching; in dentistry it is used for demonstration. At a discussion which we had with two Vice-Presidents of the University it was stressed that:—

(a) television enabled the work of the greatest scholars to be made available to many students;
(b) there were no significant educational advantages or disadvantages in the use of *cctv*;
(c) the use of *cctv* was uneconomic if there were less than 250 students, although the increasing use of video-tape could affect the situation; and that
(d) there was considerable scepticism about the value of audio-visual aids.

80. During our visit to the Fund for the Advancement of Education at New York, Dr. Eurich, the Director of the Fund, told us of experiments which had been tried in Oregon and Texas, in linking up universities by television so as to make the best use of good teachers. He pointed out the difficulty of getting satisfactory co-operation between universities, particularly between those in different regions where occasionally there was inter-university rivalry. He said that the use of modern aids was not particularly extensive in the United States. They had been developed largely because of increased student numbers and, in the case of television, because its considerable development in the schools had made it commonplace.

Film

81. Films appeared to be no more widely used at present for teaching in the United States than they are in Great Britain. The universities which we visited however did have their own film libraries, some of which were quite extensive. At Pennsylvania State University, for example, the film library has 6,000 films. It not only gives free services to the University Departments but also hires out films to schools and other institutions, and provides operators.

82. Among the places visited in the United States was Educational Services Inc. (E.S.I.) at Watertown, Mass. This institution was originally subsidised by the National Science Foundation to help the Physical Science Study Committee (P.S.S.C.) in producing films for their syllabus. E.S.I. then moved beyond this field and, at the time of our visit, was engaged in producing films for the Massachusetts Institute of Technology and for various other higher learning centres, particularly those around Boston. Old buildings had been converted and equipped at a cost of less than $200,000 and apparatus used in various films is generally made on the premises. The total staff is about 30, three of whom are administrators. Five are full-time directors, eleven are film-crew men and the remainder are scientists and technicians. It was emphasised that the scientists were not simply advisers: they were the originators of the films and were ultimately responsible for them.

83. Professor Zacharias of the Massachusetts Institute of Technology (M.I.T.) explained how the P.S.S.C. films could be used in a remedial way to bring a group of first-year students to the same level, and how they could present

a subject in quite a different light from the usual university approach. He added that in a new M.I.T. physics course all demonstrations were to be filmed so that every student could see them clearly. He preferred film to television because he thought that students were distracted by the presence of cameramen and of several monitor receivers. In addition students could, if they wished, watch the same film again in their own time.

84. At Harvard, on the other hand, Professor Skinner stressed that he was not in favour of films, for three main reasons:—

(a) films assume that all students learn at the same rate;
(b) the film does not provide reward at the right time; it sets out to interest the students at the start, whereas interest should come at the end; and
(c) the film distorts the subject matter to make it fit the medium.

He also disapproved of the P.S.S.C. method of teaching physics, and thought that to give the student the idea that he was discovering something when in fact he was not, was undesirable.

Projection aids

85. We were greatly impressed by a demonstration of the overhead projector at the Walter Reed Army Medical Center in Washington in a department which was concerned with the use of instructional devices. Here the projector was being used as the versatile visual aid which it is and not simply as a substitute for the chalkboard. The use made of overlays, prepared by hand or photo-copying techniques, was most effective. The projector itself compared very well with others we have seen both in America and Europe, in that it did not obscure the operator or the screen.

86. At the Medical Center, too, we saw two slide projectors coupled in such a way that two pictures could be shown for comparison purposes at the same time on the screen. We noted also a 16 mm projector which showed films with both magnetically- and optically-recorded sound. The lecturer could add his own commentary on the magnetic strip, and did not need to use the original recorded on the optical strip unless he wished to do so.

87. At the National Institute of Health in Bethesda, a sound projector which could take 8 mm cassettes running up to 30 minutes in black and white or 22 minutes in colour impressed us favourably.

88. Apart from these particular instances, there was little difference between the use made of the commoner projection aids in the United States and in this country.

Video-tape

89. Video-tape is much more widely used in the United States than it is here and it seemed to be generally agreed that, as it became less expensive, direct *cctv* would probably be ousted as a teaching medium. Various firms were experimenting with methods of television recording and one was developing a system of recording on disc instead of tape.

90. At the Bethesda Naval Hospital, a college course of 45 lectures on psychology had been transferred to video-tape. One disadvantage, as opposed to film, was that the latter could easily be edited, whereas the video-tape recordings could not. However, in the television process, editing is not necessary to the same extent when the lecture has been carefully prepared.

Films made from video-tape were of good quality and it was clear that it was worth converting really good tapes into film.

Language laboratories

91. In those centres which we visited in the United States, language laboratories were used mainly for beginners in language learning and for remedial work. In most cases students had access to the facilities at any time during the day.

92. At Pennsylvania State University it was pointed out that in the United States, much more reliance has been placed recently on the conversational use of language because the great distance of America from Europe lends a degree of unreality to the formal approach to European languages. Many undergraduates fail to appreciate that even some of the main languages of Europe are live languages, spoken by millions of people! In Pennsylvania, courses recorded on tape were available in French, German, Russian, Spanish and Italian. Special facilities were provided for the production of tapes for instructional purposes. Conventional language laboratories were available for the instruction of students, the instruction being controlled and the individual students' progress being monitored by the instructor in charge. In addition to these, facilities were provided in a separate laboratory where students could obtain practice in one or other of several languages according to their stage of competence. On a blackboard in this room, language lessons were listed against code numbers with an indication of the stage of proficiency which was necessary to understand each tape. The tapes were stored in a central unit in a separate room. A student could study whenever he was free. By dialling the appropriate code number for the tape he wanted, the lesson was transmitted automatically from the central unit and received by the student on headphones at his booth. The elementary lessons consisted of phrases, with regular pauses so that the student could learn by repeating them. No recording of the student's speech was made but he could hear his responses on his headphones. Each tape carried a programme lasting approximately fifteen minutes. It was rewound automatically, and was said to have a life of about four thousand hours. If another student dialled the same programme, or another on the same tape, it was necessary for him to take the lesson at the particular point it had reached, or wait until the first student had finished and the tape had returned to the beginning again. By means of the public telephone system it was possible to link up these language practice facilities to other parts of the university campus and to neighbouring secondary schools and other institutions.

93. We met some criticism of language laboratories at Harvard where we were told that compared with more formal methods of teaching they were wasteful of the students' time. It was maintained that they did not teach languages although they might develop in a student a keen ear for nuances of pronunciation and intonation. The Harvard language laboratory, which had thirty-six booths, provided recorded courses in twenty-five languages, and was used by about four hundred students in all. Five different programmes could be handled by the unit simultaneously. It appeared to be less flexible than the system at Pennsylvania State University because the programmes operated on the basis of fixed times of starting and the student could only participate if he arrived at the right time.

94. We noticed considerable variety in the quality of reproduction, and were told at the Fund for the Advancement of Education in New York that the quality was not of a sufficiently high standard in most college systems.

Programmed instruction

95. Those who advocated programmed instruction claimed that it had the advantage not only of allowing each student to proceed at his own pace, but also that anyone, whatever his motivation and whatever his I.Q., could learn by this method.

96. Programmed instruction was used mainly in the early stages of courses, and more often in scientific and technical subjects than in the arts. At Harvard, however, it was used at quite advanced levels and we saw there a linear programmed text-book of over 700 pages on neuroanatomy for fifth-year students. This particular book which covered half the full course had been written jointly by two young professors of neuropathology and of psychology, respectively. It had taken two and a half man-years to produce and in three years had undergone four major revisions. Dr. Richard Sidman, one of the authors, said that the purpose of the programme was to supplement and not to replace lectures. The only advantage which Dr. Sidman could see for the machine over the book was that with the former it was easier to tell whether the student was working or not.

97. Opinion in the States about the relative value of programmed books and machines was divided, but the majority of those whom we met favoured books, chiefly because many of the commercial machines available were too complicated and unreliable in action. On the other hand, Professor Stolurow of the University of Illinois considered that branching programmes as presented in book form caused the reader to waste time since he may have to turn to a number of pages in the book, a factor which is eliminated in computer-based systems such as his own. He claimed that such systems exceed the capacity of any live teacher, and that they were modelled not on a teacher but on an ideal process of instruction.

98. The relative value of linear and branching programmes was again a matter of opinion. Professor Skinner of Harvard favoured linear programmes. Others stated that the smallness of the steps in a linear programme was apt to bore the more able student; on the other hand it was possible for a student to get lost in the 'loops' of a branching programme.

99. The difficulties inherent in producing really good programmes demanded careful thought and energy on the part of those teachers who prepared them and, as a result, their teaching quality improved. It was an open question in the United States whether the results of conventional lecturing would not be as effective as programmed instruction if lecturers gave as much attention to the preparation of lectures as they did to the production of programmes.

100. Mr. Leslie Greenhill, Director of the Division of Instructional Services at Pennsylvania State University was somewhat dissatisfied with the machines he had used, which had been found to be mechanically unreliable. A number of experiments had been tried with programmed courses on cyclostyled sheets or on cards and there was, in addition, a variety of programmed text-books. He considered that the chief use of programmed instruction was remedial work in such subjects as mathematics and English, and the teaching of comparatively limited and routine areas of knowledge.

101. At Harvard we saw the programmed text on neuroanatomy referred to in paragraph 96 and met Professor Skinner, of the University Psychological Laboratories, and members of his Department. They stressed the fundamental importance in programmed learning of making each step so small that the success rate in answering questions would be almost 100 per cent, thereby providing the reward of achievement which they considered to be essential.

102. Unlike many other advocates of programmed instruction, Professor Skinner thought that a machine was necessary, since a programmed text could be ruined through misuse by the student. The error rate with a machine was said to be higher than with the same programme in book form (25 per cent as opposed to 5 per cent), presumably because students can cheat more easily with a book. Professor Skinner told us that since there were so many practical limitations to the use of machines, including lack of standardisation, the text was in fact more widely used.

103. In discussion, Professor Skinner said that the rapidity with which a student covered a programme appeared to make no difference to retention, but he added that no adequate test had been carried out.

104. Perhaps some of the most interesting work which we saw in America in this field was at the New York Institute of Technology. This Institute trains high-level technicians and while half of their course is technical the other half covers such subjects as logic, mathematics and natural science.

105. At this Institute a small group had been concerned with the problem of extending the productivity of the gifted teacher. To this end, a fully-automated system of teaching had been developed in some subjects. Not only did it utilise teaching resources to the best advantage, but it had also reduced the time taken by many students to cover some of the basic courses, since the students had the advantage of proceeding at their own pace.

106. Programmes had been written in the Institute on subjects such as the basic theory of transistors, and the staff who wrote these programmes received by way of incentive an addition to their salaries. The programmes were used mainly for first-year students; their laboratory work was also fairly closely programmed. The students generally preferred branching programmes, but we were warned that the complexities of this kind of programming could result in their covering the same ground several times. As each section was prepared it was validated with a group of 15–30 students using a small special-purpose computer in order to expose weaknesses in the programme.

107. Both linear and branching methods of writing programmes were used. In the case of the former, sections were re-written if the errors rose to 10 per cent, and tests were given at the end of about 100 pages. When tests involving multi-choice questions were set, the student recorded his answer on punched cards and was told at once by a coloured light whether or not he had the right answer. At the end of the test all the students' cards were put into a computer, which rapidly produced an analysis of the results, and the necessary information to indicate to each student the work to be revised.

108. We were shown at the Institute a teaching laboratory with 100 places, each equipped with a teaching machine connected to a computer, television set and telephone. From the control panel the instructor could see at a glance

how many correct responses each student had made, how in fact each student was progressing, and which ones were in difficulty. In the case of error, the programme sometimes asked a student to listen to a recorded verbal explanation or to seek advice from the instructor by telephone. The instructor could then reply verbally, or transmit a diagram or a written explanation to the student's screen. If it was necessary to show a piece of film, a slide, or a chart, the instructor communicated with the Institute's library and the required aid was televised direct from the library to the student's monitor. By means of a television camera mounted in the roof of the room, the instructor examined any written work which he asked the student to do.

Special uses of television in teacher training

109. Quite apart from the use of *cctv* for demonstration purposes and for lecturing to large numbers of students, we saw its value as a means of 'looking in' on demonstration lessons, for observing child behaviour and for watching pupil reaction to different teaching methods. Its great advantage was that it was possible to discuss a demonstration lesson whilst the lesson was proceeding and to compare it if necessary with previous ones. This was a valuable contribution to in-service training because it allowed viewers to see other teachers at work, and it helped greatly to rehabilitate teachers who had returned to the profession after a long absence.

110. At Hunter College, which is a college of the City University of New York, it had been decided because of increased student enrolment, and since the College had many small rooms and only a few large ones, to use television for teaching large classes. Its main purposes however were considered to be:—

(a) to facilitate the observation of school work;
(b) to record the work of student teachers so that it could be discussed by groups later;
(c) to enable a series of teaching situations to be presented to different groups of students; and
(d) to carry out research into teaching methods.

111. A demonstration school with primary and secondary departments was attached to the College. Competition for admission was so keen that a selection of pupils on the basis of high I.Q. had been arranged, and the resulting classes of highly intelligent children provided excellent material for research. Other New York schools were also available to the College for teaching practice.

112. The Director of the television system at Hunter College is a graduate and a trained television engineer. He reported that he had at first encountered difficulties in using television to observe demonstration lessons in school classrooms because of lighting problems and because of the need to eliminate extraneous sounds. Both had been overcome, the latter by using either rubberised vinyl flooring or woollen carpet runners. To operate the system, the College had a staff of one engineer, two assistants (the latter had High School education and a little technical training) two cameramen and one producer. Students often helped with the work. The equipment had cost about $200,000, and an allowance of 10 per cent of this cost per annum was required for its maintenance. To set up a system which would broadcast from 2 or 3 rooms to another 2 or 3 rooms without recording equipment would have cost about $50,000.

113. The use of television for actual instruction might result in better presentation, but it was felt that television had far greater value in teacher training for observation, for supervision, and as a research tool.

Use of Computers

114. Digital computers are used in teaching in several institutions in the United States, both to supervise a programmed lesson, and to do numerical and logical operations under the control of the student. To be economical, both methods of using computers require the use of a multiple-access system, such as the Multiple Access Computer which we saw at the Massachusetts Institute of Technology. Those who were using this system could be connected to the computer by means of an automatic telephone network and could then transmit and receive messages on a typewriter. At some extra expense, the user could also have visual information from the computer in the form of diagrams, letters or words displayed on a television monitor.

115. We saw a simple version of computer-controlled programmed instruction at the New York Institute of Technology, where a computer could supervise six students at a time (see also para. 107). There are several other more ambitious projects in existence, one of the best-known being at the University of Illinois. In addition, a commercial company has specimen programmes which are essentially linear programmes but the amount of information in each frame is considerably more than is customary in linear programmes (see paras. 354–357). The good student makes rapid progress while the student who makes mistakes is directed by the computer to a remedial loop in which the information is given more slowly. Some claim that it would be more economical to use a less complex computer in conjunction with a text. The student reads the text and types his answers on a computer typewriter. The computer then tells him the next step to take.

116. By using a computer for numerical logical operations, the student may solve simple logical problems, simulate the behaviour of linear and non-linear devices, practise computer programming or perform tedious calculations. At M.I.T., we saw a demonstration of what was called the 'sketch-pad' project. Rough sketches were drawn with a 'light-pen' on a television monitor defining the topology of a problem which, when supplemented by numerical data on a typewriter, was turned by the computer into a rigorously-dimensional picture, accompanied by relevant numerical information. This could be photographed. The Bell Laboratories showed a more sophisticated version of this programme. From a set of elevations and plans, the computer produced perspective drawings and also animated diagrams on 16 mm film. They had proved to be very valuable in simulating the behaviour of artificial satellites and could also be used as substitutes for architects' models.

117. All these projects are in an early stage of development. They show great promise for the future but their cost may be high for some time.

Communication

118. The problem of local or regional centres of communication to provide audio-visual educational services to individual universities, groups of universities, or other institutions of higher learning is being studied in America, and some universities already have departments of 'learning resources' (paras. 120–128).

National institutions

119. Apart from the Federal Communications Commission (para. 56), the two national institutions visited were the National Education Association at Washington (N.E.A.) and the Fund for the Advancement of Education, New York. Members of the N.E.A. whom we saw were concerned with the administration of grants for educational research, including topics involving audio-visual aids. Among the examples quoted of the value of audio-visual aids in research were:—

(a) the documentation of classroom behaviour;
(b) the study of animal behaviour; and
(c) the study of eye movements in reading.

The Fund, which is part of the Ford Foundation, is concerned about the severe teacher shortage in the universities and has sponsored experiments with various kinds of teaching aids in an attempt to mitigate the effects of the shortage.

The Pennsylvania State University

120. Some universities, we were told, hope to secure a 30 per cent increase in 'productivity' by setting up a department of learning resources, which would advise on the use of *cctv*, film, and teaching machines. Of the universities we visited, by far the most progressive in this field was Pennsylvania State University. It has had for some time a Division of Instructional Services which covers most aspects of audio-visual work, and also research on techniques of assessment and examination. The Division, the services of which are available not only to the University but also to the associated junior colleges, brings new equipment and facilities to the notice of the various faculties and thereby widens the use of 'instructional resources' throughout the University. Although the Division was not established to economise on staff, the student/faculty ratio has changed in ten years from 13:1 to 17:1, partly as a result of its activities but mainly because of an acute shortage of staff. There has been a redistribution of human resources, with fewer academic staff and more technical staff and student assistants. In a period of unprecedented growth large numbers of students have been taught by audio-visual methods. In 1963, the student population was 18,000; by 1970, it is expected to increase to 25,000. Integrated with the University are 14 associated colleges which conduct two-year courses, mainly of a technical nature. Eight of these colleges have general courses which fit in with the degree course of the University.

121. The Division of Instructional Services is run at an annual cost of about $160,000 and in the spring of 1964 its work and staffing could be summarised as follows:—

(a) examining and testing services: three full-time professional members of staff, with ten clerical assistants and a number of part-time students, were concerned with course development and evaluation;
(b) television services: six full-time professional staff who were television specialists recruited from universities which include broadcasting in their curriculum. Many of the operational personnel were students who worked part-time as cameramen. (The television studios consisted of four main and eight subsidiary studios disposed throughout the University. The

system was mainly closed-circuit, including two microwave links. The University was also setting up an educational television station which would provide courses for credit);
(c) motion-picture services, involving a staff of four professionals. This service was well equipped with time-lapse and high-speed cameras, and except for processing was responsible for all the work involved;
(d) still-photography services with a staff of four or five. The majority of these and of those employed in section (c) above had been trained at the Rochester Institute of Technology which has a special course in photography. This section produces instructional films and slides for the various departments at cost and also serves research workers in the same way;
(e) graphic services: three full-time artists, normally graduates of a school of fine arts, were employed on such work as the production of charts and posters, and transparencies for overhead projectors;
(f) instructional research: a full-time staff of three, augmented from time to time by research workers from such departments as psychology and education. This section was originally financed by grants from outside organisations but is now largely supported by the University itself;
(g) film library, with 6,000 titles, which serves the University without charge, and also hires films and provides operators to schools and other institutions.

122. In addition to these services, the Division advises on the construction and equipment of buildings for the various University Departments which plan to use audio-visual aids. At our request the Director sent us some drawings of a new building planned to incorporate instructional facilities. These are to be found in Appendix 5. It is worth noting that at Pennsylvania State University provision is made in the design of all new classrooms for the installation of television at a later date.

University of California at Los Angeles

123. The Director of the Academic Communications Facility at the University of California, Los Angeles, has also provided evidence to the Committee. This campus had 24,000 students in 1964, and until 1962 there had been several departments dealing with different media and different aspects of communication. In 1962 the Academic Communications Facility was set up as a co-ordinating centre for films, television and data on equipment and development. By 1964 it employed 50 full-time and 25 part-time staff, at an annual running cost of $500,000. It is of no small interest to note that in the recommendation to the Chancellor of the University, which resulted in the setting up of the new Academic Communications Facility, it was pointed out that, just as the printing press in the 15th century had widened enormously the distribution of knowledge, so the newer resources of the 19th and 20th centuries for the storage and retrieval of information could be used to open up new channels of communication. It was also pointed out that it was of maximum urgency to use every possible channel to the full, particularly in view of the great increase in student numbers. The main aim of the Facility is to handle the storage, retrieval and distribution of information. Today it is sub-divided into three main sections:—

(a) the Planning and Development Division, which examines new problems, develops procedures and evaluates results. For example, this

division, which is headed by a communications engineer, plans the installation of learning resources in new buildings;
(b) the Production Division, the activities of which range from graphics and illustration to the production of films and television broadcasts; and
(c) the Operations Division, which stores, distributes and displays the products of (b). It has a film library of over 1,000 titles and a collection of audio and video tapes. The Division also supplies projectionists and procures films from outside sources at cost price. Technicians for electronic equipment are always available for the repair and supervision of all equipment on the campus.

124. In the autumn of 1964, the Academic Communications Facility established a microwave link between the School of Medicine at the University and the County General Hospital some 18 miles away. Where previously duplicate lectures had been arranged for those students who were on a tour of duty at the Hospital the new link made this unnecessary. In addition students at the Hospital could ask questions on a direct telephone line connected to the public address system in the University buildings.

125. The Academic Communications Facility issues a newsletter which gives full details of the services available including new developments and equipment.

Stanford University, California

126. Among the well-known activities of Stanford University is its research into the effectiveness of television teaching. Courses on various aspects of communications have been part of the University curriculum since 1943.

127. In 1962 a new Department of Communication was set up with three main objectives:—

(a) to bring together the various groups in the University who were already concerned with the mass media of print, of broadcasting and of film, with those concerned with communication research;
(b) to provide an environment where members of staff from the various university disciplines could work together on problems of communication, and so draw on the experience of those with similar interests; and
(c) to teach undergraduate and postgraduate students the theory, skills and practices of each of the mass media.

128. In his evidence to us, Professor S. T. Donner, Head of the Department, stressed the need for universities to recognise the influence of communication on society and upon the individual. He closed with the following remarks:

'It is trite to say that we are in the midst of a communication revolution; it is banal to say that electronic communication represents the most significant change since Gutenberg; it is common knowledge that modern mass media are bringing about vast cultural changes. The question is really not whether a university should offer courses in mass communication, but rather whether a university worthy of the name can avoid studies on the media which penetrate every facet of life.'

Training of personnel for communication centres

129. Most universities prefer to have a graduate in charge of the central unit, usually one with a deep interest in communication generally and a specialised knowledge of one of its main facets.

130. The technicians required for the maintenance of equipment are usually employed by the universities, and there are many privately-run schools all over the United States which specialise in training them.

131. Each university has its own financial arrangements, and all centres are partially self-supporting and charge departments for the services provided. They are often financed out of basic university funds, with outside grants for research projects.

Summary

132. Apart from specialised uses in medical teaching and teacher training the main objects of using audio-visual resources in the United States are:—

(a) to improve the quality of instruction. It must be remembered in this connection that this is largely achieved by the greater effort and thought which are devoted to the newer methods;

(b) to improve the position of the less able student through 'remedial' work and so ensure greater uniformity of achievement; and

(c) to minimise the effect of staff shortages, and thus to enable a larger enrolment to be dealt with adequately.

WEST GERMANY

Institut für den Wissenschaftlichen Film, Göttingen

133. During our visit to the Institut für den Wissenschaftlichen Film at Göttingen, it was explained to us that this was a Central Institute financed by a Corporation which, in turn, was supported by the Lands of the Republic. The Corporation was required to approve the budget and the work carried out by the Institute, but a Scientific Advisory Committee gave advice and direction on the work itself which covered all aspects of scientific films both for instruction and research. It fell into three main groups:—

(a) *The use of film as a research tool in all scientific fields*

When a research project was submitted by a university or research unit it was first appraised by an individual professor and, if approved, the Institute was provided with the necessary funds and itself supplied the personnel. Projects were occasionally initiated by the Director himself. In each case a panel of experts advised on technical problems.

(b) *The production of instructional films for universities and technical colleges**

The Institute had a separate budget for these films, which were made only after approval by the institutions concerned. When a project was proposed, the procedure was to circularise those universities which were thought to have a special interest to ask them whether, if a film were made, they would use it in their teaching courses. In every academic institution there is a liaison professor and it is his responsibility to submit on behalf of his university a request that a film be made. Universities and other institutions were encouraged to produce their own films whenever possible.

(c) *Scientific film documentation*

The Institute was assembling an international encyclopaedia of scientific work on film and was also recording as a basis for future research social phenomena which are gradually disappearing. The twelve countries concerned in this (Great Britain is not one) produced between them 100

* Films for school use are produced and distributed by the Institut für Film und Bild.

films a year and, in 1963, the Encyclopaedia contained 650 films dealing with such subjects as agriculture, biology, botany, medicine, ethnology and zoology.

In June, 1963, the Institute had a staff of 70, of whom 14 had academic qualifications, and 5 were specialist camera technicians.

134. Universities and colleges producing their own films could seek advice from the Institute, and arrangements existed for members of staff who needed special training to spend three months at the Institute. In general, the Institute limited its own film production to projects where special difficulties or complications were involved, or where advanced photographic techniques were needed. In the case of some difficult subjects, for example, a film made on the movement of the bones in the inner ear, many attempts might have to be made before the final version could be regarded as satisfactory.

135. All films were made in close co-operation with scientific experts and each film was accompanied by an explanatory text written by the professor concerned with its production. All films could be bought or borrowed, and loans were free to universities in thirty countries. When a film was sold to academic institutions it was sold at cost of materials. Most of the films were silent, and sound (optically or magnetically recorded, depending on convenience) was used only when it was absolutely necessary. A catalogue of all films (mostly 16 mm but occasionally 35 mm), including a list of those in the Encyclopaedia, was produced annually.

Technische Hochschule, Aachen

136. At another institute we visited, the Technische Hochschule at Aachen, the student population in 1963 was over 10,000 and courses in compulsory subjects such as mathematics, physics and mechanics were taken by as many as 3,000 students. In the largest auditorium, which held 1,000 students (with auxiliary seating for a further 200) and where illustrations on a big blackboard could not be seen, we saw in use a large overhead projector costing approximately £1,000 (para. 248). With a practised performer it was very satisfactory, but to ensure that the writing was legible when projected on to the screen it had to be large and bold. There was not enough space for long mathematical equations. In the Department of Education at the Hochschule *cctv* was being used for over-flow classes because the lecture rooms were very small.

OTHER OVERSEAS COUNTRIES

137. Following our terms of reference, enquiries were made in other overseas countries. Such information as we have is summarised briefly in the remaining paragraphs of this Chapter. There are many published sources of information available relating to the position elsewhere.

FRANCE

University of Nancy

138. In November, 1963, the Council of the Organisation for Economic Co-operation and Development, Paris, negotiated an agreement with the French Government for the setting up at the University of Nancy of a pilot experiment in the operation of a lower-power television station. The aims of this experiment were three-fold:—

(a) to explore the potentialities of a university station in relation to the problems facing scientific and technical education, and to study the use of television as a teaching tool;
(b) to study the future development of the project to cover continued professional training for engineers and the re-training of technicians and teachers, both in advanced and in developing countries; and
(c) to carry out research on methods whereby television could be used to relieve teacher-shortage, on its value in the improvement of teaching practice and on the evaluation of television teaching.

139. The project is to be an international one, in that an international advisory group will guide its development, and one of the objectives of the experiment is to assess the economic and other practical aspects of a television station operated by the staff and students of a university. The O.E.C.D. provided the basic equipment and made research provision to a total of 225,000 francs. The French authorities provided the premises, installation, maintenance and running costs, and also undertook to obtain the necessary transmitting frequency.

Audio-Visual Centre, St. Cloud

140. At St. Cloud, Seine-et-Oise, there is an Audio-Visual Centre with a staff of 65, under the directorship of a senior member of the Institut Pédagogique National. This Centre is responsible for the production of films, tapes, radio and television broadcasts, for the training of teachers in the use of audio-visual aids, and for publication and research.

141. The Centre has taken part in several experiments with microwave transmissions, notably the project arranged by the Conservatoire National des Arts et Métiers for evening broadcasts to technical students.

142. A Council of Europe study group on the place of modern aids in teacher training was held in the Centre in May, 1964, and was attended by one of our members. The following points made during the conference show that the French are well aware of the potential of modern aids, and are becoming increasingly progressive in this field:—

(a) a system for transmitting regular television lectures for the first two years of higher education was at that time being conducted by five French universities. The lectures were followed up by correspondence courses and by lectures at the separate universities;
(b) film is an easily-usable and accessible tool for teacher-training colleges; more films should be produced and teachers trained in their use;
(c) modern aids should be used in teacher training for a wide variety of purposes—for example, to deal with increased student numbers, to make the best use of gifted teachers, to record child-behaviour and to re-train teachers returning to the profession;
(d) a regular bulletin to disseminate information on new equipment and research should be produced;
(e) closed-circuit television is a major new instrument with especial value for teacher training; and
(f) teachers should be trained to make the best use of language laboratories; they would then be able to spend more time with individual students.

Radio-Lille-Académie

143. In February 1962, a new V.H.F./F.M. regional transmitter was opened at Bouvigny to cover the Departments Nord, Pas-de-Calais and Somme, and parts of Aisne and Ardennes. This transmitter has been placed, on an experimental basis, at the disposal of the Recteur of the Académie de Lille for programmes for schools and for vocational and further education.

144. Apart from the schools programmes, there are programmes of professional training for young teachers and several first-year university programmes in arts subjects, science, law and medicine.

Radio-Sorbonne

145. Thirty-eight hours of air time each week are devoted to higher education broadcasts from the Faculties of Arts and Humanistic Sciences of the University of Paris.

Lycée de Sèvres

146. In 1961–62, an experimental project on *cctv* was conducted at this Lycée. It was used to repeat programmes, for training candidates for the secondary teachers' diploma, for training educational specialists in television techniques and for training the educational television staff of Radio Télévision Française.

National Centre for teaching by television

147. Since 1952, this Centre has transmitted language and general cultural programmes to schools and to technical colleges. The Centre co-operates with schools television and with the Radio-Lille-Académie and has produced broadcasts for pupil-teachers studying for the higher certificate and for adults who are studying at evening classes.

JAPAN

148. Apart from, but in line with, the extensive educational broadcasting at High School level in Japan, lectures are broadcast by the Nippon Hoso Kyokai (N.H.K.) as part of university extension courses. State universities in Japan, unlike some local authority and private universities, do not have extra-mural courses. There are five privately-run correspondence courses and N.H.K. broadcasts radio lectures for students following these courses in English, law, economics and Japanese history.

149. We were informed by the University of Tokyo that various kinds of aids were being used, for example, *cctv* in the Department of Surgery and microfilm in the libraries, and that, since their value was undoubtedly considerable, a rapid increase in their use would be limited only by lack of funds.

150. In Keio University, Tokyo, conventional projection aids are used in the Faculty of Engineering, and a wider variety including films, tape recorders, *cctv* and electronic aids are in constant use in the School of Medicine, both for teaching and for research. Realising the importance of audio-visual education, Keio University has established an Institute of Audio-visual Language Education, with language laboratories, listening and recording rooms, and tape libraries.

RUSSIA

151. We were informed that the Higher Technical Institute at Moscow used films and teaching models and were, in 1963, installing several teaching

machines. The member of staff to whom we spoke was of the opinion that machines could only be used in the initial stages and for purely factual teaching. There was, he thought, the danger that students would learn parrot-fashion from the machine, instead of thinking things out for themselves. Other members of staff thought the machines would be particularly useful for revision work. Each institution of higher learning in Russia was trying to investigate on its own the possibilities of modern aids, since each had its own problems and difficulties.

152. The growth of interest in new teaching aids is much facilitated in the Russian Socialist Federated Soviet Republic (R.S.F.S.R.) by the existence of the Academy of Pedagogical Science (A.P.S.). Teachers in higher education as well as in schools look to this body for support in adopting new ideas and in conducting large-scale experiments. The report of a series of conferences dealing with teaching aids and programmed learning was issued in 1963 by the Publishing House of the A.P.S. on behalf of the Central Committee of the R.S.F.S.R. Pedagogical Society (General Editor: V. M. Taranova). This Report deals with the use of teaching films, tape recorders, and teaching aids in general, and with the design of teaching machines, including those electronically controlled.

153. The succession of conferences appears to have begun in 1959 on the initiative of the staff of the Lenin Pedagogical Institute in Moscow and of the Institute of Foreign Languages in Gorki. In the following year a further conference was held in the Lenin Pedagogical Institute in which the Teaching Aids Section of the Central Committee of the R.S.F.S.R. Pedagogical Society played a leading part. A follow-up conference was held in 1962. These conferences have tended to clear the air and to lay down a number of general principles.

154. The 1960 Moscow Conference began with a paper by Professor A. I. Markuskevich, First Deputy Minister of Education in the R.S.F.S.R. Professor Markuskevich, originally a university teacher of mathematics and the author of school mathematics text-books, called his paper 'The Application of Technical Aids to the Process of Study'. This ministerial introduction forms part of the first of six major divisions into which for the purposes of report and study the underlying theory and practice of the use of teaching aids in schools, institutes and universities have been arranged. These are:—

(a) general pedagogical principles underlying the use of teaching aids in the process of study;
(b) methods of using teaching aids in the presentation of different disciplines;
(c) visual aids (cinefilm, diafilm, photography, sound film);
(d) teaching aid laboratories;
(e) programming, teaching machines, and mathematical questions of analysis of some elementary teaching processes; and
(f) teaching aids for courses in reading methods.

The conference also dealt with the use of teaching aids in language work. Volume II of 'The Use of Teaching Aids & Programmed Learning in Schools, Institutes and Universities' (Moscow, 1963) includes full consideration of the teaching of Russian language and literature and of foreign languages.

155. The achievements described in these collected papers represent the work

of pioneers and experimenters. The two-volume publication is a statement of organised support for the introduction of these aids in schools and senior educational institutions.

156. There is little evidence of widespread use of the newer aids in these institutions but this is equally true of other countries. As recently as 1964 *cctv* was still the subject of experiment. The Russian electronics industry is well established and is supported by a considerable and well-endowed branch of technical education. Some highly-specialised technical colleges have concentrated on communications. When the experimental period is over there appears to be every likelihood of an explosive growth in the use of these aids, supported as they undoubtedly are by a national film institute.

157. Educational television is in use in many schools and an exciting course in English, possibly aimed originally at adult students, has also been widely broadcast, having first appeared on screens in the late 1950's. Teaching machines seem to be of three main kinds. They employ circuits designed to fit the needs of an educational system based on the common aim of teachers and pupils to attain a maximum grading on a five-point scale.

158. The view expressed so confidently in paragraph 156 rests on the degree to which the organisation of higher learning in the U.S.S.R. still makes use of institutionally-based and tutor-controlled correspondence courses. There are also vast numbers of evening or part-time students. Some university teachers with whom these developments were discussed saw in *cctv* a great aid for these extra-mural and part-time students.

CHAPTER 4

CO-ORDINATION AND COMMUNICATION OF INFORMATION AND RESEARCH

159. Universities and other centres of higher education tend to work in isolation. Although contact between departments in different universities may be maintained where there is a common interest in research, there is little exchange of information with regard to teaching. Even departments within the same university often have little knowledge of what teaching or research is being conducted in other disciplines. It is possible to obtain a fairly good grasp of current research activity by attending scientific meetings, but communication about ideas and aids for teaching is almost wholly unorganised and usually consists of no more than chance personal contacts or infrequent conferences.

160. The need for large and expensive scientific apparatus such as reactors and computers has already led to some sharing of resources between universities. A similar sharing of intellectual resources would be beneficial. The Cambridge Television Week (para. 320) provided an opportunity to share research colloquia and lectures between the Universities of Cambridge and London. *Cctv* was also used for an exchange of lectures between Cambridge and Norwich. The Association of University Teachers in their evidence to us pointed out that modern electronic devices gave an opportunity to create in effect a single nation of academics, each one in easy and rapid communication with his fellows, able not only to pool ideas but to use each other's major equipment by remote control. The Association believed that serious consideration should be given to the setting up of inter-university television links for the sharing of teaching facilities, the pooling of research information and the holding of colloquia.

INTRA-INSTITUTION COMMUNICATION

161. Planned and close co-operation between the departments of a university and between those of any other institution of higher education is eminently desirable in the interest of economy of time, effort and equipment. During our visits, and in the hearing of evidence, we found that medical schools have long since realised the value of such co-operation and several of them have central departments which provide services of various kinds to all sections of the school.

162. We saw a good example of such centralisation during our visit to Guy's Hospital Medical School. There the Department of Medical Illustration is divided into two sections housed adjacent to each other. One, the Graphic Section, produces drawings, charts and diagrams for publication, for lantern slides and for the exhibitions assembled by the section for both Medical and Dental Schools. In addition this section offers advice to departments on the effective graphic presentation of their material.

163. The second, the Photographic Section, not only undertakes the photographic and cinematographic recording of clinical cases, but it also produces

photographs, slides and films for the staff of the Medical School for use in research and teaching. As the production capacity of the section itself is limited by the size of its staff, available space and equipment, apparatus is developed and adapted for use by individual members of the clinical, research and teaching staff.

164. In addition to its own investigations, the Department has provided information and advice to departments within its own Medical School and to other universities on the organisation, installation and application of audio-visual facilities in research and teaching. The following are cited as examples:-

(a) television: advice on application and installation to Department of Child Psychiatry at Guy's Hospital, Department of Anatomy at the Middlesex Hospital Medical School, the Medical School at the University of Lagos, experiments with a number of departments at Guy's Hospital;
(b) film: investigation into production and use of film loops in cassettes, assessment of films to establish their teaching efficiency. Advice has been offered to the College of General Practitioners and to universities;
(c) programmed instruction: information, advice and programmes have been offered to a number of departments;
(d) tape recording: the use of the tape recorder as a 'tutor' in conjunction with visual aids is being investigated;
(e) lecture theatre design and organisation of audio-visual aids services: information and advice have been offered to architects at Guy's Hospital and to several universities in Great Britain and abroad; and
(f) storage of hospital records: new photographic and reprographic, as well as retrieval, methods have been investigated for the Records Department at Guy's Hospital.

165. Besides acting as a production and service unit this Department acts as an agency for bringing new ideas, apparatus and methods to the attention of the academic staff and as an information and consultation centre. It also carries out investigations and devises new equipment and methods in its own right.

166. In addition, both sections undertake teaching and training responsibilities. The Graphic Section is part of the London Training Scheme for Students of Medical Illustration. The Photographic Section teaches the theory of photography in the School of Radiography at Guy's Hospital, and is a part of the London School of Medical Photography.

167. Another example of centralisation is the Photographic Department at the University of Newcastle. This was originally initiated by a former Dean of Medicine but it has extended its services to other departments of the University. At the time of our visit in 1964 it had a staff of 18, which included photographers and photographic workers, projectionists, mechanics and clerical staff, with a science graduate who has had considerable experience in the photographic industry and broadcasting as Head of the Department. The section undertakes film production for any department of the University and runs a printing and copying service. It has the beginnings of an audio recording and reproducing service, maintains and operates projectors, makes about 10,000 slides a year, and is prepared to advise individual members of staff or departments on any aspect of communication.

168. Several other institutions have realised the advantage of centralisation

and have set up the nucleus of a central department. In some cases television centres have been established to provide advice and supply equipment within the institution. Such centres have recently been started at the Universities of Leeds and Strathclyde (paras. 291–293).

169. The evidence we have heard points to the existence of enthusiasts in several institutions who are well-informed on modern methods of communication, but unfortunately their efforts have all too often been severely curtailed by shortage of money, by the indifference and scepticism of many of their colleagues, and by diffusion of effort. We found this to be the case also in the United States. The problems of communication and of its co-ordination within institutions are being met there by the establishment of what are called 'Learning Resources Centres' or, in the case of Pennsylvania State University, a 'Division of Instructional Services' (paras. 120–122). Another example of a central department is at the University of California at Los Angeles, and its functions are described in paras. 123–125.

CO-ORDINATION OF INFORMATION ON A NATIONAL BASIS IN GREAT BRITAIN

170. The returns to our questionnaire showed that a high proportion of university departments did not think that a national body to co-ordinate information was needed. We think, however, that the returns may be misleading, partly because the question as phrased may have been thought to refer only to films. The work of the British Universities Film Council is, of course, well-known and highly appreciated, and many universities appeared well content with the services which the Council provides. In drafting the questionnaire we had in mind, however, a much wider scope of activities within a central service. We have since examined the situations which obtain at present and find that there is a great need for co-ordination. We have learned of several instances where individual teachers had wished to investigate the use of new media but had been completely unaware of the results of investigation and the existence of research elsewhere on similar or even identical lines. There have been instances, too, where the academic staff have found considerable difficulty in obtaining films from abroad. Many teachers have no knowledge of the potentialities of many of the modern aids to communication. Those wanting help and guidance have had to rely too often and too implicitly on the information provided by the salesmen in different commercial organisations. We have become increasingly aware of the complicated inter-relationship and of the occasional rivalry between the existing central organisations, whose functions often overlap and whose remit in the field of audio-visual aids as a whole is limited.

171. One illustration relates to the cataloguing of scientific films. In December, 1963, there were seven hundred catalogues of non-fiction films in this country covering approximately fifteen thousand films. Although many of these are of limited usefulness, anyone wishing to obtain information about films on a single subject would have to refer to the catalogues of many of the existing libraries. In addition to the major organisations in this country which catalogue scientific films, and which are listed below, the various research institutes, the United Kingdom Atomic Energy Authority, the National Coal Board, Gas and Electricity Councils and many industrial concerns, all have a significant output of films, but not all of them have their own library systems. The numbers of commercial distributors are legion, and some of them have

sizeable libraries of films which, at least in part, are suitable for educational purposes.

172. The major institutions in England and Scotland, most of which catalogue scientific films and some of which also cover other aids, gave evidence to us. They are:—

The British Film Institute	B.F.I.
The British Universities Film Council	B.U.F.C.
The Scientific Film Association	S.F.A.
The British National Film Catalogue Ltd.	B.N.F.C.
The National Committee for Audio-Visual Aids in Education	N.C.A.V.A.E.
The Educational Foundation for Visual Aids	E.F.V.A.
The Central Office of Information	C.O.I.
The Scottish Film Council	S.F.C.
The Scottish Educational Film Association	S.E.F.A.
The Scottish Central Film Library	S.C.F.L.
Educational Films of Scotland	E.F.S.

173. Details of the activities of each one of these follow and, for the better understanding by the reader of the inter-relationship between them, a diagram has been added at the end of this section on page 39.

The British Film Institute

174. The main purposes of the Institute, as set out in its Memorandum of Incorporation, are:—

> 'To encourage the development of the art of the film, to promote its use as a record of contemporary life and manners, to foster study and appreciation of it from these points of view, to explore and promote new or extended uses for film and to encourage, support and serve other bodies working in the same field.'
>
> 'To foster study and appreciation of films for television and television programmes generally, to encourage the best use of television, to explore and promote its new and extended uses and to encourage, support and serve other bodies working in the same field.'

175. The B.F.I. is financed partly by Government grant. It administers the National Film Archive of over 7,000 films, mainly on the history and art of film. Its catalogue of science films contains about 500 titles, some of them recommended by the B.U.F.C. and the S.F.A., some distributed on behalf of the United States Information Service and the remainder from the resources of the B.F.I. itself. The B.F.I's main functions have been to guide public taste and to decide on the preservation of films for the National Archive. In evidence the B.F.I. representative said that he had made a tentative beginning in the field of higher education by cataloguing scientific films and by attempting to collect information from universities about the films which had been or were being produced by them. Problems of finance and staffing made developments in the field of higher education slow and difficult. If more money were made available the Institute could readily broaden and extend its activities in this field.

The British Universities Film Council

176. This Council was founded in 1948 'to co-ordinate and develop the use

of film and related materials in the universities and institutions of university standard in the United Kingdom for the purpose of teaching and research.'

177. The B.U.F.C. receives a grant from the British Film Institute and advises the B.F.I. on the selection, for its distribution library, of films required for university use which are not available through normal distribution channels in the U.K. The B.U.F.C. itself publishes a catalogue of films, all of which are judged and assessed by university teachers for their value at university level. Films made by individual research workers and other members of academic staffs are also included in the catalogue but the Council is not always aware of the existence of such films, many of which could be of value for teaching purposes. Our recommendations regarding this will be found in paragraphs 224 and 225.

178. The Universities Film Journal is the official publication of the B.U.F.C. and appears irregularly as material is available. It includes articles on film and television in universities and reports of special enquiries and discussions by the Council.

179. The B.U.F.C. has also shown considerable interest in the use of television in university teaching and it organised a conference on this subject in London in March, 1963.

180. In addition to its reciprocal arrangements with the B.F.I., the B.U.F.C. co-operates closely with the Scientific Film Association and with the British National Film Catalogue Limited. This co-operation aims to prevent unnecessary duplication of effort in the field of scientific film. The Research Film Committee of the S.F.A. is concerned with the technique of using cinematography in research and for this purpose it has close contacts with industry. This technique is common to researchers in universities and in industry, and the B.U.F.C. has been concerned with its use in universities—both to ascertain developments there in the use of film in research and to ensure that industrial developments are made available to universities. In relation to teaching, the interests of the S.F.A. extend to instruction in science at all levels, but those of the B.U.F.C. are limited to undergraduate and postgraduate teaching in all faculties. Both organisations provide information in their publications about available films but whereas the S.F.A. notes all scientific films and publishes appraisals the B.U.F.C. restricts its information to films adjudged suitable for university use.

181. In their evidence to us, the representatives of the B.U.F.C. were strongly in favour of the central cataloguing of films. They said that given adequate finance the B.U.F.C., on behalf of the universities, could create an information service about all available film and projection and television apparatus. In addition, they claimed that the B.U.F.C. could conduct research into the effectiveness of film and television in university teaching, organise the research-film library recommended by the D.S.I.R., and co-ordinate films made by and for universities. They could also organise conferences and continue the B.U.F.C's public relations activities with industry.

182. Some of the recommendations we make in Chapter 5 on the value of film for university use are based on evidence supplied to us by the B.U.F.C.

Scientific Film Association

183. The Scientific Film Association is mainly financed by the Lord President

of the Council through the British Film Institute. It studies and promotes the use of scientific, medical and technical films and through publications, lectures and film presentation it helps to familiarise teachers and research workers with the potential value of the film. On the one hand many thousands of groups and organisations seek and use films; and on the other, many hundreds of sponsors and distributors release large numbers of films each year. The lines of communication between supply and demand are tenuous. The S.F.A. sets out to provide links between user and supplier, to systematise the sources of information and to present them in accessible form, with authoritative comments to facilitate the work of the borrower. The S.F.A. publishes catalogues of appraised films, including a catalogue of international films produced by the thirty member countries of the International Scientific Film Association. The Medical Section of the S.F.A. organises the periodic review for assessment purposes of British and overseas medical films. Some members of the Committee attended a few of these reviewing sessions, where teachers at the London Medical Schools decided whether each film shown would be of value in teaching at university level (para. 207).

The British National Film Catalogue Ltd.

184. This is a non-profit-making company which receives grants from the Foreign Office and the Central Office of Information. It came into being in 1963 as a result of a U.N.E.S.C.O. plan that each country should have a comprehensive list of all the films produced by it. The first annual volume was issued in March, 1964, and covered all British-produced films released since January, 1963. Further catalogues were published every two months, followed by another cumulative annual volume in March, 1965. The aim was to record in one catalogue the titles of all films (not only educational ones) which were available in Britain and so simplify the problem of finding what films existed. The B.N.F.C. has close connections with both the S.F.A. and the B.U.F.C.

The National Committee for Audio-Visual Aids in Education and The Educational Foundation for Visual Aids

185. The central organisation concerned with audio-visual aids in England and Wales consists of:—

(a) The National Committee for Audio-Visual Aids in Education, set up by local education authorities and teachers in 1946, and responsible for educational policy over the whole field, and

(b) The Educational Foundation for Visual Aids, set up by the Minister of Education in 1948, and responsible for production and distribution.

The Foundation received a loan from the Ministry of Education in 1948 to provide it with initial working capital and in 1964 it received a further loan. Unlike its Scottish counterpart, the Scottish Film Council, the Foundation itself does not receive annual grants from the Exchequer, apart from a small grant from 1962/63, which is related strictly to the activities of its Experimental Development Unit. Its income is derived from the National Committee, which in turn obtains contributions from local education authorities, and from its production and trading activities. It also receives substantial sums from industrial and commercial organisations which are devoted to the production of specific educational films.

186. In their evidence the representatives of the National Committee and the Educational Foundation said that originally the organisation had been concerned with the production of educational films and filmstrips, and that one of their first tasks had been to compile and publish a national catalogue. The Foundation Film Library had been established to handle the distribution of films, filmstrips and some additional material, and by 1964 it held a stock of some 25,000 copies of 4,500 filmstrips. It also included a growing number of concept films for the 8 mm cassette-loaded projector and a smaller number of films of the television programmes broadcast to schools.

187. The advent of newer aids such as closed-circuit television, language laboratories, the overhead projector and programmed learning, however, resulted in a rapid expansion of its activities, and the Foundation's technical department had developed the first full-scale language laboratory in the country. The need for objective information, both on the mechanical aspects of aids and on the educational implications of their use was quickly realised and this had led to the setting up in 1962 of the Experimental Development Unit. In 1963 a new National Audio-Visual Aids Centre was established where the whole range of audio-visual aids was available and where local education authorities and individual teachers could seek advice, watch practical demonstrations, and attend organised courses.

188. The witnesses said that the Foundation's services had been used mainly by schools, training colleges and technical colleges but they emphasised that these services could easily be made available to universities if sufficient additional finance were provided. There would have to be adequate university representation on an enlarged National Committee and they recognised that universities and university departments would require a considerable degree of autonomy, for example in the making of their own films. But they stressed that many of the services at present provided by the Foundation, such as the Foundation Film Library, the National Centre, the advisory, information and technical services could be made available to both schools and universities. This would enable needs at all educational levels to be met at minimum cost, and the amalgamation of the cataloguing and distributing departments to serve all levels could bring nothing but advantage. In their view catalogues were of little value unless they were supported by an efficient library service. The ease with which films could be made available to the user was of paramount importance.

189. Finally, in addition to their activities in this country, the Foundation provides a liaison with audio-visual organisations abroad and, together with the Scottish Film Council, are the British contributors to an international series of teaching films.

The Central Office of Information

190. This Government body has a Central Film Library consisting mainly of documentary films but it also has about 700 films designed for industrial and technical training. In our opinion most of these films are more suited for schools or for industry than for establishments of higher education, but there are some which could be of value at this level.

Scotland

191. In Scotland there is no single counterpart to the National Committee for Audio-Visual Aids in Education with its executive body the Educational

Foundation for Visual Aids. There are instead four bodies, closely related and housed in the same building. These bodies are:—

(a) The Scottish Film Council;
(b) The Scottish Educational Film Association;
(c) The Scottish Central Film Library; and
(d) Educational Films of Scotland.

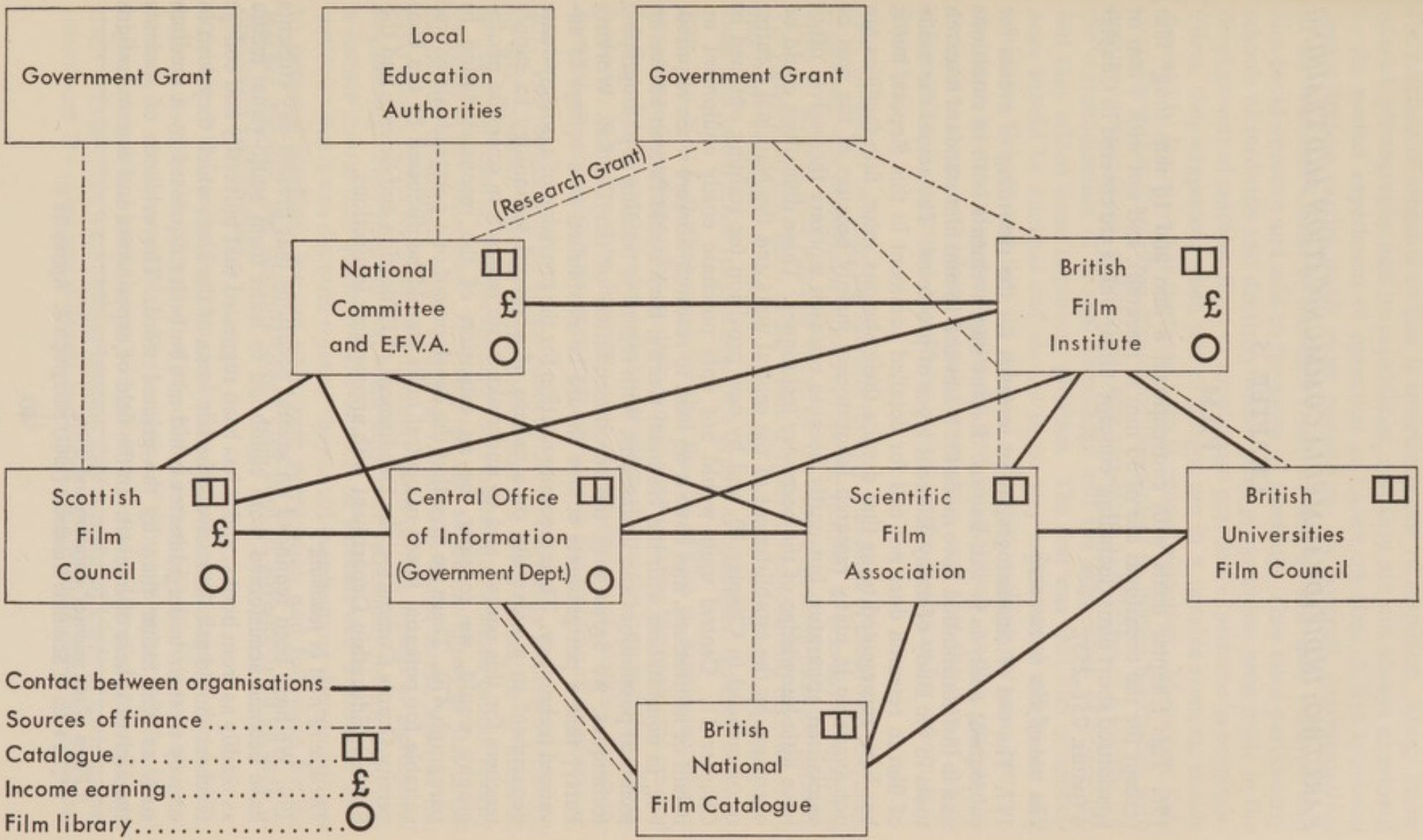
192. The Scottish Film Council is the senior body. It used to receive its exchequer grant through the British Film Institute but now receives a direct grant from the Scottish Education Department. The Council has a general interest in the cultural and industrial training aspects of film. Its main concern and that of the Scottish Educational Film Association is with educational films. The S.E.F.A. is primarily concerned with schools, further education establishments, industry, churches and youth organisations but it provides services to universities whenever required. It has closed-circuit television and language laboratory equipment. It has organised demonstrations of programmed instruction and of all types of apparatus including overhead projectors, and has arranged viewing sessions and courses for projectionists. Special sessions have occasionally been arranged for universities. The Scottish Central Film Library contains about 6,000 films, slides and filmstrips. It distributes films to most of the schools in Scotland, as few Local Education Authorities have their own libraries. It also supplies Scottish universities on request. Educational Films of Scotland is responsible for the production of educational films, filmstrips and transparencies intended for use in Scottish schools and to supplement the resources available from commercial film makers.

193. In their evidence, representatives of all four organisations stressed that although there were in Scotland several bodies, each dealing with a different aspect of communication, they were all associated with the Scottish Film Council and could easily interchange information. The Director of the Council felt that universities would make more use of the facilities which the Council provided if they knew what films were available. He thought the Council could help universities by acting as an information centre and that a comprehensive index of films would be of value.

THE UNITED STATES

194. Reference has been made earlier in this Chapter to pioneers of central units in universities in the United States and to their work within their own universities. The facilities supplied by their departments are more fully described in Chapter 3. There are many bodies concerned with co-ordination of information on a national scale in the United States. Some are special-interest organisations which deal with subjects such as medicine or public health, or cater for special groups like the American Science Film Association. Others include a national tape library for language laboratories, an associated group of university-sponsored film-production units, and the institutions which provide audio-visual facilities for the fighting services.

195. Our recommendations about the co-ordination of information, facilities and training both for individual institutions of higher education and for the country as a whole will be found in Chapters 10 and 11.


Government Grant
Local Education Authorities
Government Grant
(Research Grant)
National Committee and E.F.V.A.
British Film Institute
Scottish Film Council
Central Office of Information (Government Dept.)
Scientific Film Association
British Universities Film Council
British National Film Catalogue
Contact between organisations
Sources of finance
Catalogue
Income earning
Film library

CHAPTER 5

FILM

196. This Chapter deals with conventional 8 mm and 16 mm long* film (except for the occasional use of 35 mm in research), and not with 4 mm or specialised short films (including 'concept' films) which are covered in Chapter 6 (paras. 251–253).

The use of film in research

197. The use of cinematography in research for the recording of events for subsequent analysis is well-known. Recent improvements both in emulsions and in instrumentation have made the 8 mm and 16 mm film standard research tools in the study of many different types of problems. The actual use made of film in research does not call for detailed comment in this Report, but it has been represented to us that despite their obvious value, film facilities are not available in many research laboratories, mainly because of the cost of specialised apparatus, but partly because research workers themselves often have little knowledge of the necessary techniques. These difficulties could be overcome by the establishment of the central units and the National Centre, recommended in Chapter 10, and by new provision for training outlined in Chapter 11. Central units would not only purchase costly equipment on behalf of institutions, and issue it on loan to research workers when required, but, in consultation with the National Centre, they would furnish advice on technical possibilities and limitations. With regard to training in photographic techniques, we agree with the recommendation of the D.S.I.R. Working Party† that a postgraduate course should be established in a college of advanced technology. Their recommendation for the provision of a postgraduate department in a university or a college of advanced technology to supply teachers for this course, and to undertake basic research in scientific photography would, we consider, be an extension of the recommendation in paragraph 470. There we urge that the development of a postgraduate course suitable for potential heads of central units should be discussed by the University Grants Committee, the Department of Education and Science and the Scottish Education Department with appropriate institutions.

The use of film in teaching

198. We have been reminded on several occasions that present-day students have become accustomed from childhood to learn from audio-visual media as readily as from books, and it has been suggested that university and college teachers should ask themselves whether some of the ideas which they wish to convey to their undergraduates could not be better expressed by a medium such as film rather than by the printed word. The evidence of students themselves is here of interest. In the field of experiments and demonstrations

* Films of ten minutes' duration and over.

† 'The Film in Scientific Research' (1963) paragraph 4. Appendix 1.

the reaction of students to film is sometimes one of suspicion. Many know of trick photography and its capabilities, and they are not always convinced by the perfect experiment or operation as shown on film. A live television demonstration carries much more conviction. By contrast, representatives of the National Union of Students (N.U.S.) told us that they believed that film could improve and add to the scope of teaching. They cited particularly schools of medicine and dentistry where great progress has been made in the development of teaching films to supplement practical experience in hospitals. Films, they suggested, when put to proper use in a suitable context, enable more to be learnt in less time and with improved retention. Moreover, they considered that films often stimulated the student to pursue his studies with greater independence, and that the film was often as effective as a teacher for the communication of factual knowledge and the application of principles. But they added some important provisos. The first was that film commentaries should be minimal and should in no way replace later discussion and criticism. Others were that the value of a film for teaching purposes rests on the correct correlation between audio and visual effects, so that neither the ear nor the eye is overloaded with impressions, and that the rate at which information is presented should be suited to the audience for whom it is intended.

199. In teacher training, the students thought that films of classroom teaching, combined with discussions, could reduce the number of one-day observation visits to schools and possibly some of the short teaching-practice periods. They suggested that films could widen a student's educational experience by recording examples of teaching situations which he might not otherwise see, such as a one-teacher rural school or a group of backward children at work.

200. The N.U.S. further suggested that the use of film to supplement works experience for engineering students would help to solve the problems created for firms by the concentrated influx of students during the long vacation. Here, however, it must not be forgotten that the experience of working in an industrial environment is an important element in the training of engineers.

201. The representatives of the Association of University Teachers (A.U.T.) in their evidence referred to the use of film for the presentation of material not easily accessible, and for making those observations which cannot readily be made in any other way. They referred also to the usefulness of film in the exposition of subjects which could be reduced to visual terms, such as the early stages in the teaching of astronomy or in certain aspects of mechanical engineering. They believed that when films were judiciously interpolated into a lecture course they quickened the interest of students and broadened their outlook. But it was doubtful whether they could ever be more than an adjunct to personal teaching, for not only were preparation and follow-up by the teacher essential, but students would also want to advance from viewing to discussion and analysis.

202. Many university teachers, including the representatives of the A.U.T., believe that considerably greater use of films would be made if suitable ones were more readily available. The majority of films are unsuitable for use at higher educational levels, some because they include theoretical material best dealt with in other ways; others because they contain all kinds of irrelevancies introduced for other and different audiences. Many films today are intended

for school-children rather than undergraduates, because the makers for economic reasons aim at a wide audience. Sometimes they are 'prestige' films which illustrate with success an industrial process but which, from a teaching standpoint, are less satisfactory. Replies to a questionnaire sent out by the British Universities Film Council in 1959* showed that, although many teachers wanted to use film as illustration in their lectures, the long instructional film, particularly the sound film, was not what was wanted. Teachers had no wish to hand over a lecture to an impersonal voice. They tended therefore to use films only when they wanted their students to hear the views of a well-known authority or when they felt that only by film demonstration could some phenomenon be shown adequately.

203. Many teachers consider that films should be used in the same way as lantern slides for the illustration of lectures. But some enthusiasts claim this to be much too unimaginative and too narrow an outlook. They believe that there should be a more widespread appreciation of visual perception and values. Whereas book diagrams and illustrations help to illuminate the text, films have themselves to present the concepts and are in no way a supplement. It has been suggested that some text-books for first-year university work could with advantage be replaced by films. We do not support this idea. The preparation of films would be very time-consuming and costly, and there would be the temptation to use them long after they had become outdated. Unless they could be produced as freely as books they suffer from the disadvantage that they give only one approach to a particular topic whereas books by their variety and range present subjects from different viewpoints. On the other hand, it would undoubtedly be an advantage to have a number of films made by authoritative teachers on their specialities. Those made by great scholars would be of interest and of value to posterity.

204. The verbal discourse, typescript and print are no longer the only effective channels for communicating ideas. Academic films are as proper a use of cinema techniques as books are of writing and printing and, in this connection, we foresee a time when in certain disciplines, such as medicine, biology and psychology, a film recording an original piece of research may be accepted by universities for a higher degree.

The value of film in teaching

205. There is in our view a danger common to both film and television that they might be misused through regarding them as substitutes rather than aids. Film should not be used to show common observations and experiments which the student should, and could, make for himself. A film demonstration of an experiment or of an operation which is rare or unique is eminently suitable. In our opinion, films can properly be used to introduce a subject, for revision, for topics requiring time-lapse or high-speed photography, for teaching a technique, for the presentation of animated diagrams, for illustration purposes where colour is important, and in any other situation where movement or change is involved (see also para. 206). At the University of Newcastle we saw an excellent example of the use of film as the ideal medium for a particular theme. This film, made in the Department of Photography, was a clinical record of the progress of two patients from uncontrolled

* 'The University Film Journal' No. 19, February, 1960.

stuttering to coherent speech. It was difficult to see how this could have been recorded so effectively in any other way. Similarly, at the Dental School of the University of Glasgow, we were greatly impressed by the clarity of animated diagrams which formed a film sequence illustrating the insertion of a hypodermic needle into the root canal of a tooth. It was clear that parts of this procedure could only have been illustrated by film.

Medicine and dentistry

206. Considerable use has been made of film in the teaching of medicine. The criticisms from other disciplines which have been levelled at films made by commercial companies, such as wrong emphasis, too much padding and advertisement, are of course equally applicable in the case of commercially-produced teaching films on medical subjects and the Medical Committee of the International Scientific Film Association has issued a pamphlet of recommendations to makers of medical films in the hope that it will be of assistance to both users and makers. In it they pointed out that films were often too long because, for economic reasons, they were designed for as large an audience as possible and, as a result, included material of varying levels of interest and complexity. It would be helpful, they said, if makers would bear in mind both the particular audience for which the film is intended and the exact purpose it is intended to achieve. The Medical Committee then named the groups for which medical films might be designed, pointing out that in certain cases a film might well be suitable for only part of one of the groups, and that one film would seldom be completely suitable for more than one group. The purpose of a film they outline as follows:—

'(a) showing a student how to carry out a procedure;
(b) explaining the reason why he should adopt a particular course of action;
(c) increasing his experience by demonstrating something to him;
(d) teaching him to recognise the relationships and the differences between different objects by comparing them on the screen;
(e) arousing his interest in, or changing his attitude towards, a subject; and
(f) briefly reviewing the knowledge on a subject—e.g., showing symptoms, signs, treatment and outcome of a case or a disorder.'

207. Some of our members have attended the film sessions arranged by the Medical Section of the Scientific Film Association (S.F.A.) where medical films are shown to, and discussed by, a panel of specialists and assessed for teaching purposes. The panel consists of clinical teachers who serve on a voluntary basis and the efficient and practical way in which the assessment was carried out was very impressive. Assessments such as these of the value of film for teaching in other disciplines as well as medicine would, in our opinion, be a valuable and essential contribution to the work of the National Centre, since it would be in a position to co-ordinate them for the benefit of all institutions of higher education (see para. 449).

208. We were told in evidence that the three main uses of film in dentistry were:—

(a) as a microscope to show details of technical procedures;
(b) to record unusual and rare cases; and
(c) in orthodontics, where lengthy procedures which take two to three years could be recorded in a short film.

Both the films described in paragraph 205 and several others which we were shown during our visits had been made either in the photographic departments of the institutions concerned or by individual members of staff. Such films are much more useful than those produced commercially, but it cannot be expected that all teachers would be sufficiently skilled in photography to be able to make their own films. However, with the help of the central audio-visual aid unit in their own institutions, they could, if they wished to make a film themselves, be given advice on the value of film as a medium for a particular idea and on the technicalities of film production.

Technical colleges

209. The Association of Teachers in Technical Institutions in their evidence said that films were widely used in technical colleges for such subjects as engineering, science, metallurgy, building and commerce. Criticisms of films were that they often diverged from the main theme, that important points were not repeated, that more than one showing was necessary and that there were difficulties in arranging for hire. Films had nevertheless been found to be of value, particularly short films which stimulated the interest and imagination of students.

The making of films

210. It is clear from the evidence we have heard that there is a great shortage of suitable teaching film in all disciplines and particularly in teacher training. If a film is to be of real value for teaching purposes it must be made either by, or under the direct control of, a teacher who is to use it. To be of value to other institutions it is preferable for the film to be of the type which carries two sound tracks, one optical for the original commentary and the other magnetic for the use of teachers who prefer to make their own comments. The latter is easy to erase. Where a film has no sound track, a commentary on a separate tape may be synchronised with the film if necessary. The very short film which is meant only to illustrate a part of a lecture can be produced easily by a teacher who is skilled with his camera. The making of a longer film not only is time-consuming but requires training and skill, and few university teachers can achieve the professional 'finish' which is expected by present-day students. Professional film directors on the other hand are expensive. Moreover, they lack the requisite knowledge of the subject-matter and therefore rarely know what aspects need to be emphasised. In our opinion a longer film should ideally be made by the teacher himself if he is highly skilled in the use of a camera and has the time at his disposal. He should always be provided with the maximum of assistance by the central unit (see also paras. 215 and 416).

The length of film

211. Despite the earlier criticisms of long films, they are useful at university level for specific purposes. These may be summarised as follows:—

(a) for an overall survey of a subject, to be used either as an introduction to a course and to show the students the whole 'wood' before they begin to study the individual 'trees', and for revision purposes;

(b) to explain a process or visual technique. They could offer the student visual experience either before he learns to apply the technique himself, or where visual illustration is essential to a student who may be required to

know its value and importance without ever being called upon to apply it;
(c) to show phenomena or conditions which the student would otherwise have no opportunity to see;
(d) for recording guest lectures by distinguished visitors; and
(e) as composite archives on a subject such as the history of technology.

Apart from these exceptions, the long teaching film has many disadvantages at higher levels of education. It is difficult to fit into the restricted time available for teaching; it is expensive to make or to buy, and much time is taken up on arrangements for its hire. Often a long film contains material which is irrelevant or is too complicated to be assimilated in one showing, and it requires the attendance of a projectionist. Of far greater potential value are the short film and loops used in the cassette-loaded projector described in Chapter 6, paragraphs 251–253. Our assessment of their value is given in paragraphs 259–262. Ideally such loops should present only factual data, without any attempt at interpretation, so that different lecturers could use the same film in varying teaching situations, adding their own comments.

212. The Photographic Department of Guy's Hospital Medical School has carried out experiments on the relative value of films made in the Department, basing its evaluations on returns to questionnaires and on the students' practical work. Mr. Charles Engel of the Department stressed the need in medicine for extremely short films which illustrate one single phase of a phenomenon or event, or one particular aspect of a technique (see also para. 257). Examples of this are three separate sequences which have been made on the subject of cardiac arrest. The first shows a heart beating normally, the second the beat in a trial arrest and the third the heart in ventricular fibrillation. Each sequence is of only 15 seconds' duration and the three are joined together to form a loop for a cassette.

The cost of films

213. A teaching film of 15–20 minutes' duration may cost approximately £3,000 when it is professionally produced. Each print could sell for a top figure of £50 but, assuming that 25 departments in the country taught the particular technique, and that a copy was sold to each department, this would only realise a return of £1,250. It would seem therefore that the limited distribution together with the rigorous requirements of subject treatment (para. 202) would preclude the commercial production of teaching films on any but the most exceptional topics. It has been estimated that the costs of a commercially-produced film can be cut to a tenth when made in, and by, the teaching institution itself, although some of this supposed saving is unreal since overheads and labour costs are not always accurately assessed.

214. The answer to the problem of the great scarcity of teaching films, both at undergraduate and postgraduate level, seems however to lie in the development of suitable and co-ordinated production facilities within central units of the institutions themselves (para. 421).

215. Production overheads and material costs would then be met by the institution concerned, whether the film was made by the central unit itself or by an individual teacher with the expert advice and assistance of the unit (see also para. 210). When any such film is planned, specialists in the particular field to be covered should be consulted and general agreement reached about the context and treatment. Such collaboration will lead to a more widespread

acceptance of the film for teaching purposes. A copy of the film should be sent to the library section of the National Centre for inclusion in its catalogue, and for an appraisal of its value for teaching purposes in other institutions. The National Centre would be in a position to ascertain from central units all over the country whether the film would be useful elsewhere and, if so, how many copies would be required. These additional copies should be obtained by the National Centre and sold at cost to any institution requiring them. Copies required for the library of the National Centre should, of course, be a charge on that Centre.

216. In the case of research film, the central unit would also have an important part to play. The making of research film is properly the responsibility of the individual or laboratory concerned with any particular topic, but the problems associated with the use of cinematographic techniques, the cost of equipment and the time required for a research worker himself to develop the necessary photographic, optical and cinematographic techniques should be the concern of the central unit (see also para. 421(c)). The central unit should lend items such as high-speed cameras, time-lapse apparatus and analysis facilities together with, where necessary, trained technicians to set up work in the laboratory from which the demand came. Occasionally it might be better to provide facilities for the research worker than to move the equipment to his laboratory. A further and most important function of the central unit would be to extract from research films sequences to be used both for teaching and for research documentaries. There should be close and sustained co-operation between central units and the National Centre with regard to communications in this field, for the National Centre should know of any research documentaries made for the benefit of research workers elsewhere, and of any teaching sequences taken from research films.

The making of film from video-tape

217. During our visit to the Bethesda Naval Hospital in Washington we saw much excellent film which had been produced from video-taped material. A great advantage of this method of film production is the economy which is involved both in time and money. When a course of lectures or a seminar is televised or recorded on tape, the taped recording should be transferred on to film if it is thought likely to be of permanent value. A further economical source of film production is broadcast educational material recorded on video-tape. Negotiations could be entered into with the broadcasting companies to allow the production of films from these programmes where problems of copyright are not involved.

Importation of films from overseas

218. Several international agreements and conventions exist which grant to the contracting countries privileges such as exemption of educational material from customs duty on a temporary or permanent basis. However, both the exporter and importer of a film must be from contracting countries. Even when both countries are signatories of a convention, all the conventions signed by the U.K. call for a certifying body in the importing country to guarantee the individual user's *bona fides*. Expense, form-filling and delays are therefore involved. In our view, steps should be taken to exempt from import duty all the smaller-format films used in education and to treat them

as non-fiction books. Other difficulties involved in the importation of foreign films include lack of information, copyright and language problems.

219. Reference has been made in paragraph 184 to the central cataloguing by the British National Film Catalogue Ltd. of all British films. This is being done in other European countries as a result of the recommendation of the 1962 Conference of Film Distributors of the Council of Europe. The systematic and comprehensive appraisal of films would, we consider, be best arranged on a national basis (para. 449).

220. Author's copyright and such matters as recording rights are usually cleared before export, but problems arise when television recordings are made on film (para. 344).

221. When films are imported from countries other than the United States and those of the Commonwealth, they are not always available in English and the commentary may need other forms of adaptation. Magnetic recording techniques have opened up new possibilities for rapid and cheap language dubbing, and it may well be that teachers would prefer to add their own commentary when they have received and studied the film. Where, however, a translation is thought by assessment experts at the National Centre to be an advantage and to be necessary, the cost of such translation and dubbing should be borne by the National Centre, whose responsibility it should also be to procure overseas films judged to be of value at university level.

Statutory deposit of films

222. Many valuable films have been lost. It is clear that the film-maker, unlike the book-publisher, has never been called upon to make a statutory deposit of a print of his work. Now that television broadcasting has become a voracious consumer of visual material either on film or tape, the requirement of statutory deposit would lead to a terrifying amount of material to store. Nevertheless, some fresh approach should be made to the preservation of master copies of tapes and films especially when they have clear educational significance.

Recommendations

223. We recommend that determined efforts should be made to overcome the present shortage of suitable teaching films at higher educational levels. Enthusiasts in cinematography in various institutions should be encouraged to produce teaching films of general value in their disciplines, working in close co-operation with their own central units and in consultation with colleagues in other institutions who have like interests (paras. 202 and 210).

224. The films produced should be submitted to the appropriate assessing panel of the National Centre for inclusion in its catalogue, and should then be made readily available by hire or purchase to other institutions in Great Britain and abroad (paras. 449–450).

225. If sequences from research films are thought to be of value for teaching purposes, extracts of these films should be sent to the appropriate assessing panel at the National Centre for appraisal. The selection of suitable sequences should then be the task of the National Centre (para. 216).

226. Research films themselves should be made available through the National Centre to other institutions (Chapter 10).

227. The National Centre should arrange for the processing and printing of films at a reasonable cost (Chapter 10).

228. Where a permanent record is required of a lecture or talk which has been televised and recorded on video-tape, this should be transferred on to film. Films should also be made of appropriate educational programmes after negotiation with the broadcasting company concerned (para. 217).

229. When a longer film is being made, it should preferably have a magnetic sound track so that teachers can either retain the original commentary or record their own (para. 210).

230. All educational films imported from abroad should be exempt from import duty. Their appraisal should be undertaken at the National Centre which should also be responsible for procuring such films as are deemed to be of value, translating or dubbing them when necessary (Chapter 10).

231. Consideration should be given to the preservation of master copies of tapes and films which are clearly of educational value (para. 222).

CHAPTER 6

PROJECTION AIDS

232. Our enquiry showed a wide use of conventional projection aids. The completed questionnaire indicated that the percentage of all departments using 16 mm film projectors was 68, the percentage using epidiascopes was 72, and that 57 per cent and 28 per cent respectively were using filmstrip and slide projectors. Among individual types of departments these figures varied considerably. About half the science and agriculture departments used 16 mm film projectors, the same proportion of dental departments used epidiascopes, but well over 90 per cent of education departments (university departments of education, institutes of education, training colleges and colleges of education) used each of these aids. The reason for the very high percentage in these departments is that the aids are used not only in teaching but also in order to demonstrate their use to students and to give them practice under classroom conditions. In dental and veterinary departments over 40 per cent used slide projectors, a figure well above average (see Appendix 2, Table 1). A further analysis showed that with the exception of slide projectors, universities made less use of conventional aids than did other institutions (see Appendix 2, Table 2). All the figures relate to the use of the aids in teaching; the use in research was much less. It is, however, interesting to find that more than a third of veterinary departments used a 16 mm film projector in research, a figure much above the average for all institutions.

233. The position with newer projection aids was quite different. The proportion of the total number of departments using the 8 mm cassette-loaded projector was only 6 per cent and that using overhead projectors only 3 per cent. The education departments made much greater use of the cassette-loaded projector, while the overhead projector was used most in the engineering and technology departments of the colleges of advanced technology.

234. In this Chapter we discuss three of the more commonly used aids—the epidiascope, the slide projector and the filmstrip projector—and two of the newer aids—the overhead projector and the cassette-loaded projector.

CONVENTIONAL AIDS

Epidiascopes

235. Included under epidiascopes in the tables of Appendix 2 are both diascopes and episcopes and it may be helpful to begin with a brief description of these three aids. The diascope is an apparatus which projects still pictures on to a screen by passing light through a transparency. Strictly speaking, all filmstrip and slide projectors, and indeed overhead projectors, are diascopes. The episcope differs from the diascope in that still pictures are produced by scattering from an opaque picture or flat object and the practical advantage is that no specially-prepared material is needed. Compared with diascopic projection this aid has been relatively inefficient in the past: to be effective it has required exceptionally good blackout. Modern episcopes, however, are

capable of handling larger material and, because of the smaller magnification required, have permitted a much higher efficiency with a lower standard of blackout. But the advent of the relatively cheap 35 mm camera has made the production of transparencies for projection inexpensive and speedy and, as a result, episcopes are not at present widely used. The epidiascope combines the episcope and the diascope in one instrument which is not easily portable.

236. As we have already pointed out in paragraph 232 a high proportion of departments use this type of equipment for teaching purposes. Our survey showed that it was used fairly frequently by about half the staff, but, as with most other aids, there was a wide range of opinion as to the size of class for which it was most suited (Appendix 2, Table 3). In addition to the 72 per cent of departments already using this aid a further 5 per cent (61 departments) said they would also like to have it for teaching purposes. Most of these departments were in universities.

237. In our visits we did not often see this type of equipment in use. A notable exception, however, was the Medical Illustration Department of the Westminster Hospital Medical School which has a very large projector, costing about £4,000. This was a combined projector and episcope which was used for teaching and for conferences. It was installed in a lecture theatre seating 250 and had been especially designed for use in large halls. It could project images of specimens or of any other object up to 12 inches square. Attached to this particular model was a projector which could project a full-size X-ray photograph.

Slide and filmstrip projectors

238. With the increasing efficiency of photographic techniques the slide projector, using photographs on 35 mm film mounted individually as 2 inch square slides, has become the modern version of the diascope. It is light and compact and when used with interchangeable lenses of varying focal lengths it can produce greatly enlarged pictures of high definition. It was a little surprising to find that only 28 per cent of departments were using such projectors for teaching purposes and that those without them expressed no desire to make good the deficiency (Appendix 2, Table 5). The highest proportion of users was in universities, among the relatively small numbers of departments of dentistry and veterinary studies. Our survey showed, however, that in those departments where there were slide projectors they were used very frequently by a high proportion of the teaching staff. Although there was again no general agreement about the size of class for which they were most suitable, the figures in Table 3 of Appendix 2 suggest that they would be used more readily with large classes than would epidiascopes.

239. During our visits we saw several institutions where extensive use was made of slides and slide projectors. The Medical Illustration Department of Guy's Hospital Medical School and the Department of Photography at Newcastle upon Tyne University each produce centrally about 10,000 slides a year and this service is available to any department within their institutions. Analysis of the slide output at Newcastle University showed that 60 per cent were medical, 25 per cent non-medical, and the remaining 15 per cent were for theses, papers and extra-mural work. The Department at Guy's Hospital has designed and installed special day-light slide-viewing equipment in a number of clinical departments. The Birmingham College of Advanced

Technology has a central visual aids section which undertakes assignments for all departments of the College and about 5,000–6,000 slides are produced annually. Another central visual aids section is at the Bolton Technical Training College where we saw a very well-equipped suite of rooms and a wide variety of apparatus designed to show the students the use of visual material in the teaching of technical subjects. The standard of slides produced by the students of this College was exceptionally high. Finally, at the Institute of Dermatology, London, we saw a most impressive collection of slides, all of which had been prepared in the Photographic Department. Not only is this a very extensive classified collection of beautifully prepared and mounted slides but they are stored in a unique arrangement of very large frames which make the slides readily and easily accessible. In our view they constitute an unusually valuable teaching aid. At the Institute we were also shown an experiment in which instructional material spoken very slowly and clearly on tape was accompanied by slides and a table viewer. This was designed for, and was proving to be very helpful to, overseas students who had difficulty in following the English language.

240. The filmstrip projector is a slide projector with a separate adaptor which allows a continuous strip of photographs on 35 mm film to be shown instead of separate slides. The advantage of this method of presentation is most evident when a series of photographs on the same, or closely related topics, is shown in a fixed sequence. When individual photographs are to be projected, however, or when the sequence of presentation needs to be flexible, it is necessary to mount the photographs as separate slides. We were also shown examples of filmstrip during our visits, but these were not as numerous as the comprehensive slide collections described in paragraph 239.

241. Reference has been made in Chapter 3 to our visits to institutions in the United States. As regards slide and filmstrip projectors, there was no great difference between their use in the United States and in Great Britain.

NEWER AIDS

Overhead projectors

242. The overhead projector, sometimes called the 'writing projector' or 'diascriptor', is a modern form of the diascope. It projects pictures from horizontally-placed transparencies up to 10 inches square to give images of about 8 feet square when the projection screen is some 12 feet from the projector. The projected pictures may be either prepared charts or diagrams on transparent sheets, which are mounted individually in card mounts and placed separately or in combination on the projection area, or they may be illustrations drawn during a lecture by the teacher on a continuous transparent roll of acetate film by means of a wax-based pencil or with a felt-tipped pen. When no longer required the pencil drawing may be erased with a soft cloth and the ink by a cloth moistened with ink solvent.

243. There are two main forms of these projectors. In one, the light from the projection lamp is reflected out of the light box into the focusing head and through a projection lens by means of a large curved mirror; in the other, a quartz-iodine light source is used in conjunction with a special lens (called a Fresnel lens) which acts as a condenser. Both types of projector are fan-cooled. Because of its higher-quality optical system the resolution of the

former projector is higher, but it is heavier and more expensive. It is the type most suited to a permanent installation. The latter type of projector is less expensive, lighter, and easily transportable.

244. The main advantage of the overhead projector is that the teacher is able to provide illustrations of greater breadth and depth than he can on a conventional chalkboard. By using a roll of acetate film (usually 10 inches wide by 50 feet long) which is fitted on rollers at the sides of the projector, the teacher can draw a series of about 60 diagrams without the need to erase any of them. Each completed diagram can be moved across the screen to expose a fresh area of film on which the next illustration can be drawn. A review of all illustrations on the roll can easily be accomplished by rewinding the roll to its starting position. By this means a teacher can either illustrate his lecture with fresh diagrams, drawn *ad hoc* on each occasion, or, if he prefers, he can use a roll of illustrations prepared in advance and retained permanently.

245. Alternatively, by overlaying a number of previously-prepared diagrams on separate card-mounted sheets of film the teacher is able to build up, step by step, complicated diagrams which could not successfully be attempted on the chalkboard. These diagrams may be prepared by the teacher using wax pencil, pen and coloured inks, and coloured adhesive paper; or they may be existing diagrams copied on acetate film by photo-copying or dyeline printing.

246. Two Reports which appeared in May* and June† 1964, give more detailed information on the use of the overhead projector: a third report‡ was published in July, 1965. We do not think it is necessary therefore to go into any further detail, except to summarise the main advantages of this very versatile instrument. These are:—

(a) since the illustrations are projected backwards on to a screen placed behind the teacher, he is able to remain facing his class and does not run the risk of losing contact intermittently as he does when writing on a chalkboard;
(b) the projector does not require a blackout; it can be used in the normal lighting of a classroom or lecture theatre;
(c) although it is customary to use a screen the image can be projected satisfactorily on to a smooth, light-coloured wall. In some circumstances, however, the image suffers from 'keystone' distortion;
(d) the overhead projector is not limited to static diagrams. It can show moving diagrams and models and can project many experiments as they are performed;
(e) the projector can be used in situations where chalk dust would be particularly undesirable;
(f) it can make working with a small group more informal and writing for large groups less strenuous;
(g) it eliminates the tedium of cleaning large boards and makes possible the retention and revision of much material; and

---

* Report of an experiment in a grammar school: 'Visual Education': May, 1964: National Committee for Audio-Visual Aids in Education.

† 'A Guide to the Overhead Projector': British Association for Commercial and Industrial Education.

‡ 'The Overhead Projector': The Experimental Development Unit of the Educational Foundation for Visual Aids.

(h) in closed-circuit television teaching the chalkboard must be well lit to provide satisfactory pictures on monitors and there are often difficulties of 'glare'. The overhead projector needs no additional illumination and illustrations from it can be reproduced excellently by the television camera.

The results of our survey

247. Our enquiry showed that in April, 1963, only 3 per cent of the institutions or departments who completed the questionnaire were using overhead projectors and that these were mainly in universities and colleges of advanced technology (Appendix 2, Table 2). They were used frequently by about half the staff of the departments concerned and were regarded as most suited to classes of more than 20 students. A further 3 per cent of institutions or departments expressed a desire for these projectors (Appendix 2, Table 5).

248. Most of those who have given evidence to us were enthusiastic about the potentialities of the overhead projector. The only misgiving that was expressed was whether a writing area 10 inches square would be too restricted for mathematicians, for example, who would need to work out lengthy equations. This can be a disadvantage and we were therefore interested to see that both at the Royal Victoria Infirmary, Newcastle, and the Technische Hochschule, Aachen, there was an overhead projector with a writing area just over 12 inches square. The apparatus at Newcastle could also be used to project X-ray photographs. However, a larger writing area can only be obtained by a disproportionate increase in the cost, because higher quality optical units are necessary to maintain light intensity and picture quality over an increased projection area. These larger projectors, which are designed for use in exceptionally large lecture theatres, cost more than £1,000, compared with the normal cost which ranges from about £90 to £160. We believe this extra cost could not be justified in most circumstances, where the 10 inch model would be satisfactory.

249. Other interesting features seen on our visits were at the Bolton Technical Training College where there were excellent facilities for making transparencies, and at the Walter Reed Army Institute of Research at Washington where an overhead projector had been low-mounted so that no part of it obscured the vision of any member of the class.

Conclusions

250. We have no doubt that the overhead projector is a very valuable and versatile aid which is in many respects more flexible and effective than the chalkboard. We recommend that the central service units should hold a stock of portable projectors for use by individual lecturers and should assist with the production of transparencies or, when required, produce them in the unit. We also recommend that overhead projectors should form part of the standard equipment of lecture theatres and that, where possible, they should be built into the lecture bench. Where this is done the projector should be low-mounted so as not to obscure the vision of any member of the class and the lens should not be detachable. The design of projectors should be such that overlays are interchangeable.

Cassette-loaded projectors

251. In the earliest experiments where film was used for teaching it was generally assumed that teaching film would differ little from entertainment

film, and it was not until the 1930's that the teaching film became clearly distinguishable from the documentary or entertainment film. Nevertheless for over 50 years there has been some support for the very short teaching films which illustrate a single concept and which could be integrated into normal classroom work. Despite this, and the fact that many teachers accepted their educational value, little progress was made in the use of short films.

252. At the same time interest developed in the loop film, which allows a length of film to be repeated continuously. This has met with more success, and there are available today 16 mm loop films in several subjects, particularly in science and physical education. But such films suffer from the disadvantage that the room must be darkened and time is required to lace the projector and the loop absorber. Although teachers are becoming more accustomed to the 16 mm projector the additional trouble involved in showing loop films has limited their application and made short films unpopular.

253. In 1962, however, the 8 mm cassette-loaded projector became available. For this projector the film is loaded into a cassette which is inserted into a slot on the front of the projector, thus eliminating entirely the lacing which is necessary on most 16 mm projectors. The projector is started by a simple control and the short length of film, up to a maximum of 4½ minutes' running time, is repeated continuously until the projector is switched off. The original version of this projector is designed as a single unit portable system with a rear-projection screen of plexiglass which is hooded to minimise reflections. A newer version, which has recently become available, projects on to a separate screen. It has a device whereby the film can be stopped and individual frames examined and certain models permit slow-running operation. The films are silent and therefore allow the teacher to give his own commentary.

The results of our survey

254. As with the overhead projector our inquiry showed that relatively little use was being made of the cassette-loaded projector in higher scientific education. Only 6 per cent of the institutions or departments who completed our questionnaire were using it, the highest proportion in the Colleges of Education in Scotland (Appendix 2, Table 1). The projectors were used fairly frequently by about half of the staff concerned and the majority regarded them as most suited to classes of up to 20 students (Appendix 2, Table 3). A further 9 per cent of institutions or departments said they would like to have these projectors (Appendix 2, Table 4(c)).

255. During our visits we saw demonstrations of cassette-loaded projectors in the Biology Department of Guy's Hospital Medical School, at Birmingham College of Advanced Technology and at the Bolton Technical Training College. At Bolton we saw cassette films which had been made at the College, and we were told that in some instances the making of the films had revealed aspects of the technical process which had not been appreciated by the craftsman actually carrying it out. This had proved an interesting by-product of film making.

256. At the National Institute of Health, in the United States, we saw an 8 mm projector incorporating sound, which could take cassettes of up to 30 minutes' running time. The longer film did not seem to us to retain the merit of the short, single-concept film, however, and the cost of the projector was nearly three times that of the silent projector.

Evidence

257. We received evidence from Mr. Charles Engel of Guy's Hospital Medical School, who, in the course of writing a report on the use of very short films as university lecture illustrations, had consulted university professors of anatomy and physiology in Great Britain, the Commonwealth, Germany, the Netherlands and the U.S.A. According to him, the majority of the professors were in favour of short films and cited four criteria which they thought should be fulfilled:—

(a) the short film should not attempt to interpret, but should present factual data only, so that different lecturers could use the same film under varying teaching situations, adding their own comments;
(b) each film should concern itself with only one well-circumscribed aspect of movement or one phase of an event;
(c) each film should be as a short as possible; and
(d) the film should be readily available for instant use in the lecturer's department.

It was also suggested that a development of the projector to offer multiple cassette-loading with remote-control random selection, a zoom lens with remote focus-control, and facility for both rear and front projection would sometimes be an advantage.

258. Additional support for the cassette-loaded projector was given in evidence by representatives of the British Universities Film Council, the Association of University Teachers, the National Committee for Audio-Visual Aids in Education, the Scottish Film Council and by Professor Zacharias of the Massachusetts Institute of Technology at Boston. It was frequently emphasised during discussion that since copies of these short films would be inexpensive (about £2), the need for central storage and distribution on a national scale would not arise. Adequate collections could be built up in university libraries or in individual departments.

Conclusions

259. Details of trials on one type of cassette-loaded projector were given in a Report* published in April, 1964, which concluded that '. . . the 8 mm cassette projector has solved the problem of the projection of short films and loops in the classroom. It eliminates the problems of, and the time involved in, lacing and setting-up; it enables the teacher to introduce an illustration at any stage of the lesson and to repeat it as often as required. It follows that the advantages of the projector can only fully be realised if the films are, like filmstrips or books, . . . readily available at hand. This projector can in no way be regarded as replacing the filmstrip or slide projector, or the 16 mm sound projector. Indeed, it is complementary to them. It puts into the hands of the teacher a new and valuable tool which can make a definite and specific contribution in the classroom. The extent to which it would do so will, to a large extent, depend on the quality and range of films which become available.'

260. These trials were carried out in schools and colleges but we believe that the conclusions reached are equally valid throughout higher education—that this projector, like the overhead projector, is a visual aid of great potential.

* 'Experimental Development Unit Report No. 1': National Committee for Audio-Visual Aids in Education, April, 1964.

We therefore recommend that central service units should maintain a stock of cassette-loaded projectors for use by individual lecturers in smaller lecture rooms and in laboratories, and also by individual students for private study and revision, perhaps in association with tape-recorded material.

261. The extent of the use of these projectors will depend upon the supply of films available and we recommend that central service units should provide facilities for their production. The library services of the unit should catalogue and store copies of films for use in its own institution and should ensure that details of these films are notified to the National Centre for inclusion in the national catalogue.

262. We also recommend that within its library services the National Centre should make provision for the scrutiny of all teaching and research films submitted for inclusion in the national catalogue and for the extraction of those sections which would be particularly suitable for 8 mm cassette projectors.

CHAPTER 7

TELEVISION

263. Television is a powerful and influential medium of mass communication and in this Chapter we consider the part it can play in the field of higher scientific education.

264. It is important to distinguish between broadcast or 'open-circuit' television received by all on domestic sets and 'closed-circuit' television which is restricted to, and can be received only by, specific audiences. The former is public television and involves multi-directional radiation over a considerable reception area; the latter is a system of private television using a highly-directional transmission link, either in the form of a very narrow beam of radiation which can be received only by means of a highly-directional receiving system designed for the purpose, or a coaxial cable linking the camera directly to the receiver.

CLOSED-CIRCUIT TELEVISION

Universities

265. Replies to the questionnaire which we sent out showed that in the Spring of 1963 only 7 per cent of the scientific departments concerned, and less than 40 per cent of the staffs of these departments, were using television either for teaching or research, and that a further 30 per cent of the departments wished to do so (see Appendix 2, Tables 2, 3, and 4(a)).

266. The highest percentage figures were found in departments of engineering and technology, followed by departments of medicine and surgery, and then by those of dentistry. In one medical school, *cctv* has been used since 1958. Heads of departments who were using television either for teaching or for research were asked to tell us the way in which they were using it and to assess its value. A summary of their comments is set out in the following paragraphs, together with information gathered as a result of our visits.

Radiology and radiodiagnosis

267. At Bristol, television equipment is attached to an X-ray image intensifier and produces a brighter image with a smaller X-ray dosage. Demonstrations are given both to undergraduates and postgraduates and members of staff are convinced of the value of television for teaching.

268. Similarly, at Leeds it has been found to be of considerable use in the teaching of anatomy to both medical students and nurses. Eighty students in a well-lit theatre are able to watch X-ray examinations which would otherwise be seen with difficulty by only three or four students. (In view of the fact that screening has to be minimal, the programmes consists of quick, interrupted 'shots'. If these were video-taped the programme could be edited and condensed, and in its final form could be used for generations of students.)

269. The Department of Radiology at Birmingham has two *cctv* sets and hopes to have a third in 1966. The staff are very enthusiastic about the use of *cctv*

and are convinced that it is of great value in the teaching of a wide range of radiological material.

270. In paediatric radiology, where radiographs are usually small, the television demonstration method was described to us by a radiologist at The Children's Hospital in Birmingham as invaluable. In his view, there should be a camera so placed in each of two lecture rooms at the Hospital that it could be trained on any details which required demonstration. The picture on the monitors could be changed, by appropriate switching, from the demonstration to scenes in the operating theatres, to ward examination rooms, out-patient clinic rooms, pathology department and X-ray examination rooms. Camera movement and lens zooming in these five cameras could be operated by the lecturer from the lecture room. We agree with this radiologist's opinion that the value of television when used for teaching in this way would soon justify the installation costs involved.

Psychology and psychiatry

271. The staff of psychology and psychiatry departments pointed out the importance of television for one-way observation purposes to demonstrate to students the techniques of psychological testing and interviewing and to watch the behaviour of animals and of small groups of children. Entire classes could follow these on monitors, without interfering with animal behaviour and without embarrassment to patients or children. Information such as instrument readings could also be shown to groups of students.

Physiology and pharmacology

272. In the Physiology Department at Edinburgh television is used for magnifying phenomena taking place in a minute area to classes of seventy students or more. It is also used to demonstrate experiments taking place in confined spaces where students cannot assemble, and for low-power microscope demonstrations where it has been found to have some advantage over microprojectors for moving objects, although the absence of colour was said to be a serious limitation.

273. Members of several other departments of physiology pointed out the value of television as a means of magnifying detail for examination by large classes. During a visit to Birmingham we were told that the Department of Physiology was for this reason the one which had probably benefited most from the use of television. Procedures carried out in very small fields could be shown without the inconvenience of darkening a room, which is essential for a similar demonstration on film. Another advantage of television as opposed to film demonstrations was that students tended to be sceptical of the latter (para. 198). The value of accurate colour television as a teaching tool in physiology was again stressed because it would enable students to acquire a knowledge of the exact colour of the tissues, vessels and other structures which were being demonstrated to them.

274. Reports were received from several departments of pharmacology that television was being successfully used for the demonstration of detail. The Head of the Department at Oxford was not entirely satisfied with his experiments in this field, largely because of inadequate equipment and because demonstrators were still developing the technique. He intended, however, to continue his experiments with the medium.

275. Members of the Department at King's College, London, had found

television to be useful not only for showing detail to large audiences, but also for enlarging by means of a suitable lens details which are too small for the naked eye to see. Here, television is used as a microscope.

Clinical medicine and surgery

276. The magnifying power of television is its obvious value in surgery but there is the added advantage of a lower risk of infection by limiting the numbers of those present in an operating theatre.

277. In clinical medicine, members of the Cardiology Unit in the Department of Child Health at Glasgow said that a training scheme in paediatric cardiology was being planned for overseas graduates and that *cctv* would be invaluable for this purpose. In research, they regarded television as essential to the performance of time-consuming and complex haemodynamic studies.

Anatomy and biology

278. Students in the Anatomy Department at St. Mary's Hospital Medical School, London, had found *cctv* to be more stimulating than films or slides, and it was expected that it would be very useful with large practical classes, when there were not a sufficient number of demonstrators.

279. The Medical School at Newcastle has been particularly progressive in the field of television. It is used daily, mainly by students of topographical anatomy. Its use is to be extended to living anatomy and embryology. Newcastle has found that one senior member with television can release about ten demonstrators for other work. The advantages are that the demonstrations are made by experienced staff and that the other demonstrators have more time for personal discussion with the students. The use of television has also shown that it is possible to economise on demonstration material since only one good specimen is needed for the whole class. The Head of the Department of Anatomy has found that television simplifies the instruction of students in methods of dissection, and this has proved to be particularly valuable in dissections of the brain. It has of course been used for magnifying detail and also for the demonstration of special material, such as circulation in the living animal. It was stressed that television demonstrations were always reinforced by personal demonstrations to small groups, and that *cctv* had become an essential part of the Department's teaching equipment and one much valued by both staff and students. Members of the Dental School at Newcastle too used television extensively for the teaching of topographical anatomy and dental morphology.

280. In the Department of Botany at Queen's College, Dundee, *cctv* equipment has been in constant use in lectures, lecture/demonstrations and in practical work. The staff find it to be a most useful piece of teaching equipment and students are very responsive to it. It is used for showing microscopic and macroscopic specimens, diagrams and charts. In University College, London, it is used for similar purposes but it has also been used to relay pictures from research laboratories to lecture rooms and to transmit lectures to large audiences in several theatres simultaneously. The Head of the Department drew our attention to the potentialities of television if it were used in the University on an intercollegiate basis.

281. This use of joint teaching resources was suggested too by the Head of the Department of Zoology at University College, London. The absence of colour in *cctv* is a disadvantage in the teaching of this subject but if student

numbers increased very rapidly television might be installed despite this limitation.

Engineering and metallurgy

282. At the Department of Metallurgy in Leeds it was hoped that television would help to overcome the problem arising from increased student numbers. While the classes were small it was possible to give tuition of an almost individual nature on such topics as the interpretation of the micro-structure of a metal surface. Now that such tuition was no longer practicable, television enabled 30–40 students to receive instruction on their monitors and to proceed to the examination of their own specimens. The staff of the Department of Mechanical Engineering at King's College, London, hoped that by using television students could spend more time on the individual examination of specimens.

283. It was intended also in this Department to use television to demonstrate techniques and models from rooms where lack of space limited the number of direct viewers. We saw an example of this latter use at Birmingham, where heavy apparatus for the testing of metals in compression was installed in a confined area of a laboratory. The behaviour of the material under test was relayed to a lecture room, which had a two-way sound communication with the laboratory. The importance of making adequate provision in new buildings for television cable conduits was seen here because the cable had to be laid on the floor of the theatre and passed through several laboratories and corridors. Here, too, we saw television used in radar research designed to investigate the detection of specific shapes on the television screen in the presence of interference.

284. At Cambridge we attended a first-year lecture in thermodynamics where *cctv* was used for the transmission of the lecture to a second room. The camera was pre-set to cover the lecturer as he worked at one blackboard; it had to be adjusted when he moved to the next board but he found it easy to make the necessary adjustments himself. There was also a television camera which was trained over his own shoulder on to his notes, thereby enabling him to show the students any part of them he wished. We were told that the students who were not in the same room as the lecturer were not at a material disadvantage. We were told that, even if the lecturer himself only appeared intermittently on the monitor, this was sufficient to maintain contact with the class. Where the first-year classes number 250–300 students it was difficult for students at the back of the theatres to follow the lectures. The best size of groups was envisaged as around 50 and groups of this size can be taught by the use of *cctv*.

Physics

285. In the Department of Physics at Cambridge it was felt that the use of television as a teaching aid had many possibilities, particularly in optics, and for the transmission to the lecture room of pictures of experiments using research equipment which could not easily be moved. Its use in research was restricted to viewing meters and other measuring instruments which were normally inaccessible. It is also used in this way at Glasgow and Liverpool, and at the latter is held to be indispensable for this purpose.

286. The Physics Department at Exeter has found television to be extremely

useful in the field of optics for demonstrating spectra, fringe phenomena and interference, and for particularly effective demonstrations of Brownian movement.

287. In the Department of Physics at the Manchester College of Science and Technology we saw a camera in a small, portable fitment used to demonstrate Brownian movement, Millikan's oil-drop experiment, Young's interference fringes and particle tracks in a cloud chamber. All these experiments would have been difficult to show under normal conditions to more than one student at a time but by using *cctv* they were clearly visible to large groups of students. This was a striking demonstration of the 'close-up' use of television.

288. At Manchester University we saw another interesting use of *cctv* in the Department of Physics where it played an integral part in a seminar method of teaching experimental physics. After an introduction by the lecturer selected students performed an experiment, the details of which were relayed by two television cameras to monitors around the class. This enabled each student to take his own readings as accurately as if he himself were performing the experiment, and the class as a whole was able to discuss the results obtained and to suggest further lines of experiment. It was suggested to us that a class of 40 to 50 students could be handled quite comfortably and that by this technique from 10 to 25 per cent of laboratory work could be taught by television.

289. At the University of Glasgow, television has been found to be useful amongst other things for arousing the interest of the less intelligent student, but the staff indicated that they would be reluctant to use *cctv* for relaying a lecture to a number of theatres, though this is done at the Physics Department at Newcastle.

290. One additional research use mentioned by Southampton was the viewing and recording of images produced by Cerenkov light through intensifier systems.

Television centres

291. It follows from these examples that at least some of the special attributes of *cctv* are well appreciated by many universities. Two of them, the Universities of Strathclyde and Leeds, have established television centres capable of serving the whole university and several medical schools have their own centres.

292. Strathclyde has set up a studio, where one of the aims is to find out how television can be used to improve the efficiency of communication in lectures. It is thought that most departments can best use the studio by producing a programme on the video-tape recorder, which can then be copied on to 16 mm film for projection and discussion in the department itself. When we saw the studio in May, 1964, it had only just been built and had not then begun to function, but we were shown an impressive demonstration lecture which was televised and played back immediately on the video-tape recorder.

293. A Working Party set up by the University of Leeds early in 1963, recommended the establishment of a television service. The purpose of this service would be to provide television facilities for departments as an aid to research and as a medium of teaching and educational research. This recommendation was accepted by the University and by the University Grants

Committee, and work on the building and on the installation of equipment was expected to take place in 1965.

Summary of uses in universities and colleges of advanced technology

294. It was clear both from the replies to our questionnaire and from the visits to some colleges of advanced technology that closed-circuit television was used there for much the same purposes and in much the same disciplines as in universities. Other departments in which *cctv* was used in these colleges and in central institutions in Scotland were those of liberal studies, industrial and civil engineering, pharmacy, chemistry, rubber technology, textile industries and electronics.

295. The returns to the questionnaire showed a considerable interest on the part of both universities and colleges of advanced technology in the acquisition of *cctv* installations. The uses for which television were intended were mostly those already described in this Chapter. They fall into the main categories of:—

(a) magnification of detail;
(b) enabling many students to see detail well, in comfort, and under conditions of lighting which made possible the taking of notes;
(c) illustration of remote objects which were in confined spaces, or were dangerous or difficult to move;
(d) unobtrusive observation;
(e) economy of staff and demonstrators;
(f) monitoring research procedures; and
(g) for overflow classes—to accommodate increased student numbers.

296. In addition to these uses the staff of many departments wanted to use *cctv* to improve teaching standards. Some said that television would help to reduce stereotyped and dull teaching; others that the use of television for some first-year courses would reduce the need for repetition and would, therefore, free members of staff for more tutorial and seminar work. In physiology recorded *cctv* lectures would provide teaching material when certain animals were unobtainable at the time when they were needed. One department of medicine would like to use television in order to record on tape postgraduate lectures for groups who could not attend at a centre.

Colour television

297. It was clear from the evidence presented to us that colour television would be of immense value to the biological and medical departments. Members of some of these departments who were using television stressed that the absence of colour was a great disadvantage and that its introduction would revolutionise the teaching of cell structure.

298. In collaboration with a commercial firm, experiments have been undertaken by the Department of Anatomy at Guy's Hospital Medical School with the use of colour television, but both Guy's and other institutions are deterred at present from installing it because the cost is prohibitive.

Institutes, departments and colleges of education

299. The questionnaire returns showed that very few institutions in this category were actually using closed-circuit television, but that a great many of

them would like it installed, mainly for the purpose of demonstrating teaching techniques, and partly for the showing of detail to large groups.

300. We visited a number of training colleges which seemed to be outstanding in this particular field. The first was Brentwood Training College, which had been experimenting with *cctv* since 1962 and, in 1964, was hoping to develop further by installing a cable link with a nearby school. The staff were also considering the possibilities of a microwave link. They stressed that its main value in a training college was not as a supplement to the teacher force or for the magnification of detail, but as a means of demonstrating methods of approach and teaching techniques to students without the air of artificiality which is so often apparent when students are sitting with the class which is under observation. The installation at Brentwood consisted of a demonstration room equipped with two 625-line cameras, one fixed and one on a monorail, and both controlled remotely from an adjacent room so that no operators were needed in the room where the actual demonstration was taking place. The top floor of the teaching block at the College was equipped with one 14-inch and three 27-inch monitors which enabled 300 students to watch the demonstration. Experiments were carried out in the demonstration of class management and of various teaching techniques. One of the most successful of these had been a programme to demonstrate class contact. The first part of the demonstration showed the effect on children of bad teaching—boredom and eventual loss of discipline, whilst the second part, where contact was successfully established, showed clearly the marked difference in class reaction. *Cctv* had also been used on occasion to watch child behaviour when young children were alone in the demonstration room observed only by the camera, and for direct teaching of various subjects.

301. We were told that the children found the moving camera on the monorail less distracting than the presence of student teachers and that it was very unusual to find a child disturbed by the movement of the camera.

302. It seemed to us that some of the lessons which had been given on *cctv* could have been shown by the use of suitable film, but we were told that very few such films existed. Moreover, film generally lacked the 'immediacy' which made television so effective. The College intended to instal a video-tape recorder so that the programme could be referred to during later discussions. As an additional use, the equipment could be used either to record events in a school classroom, which could be brought back to college for student use, or to record lessons given by students so that mannerisms and faults could be noted and corrected. The next step would be the purchase of a portable microwave transmitter which would enable live pictures to be sent back to the College from any school within a 40 mile radius, using video-tape to record these programmes.

303. At Avery Hill Training College we were told of the cable link installed in 1963 between the College and Kidbrooke School for Girls three and a quarter miles away. This had talk-back facilities which enabled the students at the College to discuss with the lecturer a lesson he had given at the School. The equipment consisted of two 625-line cameras, a control console and three monitors at the School with three 27-inch receivers at the College. (At the time of our visit 180 students were watching one receiver, but this was found to be unsatisfactory and a more reasonable number was thought to be 60.) The classrooms at the school had not been designed expressly for television

teaching and there had been some difficulties with acoustics and lighting. The children were in no way distracted or disturbed by the presence of equipment and camera crews. Unlike the arrangements at Brentwood (paras. 300–302), this College felt that it was better not to have remote control of cameras since the crews could turn their cameras instantly to show any incident of interest which happened during a lesson. Students could be shown the class at regular intervals. Experience showed that it was essential to have a close liaison between the lecturer, the cameramen and whoever was in charge of picture switching. We were told by members of the College that any lesson which is to be transmitted must be very carefully thought out, not only in relation to the work to be covered, but also with regard to presentation. It was necessary too for the camera crews to be aware of the general plan of the lesson in order that the cameras should be in the right place at the right moment.

304. Replies to a questionnaire circulated to those students who were following television lessons had shown clearly that the students felt *cctv* to be superior to normal lecturing. This arose from the realisation that only by actually seeing such things as class organisation and the speed at which children learn could the students fully grasp them. Another benefit which the students felt they had gained by watching expert teachers at work was the art of questioning a class. The students felt that the reaction of children and their responses, which came through clearly on *cctv*, helped them to understand this particular aspect of teaching much more than conventional lectures where only hypothetical cases could be discussed. The main disadvantages of *cctv* lessons in the opinion of some were:—

(a) the children did not behave normally;
(b) the children's answers could not always be heard;
(c) the whole class could not be seen; and
(d) the presence of equipment in the room.

The College staff, however, had not found that the equipment was distracting or that the children behaved in any way abnormally after the initial strangeness. It was hoped to improve the sound system and, by using a larger room, to enable the students to see the whole class.

305. Full details of the work achieved by students using *cctv* could not be assessed at the time we took evidence from the College, but the staff felt that the returns to the questionnaires showed clearly that the students overwhelmingly favoured *cctv* lessons on general teaching technique, compared with conventional lectures on this subject, and that the majority of them preferred to see the lessons on *cctv* than to be present in the school classrooms. They felt that methods of presentation could be improved, and would then allow more of the 'atmosphere' of the class to be conveyed to the students and that, by using the school teachers themselves and not college lecturers, the criticism of the lack of teacher-pupil relationship would be eliminated. They added that the difficulties of taking large groups of students into schools were considerable and that here the benefits of *cctv* to the College were obvious.

306. Early in 1964 the Department of Education and Science invited 11 training colleges, including those at Brentwood and Avery Hill, to collaborate in the use of *cctv* in the training of teachers. The particular purpose of this

series of experiments was to assess the use of television in facilitating the observation of pupils by students, so that the frequency of observation visits and of teaching practice might be reduced for the schools. The work of collating this information will be undertaken by the Institutes of Education of the Universities of London and Leeds.

307. At the Department of Education, Birmingham, a new building under construction was to have *cctv* installed. This would be used for 'indirect' observation purposes and would replace the one-way glass screens previously used. It was important that students should be trained in the technique of teaching before a camera and that, just as a student could hear himself teach by means of tape recordings, so he should be able to see himself before a class by means of video-tape. In this way his own mannerisms could be seen and faults corrected.

Scotland

308. One of our members visited the Scottish colleges of education. He was told that the Committee of Principals of the colleges had recently set up a sub-committee on *cctv*, on which all the colleges are represented, to survey its present position in the colleges, to assess its value in teacher-training and to advise on future policy.

309. Two new colleges have been opened at Ayr and Falkirk; another, at Hamilton, is being built at present. The other colleges have building extensions in train or at the planning stage to deal not only with the greater number of students enrolling but also with an increasing variety of courses arising out of developments in curricula and methods. The sub-committee will have an important role in assessing the part that *cctv* can play in teacher-training and the modifications to building plans which are necessary so that the equipment may be used to the best advantage.

310. Notre Dame College of Education in Glasgow is at present using *cctv* mainly to cope with increasing numbers of students and lack of accommodation for large groups. Dundee College of Education has been experimenting for some time with a trial installation of purely video equipment using no carrier frequencies. But it has now installed, and is using fully, equipment with two vision channel outlets for 625-line *cctv* and an outlet from which can be received the standard 405-line television transmission from two commercial stations, Grampian and Scottish, as well as B.B.C. 1. The unit is also capable of distributing throughout the College microphone announcements, disc and tape recordings. In the new unit the video signals are fed directly into a specially-constructed rack by means of which these signals are superimposed on a 3·6 Mc/s carrier wave. The sound from the microphones is also led to this rack and superimposed on a 2·1 Mc/s carrier wave. This technique is used so that the cameras and sound equipment are able to feed simultaneously a large number of monitors which could be any distance up to two miles from the cameras and microphones. The new demonstration school will be situated about a quarter of a mile from the College and this arrangement will allow class lessons in the school to be shown to students in the College. It so happens that the frequencies stated above are the standard carrier frequencies of the commercial relay stations in Dundee and this provides the possibility at least that an unused channel in the relay cables could be put at the disposal

of the College to enable demonstrations and courses for teachers to be televised from the College to most of the schools in Dundee.

311. The above *cctv* system is used in the College for demonstration lessons, for normal class instruction and for the in-service training of teachers. In the other colleges experiments are proceeding in the use of the apparatus.

312. From discussions with lecturers in the colleges it would appear that *cctv* would have particular value in:—

(a) overflow lectures necessitated by accommodation problems;
(b) demonstrating teaching techniques to large groups of students from the privacy of a classroom;
(c) using the apparatus for magnification; and
(d) demonstrating psychological testing and introducing interviewing techniques.

313. It was suggested that the value of *cctv* would be considerably enhanced by its use in conjunction with a video-tape recorder or kinescope equipment, which enables film to be produced from video-tape. This apparatus would enable a library of recordings of educational situations and experience to be built up that would prove of great value in teacher-training.

Evidence

314. In the evidence given to us by the Association of Teachers in Colleges and Departments of Education it was pointed out that in the field of *cctv* the position in their institutions was changing almost daily as new equipment was being installed. In addition to the installations at Brentwood and Avery Hill referred to in paragraphs 300–305, *cctv* was being used at the City of Coventry Training College for the projection of lectures in education and science and, in 1963, several other colleges and one department were considering installation. Plans were afoot also to link together by microwave several small colleges suitably placed geographically in order to make better use of the best teachers and to provide for increased student numbers in some of the smaller colleges. Some students in these colleges had the ability to pursue academic subjects to degree level but unfortunately there was a dearth of specialist lecturers to assist them to do so. *Cctv* might help to solve this problem.

315. Both students and staff were reluctant to use television as a means of cutting down the time spent on teaching practice because they regarded it as a most valuable part of training. The Association thought nevertheless that television was a very useful adjunct in that students, particularly the weaker ones, had obtained a much better grasp of teaching techniques by watching expert teachers at work.

316. Those representatives of the Association who had *cctv* installations at their own colleges stressed two important points; first, that there was a shortage of good technical staff trained in the maintenance of equipment; and second, that colleges were too dependent on the trade for information about equipment and training. They would prefer a central organisation to which all queries could be referred and which would publish a journal giving information on equipment, developments in research and on the training of technicians (see para. 435).

317. A further point made by the Association was that some communication

equipment was very bulky and that architects, in planning new accommodation, should make adequate provision for its storage.

318. Each of the technical colleges in England and Wales, to which the questionnaire was sent, had *cctv* either in several departments or in a central pool available to all departments. The staff of most departments wanted it installed and there was some demand for video-tape recorders (see Appendix 2). More than 30 other technical colleges have *cctv* installations. In the main, they are modest, and are used chiefly in the 'magnification of detail' role. A few also use the medium to demonstrate equipment remote from the classroom, or for multiple classes. The Plymouth College of Technology has a major installation including video-tape and colour. As well as using this equipment in all the ways mentioned in para. 295, the College also provides courses for teachers in the techniques of television for educational purposes.

319. Although the humanities do not come within our purview, we believe that it might be helpful to include here the evidence given to us by Professor David Daiches of the University of Sussex on the use of open-circuit television in the teaching of English literature. In an attempt to employ visual means to direct the viewer's attention to the use of language in a piece of literature and how it should be read, Professor Daiches, with the assistance of broadcast television personnel, presented programmes on poetry, drama, fiction and non-fiction prose. In poetry, for instance, still photographs and designs were used to increase the viewer's perception of the ways in which language was used in the different poems. It was also possible to suggest by immediate visual means certain devices of style which otherwise would require long and difficult explanation. In drama the programmes showed how different interpretations demanded different kinds of visual effects from the actors, and how language and gesture could come together to achieve a unity of meaning. The objective of the first fiction programme was to help the viewer to see the basic difference between the fundamental attitudes of Jane Austen and Charles Dickens and to show, by using actors and photographs, how the novelists' use of landscape and setting was related to their choice of language and ultimately to their basic view of man and the world. In the second fiction programme the acting of the exact description of character movements given by James Joyce showed that whatever symbolic meanings were intended by Joyce, the primary meaning of their actions was naturalistic and based on the most meticulously accurate observation. The third fiction programme, by showing the visual patterns suggested by some modern novelists, enabled Professor Daiches to introduce his viewers to some of the profound problems involved in the relation between style and meaning. In the final programmes on rhetoric, historical writing and journalism, the camera was found to be of great value in building up an atmosphere which could help to demonstrate the difference between a journalist's and an orator's account of the same historical event, and between a historian's and a lecturer's account of another. By visual and aural means the attention of the viewers was drawn to the artful rhetoric of Burke, the sly irony of Gibson and the dramatic excitement of Carlyle, and so on. It is Professor Daiches' conviction that television can play a great part in literary education.

Other institutions

320. In October, 1963, a television colloquium in scientific subjects was held between departments of the University of Cambridge and Imperial College,

University of London. During the same week there was also an exchange of lectures between Cambridge and the University of East Anglia, Norwich. Both were demonstrations of the uses which could be made of closed-circuit television by microwave links, and were based on what had already been done in the United States.

321. The object of the Cambridge/Norwich link was to try out the exchange of lectures, whilst the Cambridge/London link was an experiment in inter-university discussions with simultaneous vision and sound links between the two institutions. Some members of the Committee were shown the installation and watched the programme at the Cambridge end, whilst others attended at Imperial College. Equipment of broadcast standard was used in London so that picture quality and sound reproduction there were excellent. In Cambridge, the equipment was simpler and cheaper and the technical result was of course not as good. A university intending to install a permanent link would have to be content with the less expensive equipment. It was clear to us, too, that truly spontaneous discussions would not be practicable for, without a certain amount of earlier preparation, such discussions tend to be slow and uncoordinated. Practical difficulties at Imperial College made it necessary for those in the audience who wanted to participate to move to the front of the theatre. For such colloquia, however, rooms could be used which had been suitably wired and equipped with lights, cameras and microphones. Several of the speakers in Imperial College were obviously conscious of the fact that they were talking to people at a distance, but once the technique of using the medium had been acquired they would regain the informal, relaxed atmosphere of an ordinary discussion. Details and techniques should improve with practice. We would recommend that this experiment should be repeated between separate colleges, within individual colleges and on a regional basis.

322. The type of link provided by the organisers of the 'Cambridge Week' might well find an application in the London Medical Schools and in other schools where the teaching of medical students takes place in different hospitals or in departments at some distance away from the main centre of medical student instruction. Geographical separation of units in one medical school entails loss of time in travelling from one unit to another whenever students wish to attend special lectures and demonstrations in other centres. A link of this type might well improve teaching methods and save a considerable amount of travelling. It is important to remember that in the present tendency to integrate pre-clinical sciences with work in the hospitals, demonstrations suitable for television cover a much wider field than that of surgical procedures so that subjects such as anatomy, biology and physiology could also benefit from a link such as this.

323. The organisers of the 'Cambridge Week' were enthusiastic about the potentialities of such links. The exchange of lectures between universities in the Cambridge/Norwich link demonstrated the possibilities of making use of the best teachers by sharing out lectures among a group of universities suitably placed geographically. This could be of benefit to the new universities in that it might enable them to operate in certain fields much earlier than they could otherwise do. There is no doubt in our minds that the quality of university teaching generally would improve by using *cctv* in this way. Lecturers

would be bound to pay much more attention to the content and delivery of their lectures, with resulting improvements.

Video-tape recorders

324. Many of our witnesses stressed that the value of a closed-circuit television system would be greatly enhanced by a video-tape recorder, particularly where lectures were transmitted from a central studio to a number of lecture rooms or where a difficult experiment had to be demonstrated at a precise time. In the first instance the recording of the lecture on video-tape would enable it to be delivered to a further group of students without any additional effort on the part of the lecturer. (But see para. 217 on the making of film from video-tape.) This would be a valuable facility where the numbers of students were too large to be covered by the original lecture or where the lecturer himself was pre-eminent in his field. His address could with advantage be made available over the television systems to other institutions. In the second instance, the difficult experiment could be recorded beforehand on video-tape and the recording played back during the lecture period. In either of these two situations the video-tape recorder would add greatly to the flexibility of teaching arrangements and would help to reduce the teaching load on the lecturer.

325. Unfortunately the situation is not as straightforward as this. Equipment of this sort involves much advanced electronic engineering and special techniques and a recorder of broadcast standard can cost more than £15,000. In recent years a number of 'portable' recorders have been developed, ranging in price from a few hundred pounds upwards. The cheapest recorders, however, are incompatible in that tapes cannot be transferred from one recorder to another and they also suffer from a loss of picture definition. These and other technical difficulties were set out in a survey* published in October, 1964, and there is no need for us to enlarge upon them here. Nevertheless, we are of the opinion that the video-tape recorder has now reached the stage of development that would enable it to become an integral part even of a relatively low-cost installation. Institutions which are about to set up installations should seek expert advice, and the provision of such advice would be one of the functions of the National Centre (see paras. 435 et seq.).

The need for research

326. It is no longer necessary to decide whether *cctv* is educationally useful. effective or economic; this has been established in American universities and there is little need for anyone in Britain to repeat the American investigations. The research which would be valuable here should be based on those British practices and conditions which are substantially different from American. British and American universities vary greatly in the admission of students, in the organisation of teaching and research and in size. British students arrive at universities having followed very different courses from those in American high schools and having attitudes to study and views on university education sharply contrasting with those of their American counterparts.

327. There is need to examine and evaluate the methods of preparation

* 'Developments in video-tape recorders'—published in 'Visual Education', October, 1964 by the National Committee for Audio-Visual Aids in Education.

adopted by the lecturer who plans to use *cctv* as an aid. It is likely that co-operation with colleagues, academic and technical, is more necessary than for conventional teaching. This co-operation may, in turn, have measurable effects on the colleagues, on the students taught and even on the subject presented. Preparation for *cctv* teaching will take longer and could produce a more inflexible pattern of lecture. It may or may not effect any ultimate economy in time either for lecturer or for students, but it should lead to more effective and stimulating teaching and enhance the stature of the teacher.

328. A lecturer wishing to use a television camera will appreciate that he may be about to introduce some element of production or direction into his teaching. An important question to be answered is: Who is to produce or direct? The lecturer himself? A colleague? A technician? With *cctv* the teacher may himself be seeing for the first time what the students are receiving on their own monitors. The mere reproduction on a monitor screen of what would otherwise be written on a chalkboard is a misuse of television, chalkboard and lecturer. It is possible to discover the best order in which a series of pictures is conveyed and to establish an optimum pace of communication. The effectiveness of *cctv* as an aid in certain lectures may be related to the general result of a whole course. It should be rewarding to measure the comparative success following different uses of *cctv*. The learners should offer evidence about the clarity of perception, the rate of learning and the retention of knowledge, skills, techniques or data conveyed by *cctv*. The lecturer may with external help begin an experimental assessment of his own achievement both *on* and *with* a television monitor.

329. The enthusiast can readily find ways of improvising and of converting equipment and practice to his own technique of teaching. The professional relationship between the teacher and his aid is worth investigation. Students as a receiving audience will regularly apply some criteria of achievement to the use of *cctv*. The simplest comparison will be between *cctv* and conventional lecturing or demonstrating, with or without film. The final judgment may, however, rest on aesthetic principles.

330. This appraisal of student reaction and its bearing on effective learning begs for some definition of a relevant learning theory. The modern student may well be prone to discover and respond to the visual element in any learning situation. A generation of students who have grown up with television may rightly expect a visual element while professors of an earlier generation may not feel a similar need.

331. For the lecturer further investigation may be made into questions which have a bearing on his professional role as a teacher. He may wish to have for his use a record of his work or of some interesting or particularly difficult part of it. He may see and wish to assess the usefulness of a collection of similar records either as a library or as archive materials. These records may affect both his future teaching and research and also his preparation of conventional and *cctv* lectures. They may also provide part of a 'filmography', readily available to students, to support the more customary bibliography. Indeed, these consequences of the use of *cctv* on teacher and taught are useful areas of investigation.

332. Underlying the use of *cctv* may well be a stratum of studio or viewing experience of broadcast television. No user of *cctv* can be completely ignorant

of the achievements of broadcasting. The success in particular of medical, scientific and technological programmes may prompt an investigation into the general technical problem of piping successful broadcast television programmes from video-tape recordings, from films or 'off air' into *cctv*. This rediffusion of successful broadcast programmes must immediately introduce quality of presentation and standards of production against which *cctv* may be judged whenever it is used for teaching. The experience of seeing professionally-produced television or films on the *cctv* monitors may well reinforce the need to examine critically the pace of presentation, the illumination required for television cameras and the clarity of image on monitor screens. Similarly, there may be a need to evaluate the relationship between sound and picture.

333. The use of *cctv* as an aid to teaching may require some of the expertise of broadcast television. Exactly what elements of good broadcasting will best help *cctv* may be established by careful investigation and experimentation. In addition, the technique of using other audio-visual aids in conjunction with *cctv* may well be examined with profit. Simple investigation may help to decide when to use *cctv*, where and how to place monitor screens, whether transmitted signals should originate in a central studio or in a lecture room or laboratory, and the effectiveness of one, two, or more cameras.

Conclusions and recommendations

334. We believe the main value of *cctv* to be in the functions of

(a) teaching overflow classes;
(b) demonstration of detail;
(c) teacher-training; and
(d) recording on film any lectures which are to be repeated.

335. Closed-circuit television, both by landline and microwave link, as will have been seen in Chapter 3, is used in many places in the United States for overflow classes. This is the only means whereby greatly increased student numbers in very large universities can in fact be taught at all. We in this country are not faced with the problem to the same extent although, in the implementation of the Robbins Report, the use of television may have to be adopted as an emergency procedure even in our smaller universities and colleges. Where a considerable amount of demonstration work has to be prepared it is uneconomic to use *cctv* for groups of less than 250 students, who may be in one institution or linked by land-line. In our opinion, if it is used for large overflow classes, the students should be sub-divided into small groups with a junior lecturer or demonstrator in charge to answer questions and lead discussions. The formal lecture should be short enough to allow adequate time for discussion.

336. With regard to the other attributes peculiar to *cctv*, such as magnification of detail to large groups, bringing remote objects or dangerous experiments into the theatre—in fact all the uses to which it is being put at present in some universities and colleges in this country—the value and potential of *cctv* are manifest and we would urge institutions to take full advantage of them. Where installations are large enough to justify it a video-tape recorder would be invaluable in some disciplines. The considerations which are of importance

to institutions intending to instal *cctv* are examined in a Report* published in February, 1964 (para. 325).

337. The points made in evidence about shortage of technical staff, dissemination of information from a central source and storage problems in new accommodation are dealt with elsewhere in this Report (see Chapters 10 and 11 and Appendix 8). Questions of finance are dealt with in Chapter 12 and examples of the cost of television equipment appear in Appendix 4.

338. The somewhat different value of television as 'a hidden eye' in teacher-training is possibly the most important of all, particularly with respect to teaching technique, since there is an almost total lack of good films on this subject. We think that film and *cctv* are by no means mutually exclusive in this field (or indeed in any other field) and in addition to the *cctv* experiments we have already mentioned (paras. 300–307) we recommend that urgent consideration be given to the production of films specifically for teacher-training (para. 210).

BROADCAST EDUCATIONAL TELEVISION

Open-circuit television (*octv*)

339. For several reasons we have not attempted to deal as fully with open-circuit (*octv*) as with closed-circuit television. The first main reason was that unlike *cctv* it is not at present under the control of the national educational system—nor is it likely to become so controlled—and the second, that much of value has been written during the course of our enquiry on the desirability of a separate educational television service. Moreover, it has become the subject of a government study. We did, however, enquire into the use of *octv* in some countries overseas and the information obtained from the United States, France, Japan and Russia is included in Chapter 3. In the present Chapter we state briefly some of the ways in which we consider *octv* could be of value in higher education.

340. As an educative medium, especially for those who have some mastery of a subject, television offers many possibilities. The postgraduate medical programmes broadcast by Scottish Television are a good example of its value in further education and for refresher courses. So, too, are the programme series at university level transmitted by the B.B.C. and the I.T.A. Not only are they of a very high standard but they illustrate the use of television in all its expertise and resourcefulness. As ancillary courses to amplify or clarify certain aspects of a subject they are particularly valuable.

341. We believe that educational programmes, such as in-service and post-graduate courses for school teachers, would be welcomed by members of the profession. The series of mathematics programmes for teachers in primary schools in Devonshire provided by Westward Television, and the 'How and Why' series of the B.B.C., showing recent developments in the teaching of physics, have shown the value of television in these fields. Similar *octv* series, especially if organised in collaboration with institutes of education, could be of great benefit to teachers and would help to make them aware of new ideas in the teaching of other school subjects, such as chemistry, environmental studies, and modern languages and, in the primary school, 'discovery'

* 'Closed-circuit Television in Education in Great Britain'; Experimental Development Unit Report No. 2, National Committee for Audio-Visual Aids in Education.

science. Programme series on these subjects would supplement and, in certain circumstances, even replace in-service courses for teachers. Carefully chosen courses on *octv* could be of considerable value in the retraining of those married women who want to return to teaching and whose services are so urgently needed today in the schools.

342. There are several other needs which could be met successfully by *octv*. Among these are industrial and professional retraining, preparation for certain categories of preliminary and professional qualifications and liberal adult education. The Universities Council for Adult Education has recently set out its proposals for a Centre for Broadcast Education, and all these developments could well be regarded as within the general scope of adult education. Much of the admirable work carried out by the extra-mural departments of universities could reach a much wider audience if it were transmitted over *octv* and some of the work of these departments could in future be organised to constitute an adult college of the air.

343. In their evidence, representatives of the educational broadcasting services of the B.B.C. and I.T.A. gave several examples of the contribution which they believed *octv* could make to higher education. These included:—

(a) lectures by distinguished scientists;
(b) illustration of the work being done at research centres;
(c) courses designed to keep teachers in touch with modern trends;
(d) television combined with correspondence courses and private tuition to provide courses for professional qualifications;
(e) applications of processes in industrial plants; and
(f) postgraduate refresher courses.

They emphasised that both broadcasting authorities would require substantial additional finance before their existing services could be extended to cover these aspects of higher education.

344. We foresee that many broadcast programmes either in part or in their entirety would be of value in the field of higher education; others would provide valuable excerpts, and the question of copyright in these programmes was discussed with the representatives of the broadcasting authorities. Problems of copyright would of course arise when programmes include film clips from films made by someone other than the broadcasting authority, when musical artists are involved, and when these programmes are recorded for subsequent use. The B.B.C. were considering the establishment of a central lending library of educational material for *cctv* or for direct film use, but this project too would require financial support from the Government. In our opinion, the storage of such material, its reproduction on video-tape or on film, and the loan or sale of copies for educational purposes should be a function of the National Centre (see Chapter 10). It should be possible for the Centre to negotiate arrangements with the broadcasting authorities and other holders of copyright and thereby ensure that the proper royalties were paid.

345. There has been much discussion in recent months of a proposed 'university of the air' which would provide systematic courses for degree work. The concept of a televised university originated in the U.S.A., where organisation and practice in the field of university education are more flexible and more varied than they are in this country. It is an imaginative and bold idea

which is in line with modern scientific and technological developments, and which, at first sight, is especially attractive to those who are concerned to make university education available to wider sections of the community. Provided the effort were on a large scale, and it would need to be on a very large scale to be effective, and provided another channel were made available, there can be little doubt that by mobilizing the resources of television and radio, and those of local libraries and of regional colleges, it could play an important role in our educational system. But two questions immediately arise: first, would a televised university attract and sustain for a period of years the interest and enthusiasm of a sufficient number of committed viewers to justify its very high cost, and second, would the kind of courses that could be provided on the air approximate to the academic training and mental discipline which we in this country have come to regard as the essential attributes of a university education? If the concept is to have meaning and significance its educational implications as well as its cost must be appreciated. As a medium for the transmission of knowledge television has already established itself, but the intellectual training and the insight into the world of scholarship which an undergraduate gets from membership of a university are by no means derived solely from the wide range of lecture courses which universities provide for their undergraduates. Preparation for degree work involves far more than an active participation in lectures. More perhaps than almost any generation of students, present-day undergraduates need the stimulus of seminar and tutorial work, and the constant practice in the formulation and integration of ideas involved in essay writing and in the solution of problems in the various sciences. The mounting on television of such a complete course of study, with all the attendant correspondence with individual viewers—for this too must certainly be envisaged—in even a single subject such as economics or history would be a major operation: an operation far beyond anything that has so far been attempted by the B.B.C. and the I.T.A. in their highly successful specialist courses. Provision for other popular disciplines, such as English, French, sociology, politics or geography, from which a selection could be made for an ordinary or general degree, would add substantially to the cost and would multiply greatly the problems of organisation. In the biological and medical sciences, and in the physical and engineering sciences, television instruction, however effective in the theoretical aspects of a subject, could not provide the student with the essential skills and techniques which are only to be acquired by continuous laboratory and clinical practice. It may be possible to meet some of these needs by suitable arrangements with regional technical colleges.

346. We have not been able to examine the proposal of a 'university of the air' closely. While we appreciate its apparent attractiveness we are conscious of some of its inherent limitations and of the danger whereby a university may be envisaged as a mode of communicating knowledge rather than as a community of junior and senior scholars. Even as a means of communication it could not succeed unless the human and financial resources available were sufficient to enable its courses to be offered to the public in an attractive and stimulating way. At a time when the universities themselves are experiencing difficulties in recruiting staff of the right quality it must be borne in mind that a 'university of the air' would require teachers who were not only well trained in their own specialisms but who, in addition, would possess special aptitudes

and skills in the use of television as a medium of instruction. There are many who would argue that while television can provide segments of a university curriculum in an authoritative and refreshing way it cannot itself form the basis of a university, and that it would be more profitable to use our scarce resources of finance and manpower to strengthen our present systems of education. Whatever may be the outcome of private and public debate on the proposed 'university of the air' it would be wrong to encourage false hopes and even worse to create an illusion of university education as we understand it in this country. It is particularly important in this scientific age to differentiate ends from means and to define the proper role of educational technology.

347. Throughout our discussions and deliberations we have been conscious of the fact that much that can be said for the use of audio-visual aids in higher scientific education is applicable to the humanities and to adult and further education in general. With regard to *octv*, we recommend that its use in all these fields should be closely studied by a body representative of both educational and broadcasting interests. Such a body might also encompass radio within its survey, for both television and radio have reached a stage of development when their potential should be equated to the educational needs of the community. In the meantime, a closer co-ordination should be established between the broadcasting organisations and those engaged in higher education.

348. The assessment of the relative importance of the needs for refresher courses and other forms of adult education, for university courses, for commercial, technical and school courses, and the determination of the share each should have in the national broadcasting networks, are matters which extend well beyond our terms of reference. It is possible that some of these needs could be met by the use of sound radio, supplemented by text-books and filmstrips or by the distribution of video-disc recordings. To satisfy all of them at once would require the use of several television channels.

349. There is certainly a case for more channels for both *octv* and sound to be made available for educational services at all levels, and for a vigorous programme of research into the best methods of using them. We should like to see the allocation of channels in the U.H.F. band to several universities for experiments in local educational broadcasting. These might be used primarily by extra-mural departments for experiments in various forms of broadcast instruction, in collaboration with university departments, institutes of education, technical colleges and schools. The operation of such stations could give valuable information and experience in the further development of educational broadcasting in the national sound and television channels.

CHAPTER 8

PROGRAMMED INSTRUCTION

350. Programmed instruction, unlike media such as television, film and projection aids, can more truly be described as an aid to the student in learning rather than to the teacher in teaching. A good programme provides the student with all the information that a conventional lecture or lesson would contain, and it presents the material in the carefully-prepared logical sequence of a good teacher. The form of the presentation is such that it ensures that progression from one step to the next is achieved, whichever of the two main methods of programming (q.v.) is used. An important advantage of the method from the student's point of view is that it enables him to proceed at his own rate. In class teaching the teacher who presents his material at such a rate that all can understand and assimilate is inevitably moving too slowly for his ablest students. If he increases his tempo he may well leave behind those who learn more slowly. It is not only the weaker students who are lost in this way. Even the brightest students sometimes find that a particular point is missed and as a result the rest of the lecture may well be incomprehensible. The great advantage of programmed instruction is that, for *each* student, the next piece of information is not presented until the piece before it has been assimilated.

351. The advantage of programmed instruction to the teacher is that it relieves him of that section of his work which a good programme can do just as well, and so allows him more time to devote to those aspects of his work which he alone can do. The most important of these is face-to-face confrontation with the student, either in small seminars or in an individual student-tutor situation. The time for this individual or small-group working is obtained from the time the teacher saves in lecture preparation, in the actual delivery of lectures, and, to some extent, in marking. It is often said that no programme ever completely suits the requirements of the individual teacher, any more than any text-book does. The answers to this objection are:—

(a) it is not suggested that programmed instruction should completely replace lectures and other forms of teaching;
(b) the teacher could and should deal with particular points in seminars or tutorials; and
(c) many programmes are presented in such a way that it is not difficult for a teacher to modify them if he so wishes or to substitute programmes of his own.

352. It is important to remember that although the widespread use of programmed instruction may result in some saving in lecturing staff, this is not to be construed as its essential purpose. Its main advantage is that it permits a *redeployment* of staff, rather than a saving—a redeployment which should enable staff to teach more efficiently and more effectively. Programmed instruction and closed-circuit television, used in conjunction with the more traditional methods of teaching, could enable institutions of higher education to use their staff to better advantage. Outstanding teachers could, through

cctv, reach much larger audiences. Their students could come to lectures suitably prepared through programmed material, and the effectiveness of both contributions could be ensured and enhanced by a much larger proportion of tutorial work than is possible under existing conditions.

353. In order to appreciate the potential of programmed instruction it is necessary to look at the major forms which it can take, and to assess their relative advantages and disadvantages in the context of the terms of reference of the Committee.

Linear programmes

354. The form of programmed instruction commonly known as 'linear programming' has been mainly associated with Professor Skinner of Harvard University. The content of each unit (or 'frame') of the programme is small, and so simply presented that wrong answers are rare. It is a basic tenet of the psychology underlying the system that success shall be achieved, and so provide a motivation for continuing the programme. Another basic tenet is that there shall be prompt assessment and 'reward'; that is, the student should immediately be able to assess his answer by comparison with the correct one, and thus derive satisfaction from the success of his efforts. To ensure that he does so the frames are sometimes 'cued'; that is, the student may be helped to think of the correct word or words of the answer by being given the initial letters, or some other form of clue. The question to be asked may take the form of inserting words to complete information given in the frame, or it may be posed specifically. In either case the student is normally required to write a word or words, referred to as a 'constructed response'. A good programme should enable the average student to progress with no more than five per cent of errors. Professor Skinner goes so far as to say that no student, whatever his motivation and whatever his I.Q., can fail to learn from such a programme.

355. Programmed material may take the form of a book in which the correct answers are normally covered with a mask, which can be removed after the student has made his response. Alternatively, the material may be presented in a device called somewhat unfortunately a 'teaching machine', in one form of which a roller moves the student's answer until it is under a transparent cover, the correct answer (and the next frame of the programme) being revealed at the same time.

356. The writing of a linear programme in such a way that the material is presented in a logical sequence, with the steps so arranged that a successful answer is virtually inevitable, involves the skilful matching of every frame with the natural response of the student. This is a difficult and extremely time-consuming operation. Even when it is completed it is essential for each new programme to be 'validated', that is, tried out on a typical group of students, modified as necessary, retried and remodified until an acceptable and reliable programme is achieved. It is not unusual for a programme which will occupy an average student for one hour to take some 40 hours to construct. Thus, although in the ideal situation the best way to produce a programme for a particular class of students would be for the individual teacher to write it, two factors make this impracticable. The first is that programme writing involves a particular expertise which can only be acquired with practice, and which even the best teachers do not necessarily gain readily. The second is

that if 'teacher time' is to be saved by the use of programmed instruction it is clear that *many* teachers should use the programmes which a *few* have devoted much thought and time to produce.

357. Linear programmes are often criticised because, to ensure the continuous success which is essential in their conception, they consist of a large number of very small steps which must be covered by all students irrespective of their differing abilities. Whilst the slower students may need all the steps, the brighter ones may well feel that the programme becomes tedious—and even, in some cases, an insult to their intelligence. Professor Skinner counters this by saying that the same material may be programmed differently for students of different degrees of intelligence—a sort of 'streaming' system.

Branching or intrinsic programmes

358. Branching or intrinsic programming is the second major system of programmed instruction. It was developed in large measure by Dr. Norman Crowder and his co-workers. Each frame of the programme usually contains more material than a single frame of a 'Skinner' programme. At the end of each frame—which may be a page in a book—a question is asked, and several (commonly three) possible answers are offered. The student selects the one he believes to be correct and if the programme is in book form he will then be directed to a particular page. If his answer is the right one, he is informed of this ('immediate assessment') and he proceeds to the next main frame which is on the same page. If he has selected a wrong answer, he is presented with a remedial frame (or frames). A single frame will commonly give an explanation of the error, or give additional help with the original question (or both) and will direct the student to return and try again: alternatively, he may be led to the next main frame through a remedial loop. This system, in contrast to the Skinner programmes, makes some provision for students of different ability. The remedial system can vary between the simple additional frame and a very complex network of loops. Where the programme is written for use in a specific machine, the complexity of the remedial loop planning is limited by the facilities which the machine provides.

359. Not only does the branching machine differ from the linear in that it allows students of varying ability to progress at their own rates, but the programme is fundamentally different in that it is planned on the assumption that mistakes *will* be made; the consequence is the provision of remedial sequences. Professor Skinner believes that it is psychologically unsound to confront the student with wrong answers, and that the 'continuous success' method is sounder. He claims that the need to produce a correct response is a better mental exercise than one which requires the student to select the correct answer from a given list, since this does not require him to think out the correct answer for himself. There is here, of course, the possibility of guessing the right answer. Other disadvantages of the branching system are the greater difficulties in programming, and that the 'teaching machines' for this system are inherently more complex and more expensive than those for linear programmes. Despite these very valid disadvantages, there is a body of opinion in favour of branching programmes, partly because they are less tedious than linear ones, and partly because they do provide in some degree for the differing abilities of students. It may well be that some subjects, such as medical diagnosis, which involve frequent decisions between differing

possibilities may best be approached by branching programmes, whilst for others a linear programme may offer advantages. It may be, too, that the actual level of work may be a criterion. For example, followers of Crowder claim that the small-step linear programme method is too tedious to appeal to students at university level, although it may be very suitable in schools. The followers of Skinner would deny this and cite successful linear programmes at all levels, including university level. It is clear to us that there is much scope for research into the possibilities of both types of programme in the field of higher education.

Adaptive programming

360. Although branching programmes do incorporate a small measure of discrimination according to the ability of the student, not even their most enthusiastic supporters can claim that they provide sequences specifically suited to the abilities of the individual. To do so would need much more information about the student than is given simply by his last response; and to base a programme on such extended information would mean storing the results of previous responses, referring to them and, from a considerable variety of succeeding frames, leading him to the one which his record thus far makes appropriate. Clearly, this involves solving a much greater technical problem than that inherent in a branching machine, and its solution leads to complex, sophisticated and very expensive electronic devices. One such device is that developed in Great Britain by G. Pask for teaching punched-card operators. This device produces more frequently those number sequences which the trainee finds difficult to handle than those sequences which provide less difficulty. Thus the material presented to the student takes account of what he has achieved already and this justifies calling the device an adaptive machine. Professor Stolurow of the University of Illinois has developed what he has termed 'idiomorphic programming', involving the use of much more information than in intrinsic programming. This includes ability and personality test data, rate of answer, type of answer, and much else, all of which is embodied in a highly-complicated machine.

361. Only the digital computer can provide that measure of information storage, flexibility and control which allows for each student's unique abilities for learning. The computer alone has the ability to determine what item sequence, based on knowledge of previous results, should be presented to the student; and to do the 'book-keeping' involved. Input from the student is usually communicated to the computer control unit from a typewriter keyboard. The input may be the student's reply to an instructional item or, if he so desires, a request from him for information. The instructional item may be presented to the student from a slide projector or from a television display, the sequence being determined by signals from the computer control unit. The computer may also provide an output in printed form giving the student's performance on the instructional items. Computer-based teaching machines are, however, so much in their infancy that there is little to be gained at present by discussing them at length here. Their potential however is clearly considerable, and there can be no doubt that they warrant a great deal of research. Their cost is of course immense, but the possibility exists that a single computer can control simultaneous student use, providing, in effect, a computer-controlled teaching-machine classroom.

Teaching machines

362. The machines for programmed instruction which are generally available today are simpler devices. The simplest is a linear machine which is virtually two rolls of paper in a cardboard box, one carrying the programme, the other a blank for the written answers. Such devices cost but a few pounds, and even the more robust and 'cheat-proof' ones range only from £10 to £50. Since branching machines incorporate mechanisms for multiple-choice operation and remedial loops, they are more expensive and vary in price from £100 to £300. (Arrangements exist whereby a machine which costs about £300 may be hired at charges of from £20 to £7 a month, according to the length of the hiring period. Machines can also be hired on a meter basis.) Most of the more expensive machines use film presentation and a photo-electric selection device; but more modest, if less convenient, branching devices are being developed. Teaching machines are also available which utilise picture and sound as well as the printed word.

363. It must be remembered, however, that machines are but the vehicles of programmes, and it is the latter, and not the machines, that are important. Educational establishments should not be deterred by the cost of teaching machines from making experiments on programmed instruction, for much can be done with programmes in book form, or even on cyclo-styled sheets. Although there is some evidence that machines produce better results than programmed books, the margin is small and their respective merits remain in doubt.

PROGRAMMED INSTRUCTION IN GREAT BRITAIN

364. We have found sporadic activity both in research into, and in the use of, this medium in universities and colleges in Great Britain. The results of our survey in April, 1963, which are set out in Tables 1 and 2 of Appendix 2 show that less than 30 departments or institutions were involved. While there is great enthusiasm in these particular centres it would seem that over most of the field of higher scientific education there is little awareness of the potential of this medium. That this is not so over the whole field of education is evident from surveys* carried out by the Department of Education and Science and the Scottish Education Department. These show that in the schools and technical colleges there is a fast-developing interest in programmed instruction. The Department of Education and Science is in fact supporting five research projects which are under the direction of the Universities of Birmingham, Sheffield, Leicester and London, and it is playing a part in the development of courses to train teachers in the technique of programme writing. This is a very necessary development if the present shortage of good, well-tested programmes is to be overcome. Articles and reports of research have appeared since May, 1964, in 'Programmed Learning', the journal of the Association for Programmed Learning (see also para. 383) and the extent to which programmes are available was indicated in a list published in 'Visual

* The results of surveys carried out in October, 1962 and October, 1963 were incorporated in memoranda issued by the Research and Intelligence Branch of the Department of Education and Science on 16th April, 1963 and 31st March, 1964. Similar surveys were carried out by the Scottish Education Department and the results issued in April, 1963 and June, 1964.

Education', the magazine of the Educational Foundation for Visual Aids, for July, 1964. It showed clearly the scarcity at the level of higher scientific education.

365. Despite the time taken to prepare programmes we feel that further research into the use of this medium at university level may be particularly fruitful. We were greatly impressed by a very extensive programmed text, covering three months' work on neuroanatomy, written by two professors at Harvard University (see para. 96). There is apparently nothing comparable in Great Britain.

Universities

University of Newcastle

366. During our visit to the Medical School of Newcastle University we were told of an experimental branching programme produced to teach the basic elements of electrocardiography. Twelve fifth-year students, using four machines on an appointment system, had taken part in the experiment* and the final test showed that students had benefited greatly from the course. As a result of a study of student errors and reactions various sub-sections had been re-written and the interesting and unexpected point emerged that students who had returned incorrect answers had assimilated more knowledge than those who had replied correctly because they had been referred to sub-sequences which gave additional remedial data. (This particular programme was subsequently adopted by a commercial organisation and is now available on film for use in a branching teaching machine.)

University of Sheffield

367. Programmes have been produced on various subjects such as economics, mathematics and chemistry but the major emphasis of the work being done at Sheffield is on investigation into the possible use of programming techniques in industry.

368. The Department of Psychology provided evidence that programming might improve and increase the range of university teaching in three ways:—

(a) when used for routine courses, staff would be released for other duties. (During a staff shortage, statistics had been taught effectively by means of programmes);
(b) additional instruction could be given to students who needed it; and
(c) programming could be used for highly-specialised branches of a subject.

There is some evidence to show that, although programmed text-books are often as useful as a machine, the latter is better when its operation involves the use of projected pictures, necessary in the teaching of certain subjects.

Scottish universities

369. A discussion on programmed instruction in Scottish universities was held in St. Andrews in May, 1964, and a report of it was sent to us. At that time work was being done in the Universities of Aberdeen, Edinburgh, Glasgow and St. Andrews.† It had been found that while the great majority of students

* Reported fully in 'New Education', January, 1965.

† Articles on programmed learning in chemistry appeared in 'Education in Chemistry', 1964, 1(4), 189; and 1965, 2(1), 32.

approved of programmes and were anxious for more, the reactions of lecturers were more varied. Even those who were enthusiastic and agreed that programmes were especially useful in remedial work were concerned about the amount of time involved in preparation. Programmed instruction both for second-year organic chemistry students and for practical chemistry at first-year level, is now used in the Department of Chemistry at Aberdeen and the Department of Natural Philosophy has used it for first-year teaching.

Dental schools

370. During our visit to the Dental School at the University of Newcastle it was stressed that although the construction of programmes was very time-consuming there was probably a place for them in several branches of dentistry. A recent article in the British Dental Journal, which claimed that programmed instruction could be an ideal method of teaching a variety of clinical and pre-clinical subjects in dentistry, ended with the statement that 'given sufficient enthusiasm (and money) a minor revolution could take place in the teaching of dentistry and medicine'.

Institutes and departments of education

371. When we visited the Department of Education at the University of Birmingham we were told that research had been undertaken on programming and that the staff felt that it was in a position to advise on the writing of programmes at various levels. The Departments of Education and German had discussed a programmed German-for-science course which would relieve the staff of the German Department of a great deal of elementary teaching. In addition, the Engineering and Chemistry Departments were interested in the programming of a mathematics course for first-year students. This course would be largely remedial and would correct the lack of uniformity in the background knowledge of freshmen when they came up to university.

372. Members of the Department of Education at Birmingham were of the view that linear programmes were of more value for elementary work or for the slower students, but that branching programmes were better for more advanced work and for the more intelligent students. In response to many requests courses on the technique of writing programmes had been provided by the staff, some of whom had lectured on courses run elsewhere.

373. Little difference was found in the results obtained by groups of students learning by machine or by book, with possibly a slight balance in favour of those who had used the machine.

374. Since our visit we have learned that the Department has prepared, or is in the course of preparing, university-level programmes on thermodynamics, organic chemistry, biochemistry and statistics.

Colleges of advanced technology

375. The memoranda of the Department of Education and Science (para. 364) showed that research on the production of programmes was being undertaken at the Birmingham, Cardiff, Loughborough and Northampton (London) Colleges of Advanced Technology and at the College of Aeronautics. This work covered a wide range of subjects, including strength of materials and theory of structures, mathematics, engineering drawing,

alternating current theory, graphical methods of network analysis, aeronautical engineering, ergonomics, cybernetics and also experimental psychology in a department of industrial administration.

Training colleges and colleges of education

376. At the time of our visit to Bolton Technical Training College experimental work was being conducted on mathematics syllabuses at Ordinary National Certificate level, on the provision of short courses for teachers of mathematics, and on the problems associated with the introduction of programmed learning into technical education. A third of the first-year mathematics syllabus has already been programmed and we saw a group of students from Blackburn Technical College who had been brought to Bolton to work at the mathematics programmes. Bolton Technical Training College with the technical colleges in the area has set up a committee to study programmed instruction—in particular, the introduction of programmed material into technical college general courses for engineering.

377. At Avery Hill Training College the staff agreed that there was a special place for programmed instruction in training colleges. Experiments were being carried out with machines and with a number of branching programmes and student-teachers were shown how to construct programmes.

378. The results of our survey (see Appendix 2, Table 2) showed that at that time eleven training colleges in England and Wales, and one in Scotland, were experimenting with programmed instruction. Since then other colleges have become interested. This is especially true in Scotland where the Principals of the Colleges of Education have set up a Committee on Programmed Learning and where, in Aberdeen, the College of Education has instituted a Research Lectureship. This is encouraging, but the ultimate aim should be to introduce this technique to all students at training colleges and colleges of education.

Technical colleges

379. Whilst interest in programmed instruction is clearly growing in technical colleges, it manifests itself mainly by the efforts of individual teachers who produce and try out programmes in a variety of technical subjects. A few colleges have conducted courses and conferences in programmed instruction. Representatives of the Association of Teachers in Technical Institutions (A.T.T.I.) said in evidence that programmed instruction was being used at the Brighton College of Technology to teach computer programming to students of engineering, and to teach business law and management to postgraduate students. The engineers used teaching machines to supplement their lectures on computer programming and, by the end of the course, each student would himself have written one computer programme. The college was also engaged in a joint project with the Universities of London and Sussex to produce a teaching programme on mathematics for first-year students of economics and sociology.

380. The Brighton College of Technology had also organised an evening course to teach programming to its own staff. Several departments were represented on this course and teaching programmes were being prepared on various subjects. These programmes were either remedial or accelerative or were concentrated on areas of difficulty, for example, quantum physics. A

two-week full-time course designed to teach senior sister tutors how to write programmes (see para. 384) had also been organised at the College on behalf of the King George V Hospital.

381. Representatives of the A.T.T.I. stressed that lack of time was the main reason why so few teachers produce programmes. If present resources were to be used efficiently teachers would need time to experiment and to study the way in which programmes could be most profitably integrated with conventional modes of teaching. Brighton College of Technology in conjunction with the University of Sussex had proposed a postgraduate diploma in educational technology. The aim was to help students to prepare material and to arrange, with teachers, its integration with a teaching course.

382. We were told that lecturers at technical colleges who were pioneers of programmed instruction had encountered not only lack of interest but even serious suspicion among colleagues, who regarded programming as a 'gimmick'. This was felt by those who gave evidence on behalf of the A.T.T.I. to be due to lack of knowledge of the technique. They maintained that programmed instruction should be treated as an ally of the teacher and not a substitute, because it could free him for the more valuable personal contact with students.

383. Wherever misunderstanding and suspicion exist, steps should be taken to overcome them and to present the special value of programmed instruction in modern educational technology. The formation of the Association for Programmed Learning in January, 1962, and more recently, the announcement by the Department of Education and Science of the setting up of a National Research and Documentation Centre for Programmed Learning at Birmingham University should go far to help promote this understanding.

Nurse training

384. Reference was made in paragraph 380 to a course organised by Brighton College of Technology for senior sister tutors. During the course two programmes were produced, one on closed drainage of the pleural cavity and the other on the mechanics of respiration (branching and linear programmes, respectively).

385. We were told by the Principal Sister Tutor at St. Bartholomew's Hospital, who herself had attended a number of courses, that considerable interest in programmes for nurses was being shown in the profession. She stressed that long programmed courses were not particularly well suited to student nurses. Their programmes were most effective when they were concerned particularly with the points of difficulty which student-nurses often failed to grasp. She had prepared a very simple and very effective linear programme on the subject of measuring insulin for diabetic patients. Discussion amongst sister tutors from different parts of the country showed that this subject, and that on closed drainage of the pleural cavity, were topics on which student-nurses badly needed accurate and concise instruction. Without this there might well be some risk to patients.

PROGRAMMED INSTRUCTION IN THE UNITED STATES

386. The main body of research into programmed instruction has taken place in the United States. An account both of what we saw during our visit to the United States and of evidence given to us is in Chapter 3.

387. We are satisfied that programmed instruction, provided it is well-conceived and carefully tested, has a considerable part to play in higher education. We recommend that universities, teacher-training colleges and technical colleges should carry out research into the possible uses of programmed instruction in their respective spheres and on the techniques of applying it. Such research should include computer-based teaching machines, and should involve the use of programmed instruction as part of the planned application of educational technology as a whole. The possibility of using these new and powerful tools to make the maximum and most efficient use of teaching staff in a period of rapid expansion should constantly be borne in mind.

388. Faced with a major shortage of suitable programmes, there is the need for a planned development in all areas of higher education. University departments of education and teacher-training colleges should conduct in-service courses in programmed instruction and in programme writing, and thus increase the supply of good programmes. We regard it as of great importance that teachers should be released for this kind of training.

389. Institutions of higher education should consider providing some programmed courses for first-year students. These would help undergraduates to acquire during their first year a common core of knowledge and might also help to prevent some of the wastage that occurs at the end of that year.

390. At all levels, in subjects where considerable factual information has to be assimilated, use should be made of programmed instruction, so that teachers can spend their time in assisting students to use their knowledge rather than in helping them to acquire it.

391. In teacher-training establishments, students should be taught programmed instruction as a 'special method' and should learn the basic principles of programming.

392. Appropriate establishments should be encouraged, and, where necessary, financially assisted, to play their part in validating new programmes.

CHAPTER 9

LANGUAGE LABORATORIES

393. During recent years there has been a steadily-growing appreciation of the part that the tape recorder can play in education. It has developed from being simply a means of recording a lecture, classroom discussion or radio broadcast, which could then be played back at a time convenient to other groups of students, to a highly-sophisticated piece of equipment designed to increase the speed and efficiency of foreign-language teaching. For this purpose it can be used either singly for individual instruction or, as is now more usual, in combination with a number of other recorders and a master control, or console. In this form it is known as a language laboratory and here we are mainly concerned with this development. We refer to tape recorders later (paras. 399 and 468) since we have seen, and heard of, interesting experiments which suggest that their potential is not yet fully exploited.

394. The language laboratory is used to complement, but not to replace, the work of the teacher by providing students with frequent and regular opportunity to practise and improve the audio-lingual skills which are now regarded as an important and highly desirable objective in foreign-language teaching. For those who are unfamiliar with the working of a language laboratory it may be helpful to begin with a description of its *modus operandi*.

395. The language laboratory provides the student with facilities which have been described as 'listen-respond-compare', commonly consisting of a number of dual- or four-track tape recorders, installed in separate booths or on open desks and wired to a main console. The teacher can thereby distribute 'master' recordings on to the student tapes for individual playing and can monitor students individually (without interrupting the work of the rest of the class) as they respond to these recordings. By means of headsets each student can hear his responses, which usually take the form of repetitions or drills, as he makes them. At the same time he can record each response, and by re-winding his tape compare it with the master recording. If necessary he may re-record his response in order to improve on his previous attempt. Re-recording erases this first attempt, but not the master recording which has been made on a separate track and is not therefore affected.

396. The student booths provide for:—

(a) a measure of isolation and privacy by means of individual booths with dividing partitions. Noise interference is further excluded by earphones;
(b) the receipt and recording of master programmes distributed from the console, and the recording of student responses on a separate track;
(c) the playing back of the master recordings together with the student's response; and
(d) two-way communication between each student and the teacher and his console.

397. The console is under the direction of the teacher and allows him:—

(a) to facilitate the recording on the students' tapes of programmes drawn

from a number of possible sources—for example, pre-recorded tapes, gramophone records, radio broadcasts, film sound tracks—and to distribute such programmes simultaneously to each student if required;
(b) to control the students' recorders to a greater or lesser degree—for example, to stop or start them, re-wind, and erase one or both tracks—and to allow him to enter into direct two-way communication with students, either individually or collectively;
(c) to listen, without their knowledge, to the responses of individual students;
(d) to record students' responses for examination purposes, or for subsequent analysis of linguistic difficulties; and
(e) to provide remote control of a projector to synchronise visual aids such as films, filmstrips or slides with recorded material during language laboratory practice.

The results of our survey

398. Our survey showed that in April, 1963, more than 40 per cent of the institutions or departments who completed our questionnaire were using tape recorders for teaching purposes, and about 30 per cent for research purposes (see Appendix 2, Table 1). The highest proportion of users occurred among the teacher-training establishments and university departments of education, and it was interesting to note that dental and medical departments came next. By contrast there was at that time only a very small use of language laboratories —about 1 per cent—and almost all of these were in colleges of advanced technology (see Appendix 2, Table 2). Nevertheless, our survey showed that where language laboratories existed they were put to good use (see Appendix 2, Table 3) and about 50 departments (over 4 per cent) stated that they would like to have them. While these numbers are not very large it should be remembered that our enquiry was restricted to the sciences and that modern language departments, where language laboratories are mainly used, were outside our terms of reference. This accounts for the fact that the installations we describe in paragraphs 401 and 402 are not included in Table 2 of Appendix 2.

Our visits

399. During our visits to universities and colleges we were able to see several language laboratories in operation. We also saw a particularly interesting demonstration of the tape recorder in the Physiology Department of Birmingham University where tapes were used both as an aid to instruction and for revision. They contained background information relating to the work on physiological optics which was carried out by second-and third-year students, who used them to refresh and add to their theoretical knowledge. The lecturer explained that he was always available to answer questions and that he had found that a student not only asked questions more freely than he would as a member of a large class, but that the questions themselves were more intelligent because the student had more time to think them out. The tapes contained information not otherwise readily accessible and each machine had alongside it some explanatory notes and diagrams on the recorded lecture. The students appreciated these tapes because they could be used at any time, and because they themselves could stop the machine and take full notes or pause to think over a particular difficulty. This seemed to us a valuable supplement to normal

teaching methods and one which could be used equally well in other departments.

400. We were told at Birmingham University that the Modern Language Department was making its own language laboratory and that the staff of the Department of Education would like to have more equipment for their research, especially since they wanted to teach the students how to make tapes themselves for language teaching. They also thought that the experience gained in programmed instruction would be of value in the preparation of tapes for language teaching.

401. At the Manchester College of Science and Technology, where there is a twelve-booth language laboratory, we listened to a tape prepared for science students who wanted to improve their spoken German. The tape had been made in the Modern Language Department, which had both German and French native speakers. It also prepared tapes for beginners in French, German and Russian, the last having been made by Russian visitors. The installation cost about £2,300 and had proved very reliable.

402. At the Scottish College of Commerce in Glasgow, we saw a 24-booth installation where a group of graduate language teachers were taking a one-year course in order to acquire an additional qualification to teach Russian. A second 24-booth installation provided an Italian course for a class of 3-year secretarial students. In addition, a third installation had projection apparatus for teaching elementary French, and special equipment for training students in the techniques of simultaneous translation, which is a vital part of a course for interpreters. The installations were supported by excellent technical facilities, among them a separate, sound-proof studio in which we saw part of a first-year university course in French being transferred to a master tape by a native French speaker. (A technician with experience in electronics was able to carry out development and maintenance work.)

403. The language-laboratory installations we saw during our visit to the United States of America have already been described in Chapter 3 (paras. 91–94). They were in general similar to those in Great Britain. A notable exception, however, was the language library at Pennsylvania State University where the student's booth contained a telephone unit which enabled him to dial for his selected recording through an automatic telephone exchange.

Evidence

404. Some witnesses drew our attention to the greater number of language laboratories in technical colleges than in universities, a fact which they attributed to the conservative attitude adopted by some universities to the teaching of language. Many students of science, engineering and economics were required to learn foreign languages, and, since it was difficult for them to find sufficiently elementary courses at the universities, they took advantage of the facilities offered in the technical colleges. It had been found that tapes were very useful for teaching grammar, as well as pronunciation, rhythm and intonation.

405. Other witnesses said that the biggest obstacle to the training of scientists and technologists in foreign languages was the unwillingness of many science departments to allow their students sufficient time to study the required language. It was true that the students have very full programmes of their specialist interests; but, at the same time, it must be realised that the ability

to read foreign scientific papers and a facility to communicate with experts in their own tongue are an important part of the modern scientist's equipment. This had obviously been realised both in the United States of America and the U.S.S.R. where much more time is given to language study than in Great Britain.

406. We were told that to obtain the maximum benefit from modern intensive methods now being developed in the language laboratory, an allocation of at least four hours a week was desirable. These methods constitute the most advantageous and economic way of presenting languages to the scientists and it was claimed that a student could gain a working knowledge of one of the simpler languages in one term, a good working knowledge in two terms, and that in three terms he could read technical literature with ease. We felt that this might be an exaggerated claim. It is important of course to remember that the language laboratory is designed primarily to enable students to speak a language—it must be combined with visual material to enable him to read the language.

407. The need to establish courses for teachers to show them the techniques involved in using language laboratories was stressed, since effective use of the language laboratory called for considerable modification in the planning of instruction. Our attention was also drawn to the need for co-ordination of all research effort in this field. We believe that our recommendations for the National Centre (para. 435) will go far towards meeting both these points.

408. Most witnesses thought of language laboratories solely as a means of teaching languages but some stressed the possibility of using them to teach other subjects. For example, the University of Illinois and the University College of South Wales and Monmouthshire were using tape recordings to teach higher mathematics. At Cardiff a carefully-prepared lecture on probability theory was recorded on tape to enable the lecturer to teach two different groups of first-year students. One group heard the lecture 'live', while the other group listened to the recorded lecture. A subsequent comparison of the students' reactions showed that the recorded lecture was well received and, as all mathematical statements were recorded on the tape, the students were able to take notes without continually having to look at the blackboard. The gain in their concentration appeared to make up for the lack of personal contact with the teacher and it seemed that it might be possible to prepare a tape-recorded set of lectures in applied mathematics.

409. A language laboratory could perhaps be more appropriately named a 'teaching laboratory', for there are undoubtedly many other subjects which can be taught by these methods. But the criterion is whether they could best be presented by this medium or whether by some other approach—for example, film, television or programmed instruction or a combination of all three. Clearly there is a need for more investigation and study in this particular field.

Conclusions and recommendations

410. It seems clear from the results of our survey, and from the evidence presented to us, that the value of the tape recorder as an audio aid is already well established in university education departments and institutes of education and in the teacher-training establishments, where its potential is well

realised. This does not seem to be true of other university departments where the proportion using tape recorders was much lower (Appendix 2, Table 1).

411. It seems likely that more departments could benefit from the use of the tape recorder as a supplement to formal lecturing (see para. 399).

412. The small proportion of users of language laboratories shown in our survey was understandable since our enquiry was restricted to science departments but it was evident from our visits and from evidence that its value in language teaching is now assured. The demand for language teaching in science and other departments, however, will seldom justify a separate language-laboratory installation and we recommend that where this is so modern-language departments should provide for the needs of other departments. In general we believe that comprehensive central facilities are both more suitable and more economical than a number of smaller, separate installations.

413. Attention has already been drawn in paragraph 408 to the possible wider use of the language laboratory. We have instanced its use in the teaching of higher mathematics in the University of Illinois and the University College of South Wales and Monmouthshire. There are several ways in which oral instruction by means of a master tape could be combined with other forms of visual aid or with programmed instruction, but as we have pointed out (para. 409) the real question is which medium is best suited to any particular teaching situation, and here there is need for more investigation. We suggest that this could be carried out both by the National Centre described in Chapter 10 and by the universities and colleges themselves. The central service units should help to initiate experiments in individual university departments in collaboration with the National Centre and with university departments of education.

CHAPTER 10

LOCAL AND NATIONAL CO-ORDINATION

CENTRAL SERVICE UNITS

414. Increased student numbers and the growing pressure on student and teacher alike arising from advances in all fields of science and technology have faced universities and colleges for many years. While new communication media can help to ease these pressures many members of academic staffs are either unaware of their potential or, realising their possibilities, lack the knowledge or the technical assistance to use them efficiently. Valuable pioneer work has been done in some medical schools through the provision of central facilities. Their example has been followed in a number of universities and colleges, but there is a widespread need for the provision of a co-ordinated communication service in most academic institutions. We believe that, given a proper 'ideal of service' and adequate facilities, central units can improve teaching and strengthen communication throughout the field of higher education.

415. The Department of Scientific and Industrial Research in a Working Party Report of October, 1963, referred* to a lack of co-operation in the use of expensive photographic equipment in university departments, leading to waste and to a duplication of facilities. They added† that their attention had been drawn to the great potential value of edited film for teaching and, although this fell outside their terms of reference, they felt it proper to recommend that universities and colleges should be asked to consider whether the establishment of central photographic units within their institutions would not be of value in the development of photographic activities and in the use of film in research. We agree with this recommendation, but would stress that the services provided by the central unit should be extended to cover not only film but the whole field of communication.

416. While central units should be the servants of their academic customers, individual teachers, departments and faculties should in no way be discouraged from producing the aids they need, and which they have the time and equipment to produce. The individual teacher will tend to prefer his own teaching aids and will therefore produce and store them as far as he is able with the funds and space available to him. His use of teaching devices will be limited by his knowledge and experience of production methods, and by the nature of the equipment which will essentially be personal and inexpensive. Many of his routine needs can be met by a typewriter, a duplicating machine and a camera, but practical limits to the number of aids at his disposal are set, not only by the time which he is able to devote to them, but also by their number and complexity. Research workers will themselves naturally wish to supervise any recordings and analysis which are an essential part of their

* 'The Film in Scientific Research', paragraph 83.
† 'The Film in Scientific Research', paragraph 128.

research projects but they should be able to turn to a central unit for advice on suitable equipment and techniques and for assistance with the design, installation and maintenance of special instruments.

417. A teaching or research department can justify the cost of space, equipment and the technical assistance necessary for the production and storage, retrieval and presentation of audio-visual materials, if enough members of the department require these services. The decision whether a department should undertake this work will depend on the nature, volume and frequency of its need for a particular aid, and on its complexity and cost. In the same way as a department with its own restricted library resources will look to the faculty or university library for additional facilities, so a department with its own limited audio-visual unit should seek the help of the central unit when the work involved is too intermittent, too great in quantity or too complex and specialised in nature. To take one example, a central service for the printing of forms, instruction booklets and programmed texts is not only a convenience but a decided economic advantage.

418. A departmental audio-visual unit cannot be expected to provide expert knowledge and experience in all aspects of these rapidly-growing and diversified activities, and quite unjustifiable duplication of effort and equipment would be created throughout the university or college if departmental units were to strive for such universal competence.

419. Exceptionally, where certain faculties are physically separated from the rest of the university, or because of special needs, it may be necessary for them to maintain their own audio-visual units. The faculty of medicine with its associated teaching hospitals may well do so, since artists, photographers, cinematographers and museum technicians in a medical school generally receive specialised training and acquire a measure of medical knowledge for the proper discharge of their duties. Medical research workers and teachers are among the most active academic users of audio-visual aids. Nevertheless, even in these exceptional circumstances, it would be undesirable, and indeed wasteful, to duplicate some of the common service functions of the central service unit, with which there should be the closest possible co-operation.

420. Extent and frequency of use, complexity and volume of audio-visual production and presentation are the main criteria that determine the services which the individual or the department should be allowed to control. Even a faculty unit is likely to be limited in its production capacity and in its versatility in terms of equipment, accommodation, manpower, knowledge and experience. The central unit will therefore have a number of functions which cannot be carried out satisfactorily or economically at a lower level. These functions comprise production, storage and retrieval, presentation, information and consultation, instructional and extra-mural responsibilities.

Centralised production

421. In general it will be more effective and economical for the production of audio-visual material to be undertaken by the central service unit rather than by a number of smaller units. This will be particularly true:—

(a) when the volume of work is great. Most forms of bulk reprography, large numbers of photographs and of loop-film cassettes and extensive

series of colour transparencies, which may be required for distribution as duplicated sets of lantern slides, are typical examples;
(b) where alternative services do not exist, or are not available to the user, or where other forms of service would be less economical. This would apply to the user who only requires a particular aid occasionally, and therefore does not have the appropriate facilities, and cannot look to his own department for suitable assistance. Another instance would be a production or presentation task which even the departmental unit would find difficult to mount satisfactorily. Here the preparation of occasional teaching films, exhibitions or television presentations may serve as examples;
(c) where specialised knowledge and equipment are required, as for instance in the application of high-speed cinematography to a short-term teaching or research project. It would be an obvious advantage here to have the assistance of the central unit which, because of its many different users, could afford to maintain specialist staff and equipment. A properly staffed and equipped central unit should be able to undertake such work in its own laboratories or to second personnel and apparatus to a teaching or research department for a limited period; or
(d) when successful production or presentation depends on a number of integrated specialist services. Exhibitions and film production with animated sequences are two examples.

Storage and retrieval

422. Centralised storage and retrieval can offer several advantages. The unit's library can acquire books by purchase, or by loan from outside sources, and can store and catalogue text-books, journals, reprints and catalogues concerned with audio-visual methods, materials and equipment. It can also acquire, store and catalogue sound recordings, video-tape recordings, films, lantern slides, large transparencies, photographs, drawings, diagrams, charts, models, exhibits and programmed-instruction materials which are then available to members of the academic staff as supplements to their own or departmental collections.

423. Retrieval of individual items from a large collection of varied material may require, and could certainly justify, mechanised integrated cataloguing systems, and possibly computer techniques, for rapid and exhaustive search for interrelated information on aids to research and teaching. No small unit could, for example, afford to compile and maintain a truly comprehensive index of the information contained in the individual shots of all the many films available at an institution of higher education: and this will become increasingly more important as the usefulness of very short lengths of films in loop-film cassettes is appreciated (paras. 251–262).

Presentation

424. Presentation of audio-visual aids should be linked to the unit's library service. Virtually all aids require some auxiliary instrumentation, and occasionally additional staff for their effective application. It is important to remember that sound recordings and video-tape rely on play-back machines, slides and films need to be projected and photographs and charts appropriately displayed. Television represents a simultaneous combination of production and presentation.

Information, consultation and instruction

425. Information, consultation and instruction should be regarded as possibly the most useful, and therefore the most important, functions of the central unit. Information on methods and applications, on the design and fitting of efficient teaching rooms, on available aids, on existing materials such as slides and films, and on apparatus and equipment will be sought by individuals, departments and smaller audio-visual service units. The specialist staff of the central unit would be well equipped to render this service. They would also be informed about new developments, both within and without the parent institution, and able to test and evaluate new equipment and materials, and new methods and techniques published in the literature. The central units should supply the National Centre with information on research apparatus and techniques used in their institutions, and so maintain a two-way link between the colleges and universities and the National Centre.

426. Consultation is a necessary sequel if the information services are to provide more than an uncritical dissemination of data. The full-time expert staff of the unit should be able to advise, adapt or design new equipment and to evolve new methods for the solution of research or teaching problems.

427. In addition to providing the aids themselves, together with expertise on technique and usage, the central unit should make the users of aids aware of the possibility of improving both the methods and materials used. In close co-operation with subject experts and with appropriate institutions, central units should initiate and organise new research in the field of teaching methods. One such line of research described to us in evidence is that of 'course development'. This means that any course or area of study is temporarily removed from conventional teaching and is critically examined in order to define carefully the objective, the standard of performance required, the precise content and the best possible means of presentation. Such an analysis might require the use of a variety of instructional media, ranging from films to programmed texts, and the testing of the new course with appropriate groups of students.

428. Instruction at several levels should be an important responsibility of the central unit. While the methodology and applications of audio-visual communications are still relatively new they are growing in complexity and sophistication, and a central unit could serve as a catalyst to those who use them for teaching or research. It could instruct individual teachers, research workers and their technical assistants in the application of audio-visual methods and techniques to their special problems. The central unit could also train a number of technicians for work in the field of audio-visual aids. Since there is a serious shortage of trained technicians to staff central units recommendations are made on training in scientific photography and cinematography in paragraphs 473–476. Finally, we recommend that some of the large university centres should accept graduates who wish to train in educational technology. In this field they would naturally work in conjunction with the university's own department or institute of education and other appropriate departments. Further reference to the training of teachers will be found in paragraphs 477–479.

429. A central unit could also undertake extra-mural responsibilities such as the provision of staff and equipment for scientific expeditions, it could provide a link between the parent institution and other centres of research

and learning, and it could man short-range educational radio and television stations.

430. The functions of the central service unit can be summarised as follows:—

(a) production of a variety of aids from graphs and diagrams to lectures on closed-circuit television;
(b) storage and retrieval;
(c) presentation, covering the whole field from the procurement of literature to equipment;
(d) information, consultation, instruction; and
(e) extra-mural responsibilities.

431. When a central unit is formed it will be necessary to rationalise the distribution of existing stocks of audio-visual equipment, leaving in individual departments or sections only the apparatus which is either in very frequent use or which is of particular value to that department and no other. An adequate supply of equipment such as overhead projectors in the central unit will secure ready availability without unnecessary duplication. The employment by the central unit of trained technicians will ensure that the equipment is always in a serviceable condition.

Status of the unit

432. It is important that the unit should have proper academic status within the university, with representation on appropriate university committees. It must be able to appreciate the needs of different departments, and associate fully with them in their activities and responsibilities. It follows that the unit must have adequate graduate staff of the calibre to assume these responsibilities and to pursue these ends. The director, in addition to administering his own department, should be able to perform the functions of co-ordination, consultation, and technical evaluation. He must establish and maintain the right professional standards and policies, and so meet the needs of his academic colleagues. He must also co-operate with other central units and with the National Centre in the exchange of experience and of materials, and on the development and exploitation of improved methods. In order to be able adequately to perform these functions, we recommend that the director should have the status of a head of department. In many cases this may be that of senior lecturer-in-charge of a department. (Details of the skill and experience which will be required of a director, together with suggestions as to his remuneration, recruitment and training will be found in paras. 464–471.)

433. In this Chapter we have tried to describe the functions to be performed by an ideal central unit in a university or college and to give an outline of the status appropriate to the director. The nearest approach which exists at present to the centre outlined here is the Department of Photography at the University of Newcastle. The staff at present employed there is listed in Appendix 7. This information may be helpful to those institutions which are about to set up their own centres.

434. Estimates of the cost of setting up individual centres will be found in Chapter 12.

NATIONAL CENTRE

435. Reference has already been made in Chapter 4 to the lack of co-ordination at a national level in higher education, and to the existing national

bodies and their limited and sometimes overlapping activities in the field of audio-visual communication. To help remedy this situation, and to provide a focal point in this field, we recommend that a national centre be established. It should concentrate on services which cannot be rendered satisfactorily by smaller units, on the exploitation of new aids, on the training of staff for university or college central units, on providing a co-ordinated cataloguing and library service and a comprehensive information and advisory service. Once established, we envisage a steady growth to the kind of centre proposed in this Chapter, with a constant flow to it of graduates and technicians by secondment from universities and colleges, and by research appointments so that academic staff may spend a period of several months at the Centre. Small teams from the Centre itself may spend periods at universities, for example, to help in the re-orientation of teaching courses.

Functions of the Centre

Information

436. The Centre should collect, co-ordinate, and disseminate information on methods of production, presentation and storage. Data on methods, materials and equipment should be included, together with information on actual audio-visual products whether planned, in production or available. A special function of the National Centre should be the provision for visitors of information about developments in this field.

437. The actual collection of information would be carried out by the individual sections of the Centre. For instance, the photographic section could test and help to develop new methods, equipment and materials.

438. Co-ordination of information should be divided into two distinct functions. The first is co-ordination within the Centre, whereby information originating from separate sections of the Centre would be integrated for ready storage, retrieval and dissemination. The second is co-ordination of information from outside services, a function which a national centre would be best equipped to undertake. This would require extensive contacts with other centres, and with manufacturers and individual workers, both in this country and abroad.

439. Dissemination of information should include the publication of a journal dealing with all aspects of audio-visual communication as well as replies to enquiries from individuals and from other centres. Week-end and vacation courses for academic staff, organised sometimes in collaboration with other bodies, would also contribute greatly to the dissemination of information (see also para. 443).

Consultation

440. The consultation service of the Centre would be expected not only to provide factual data but to advise on the methods and materials to be used, and on equipment to be purchased, modified or designed. The Centre should be able to advise on experiments and on research in audio-visual techniques, as well as on the applications of aids for instruction—including the audio-visual requirements of lecture rooms, language laboratories and television installations.

441. The best-qualified personnel of any section should be responsible for rendering a specific consultancy service, and they should be able at need to

call on the facilities of all the other sections of the Centre. This would involve the willing and intimate collaboration of all sections.

Research

442. The staff of the Centre should be such that each section could undertake investigations either independently or in association with an educational institution which did not have the resources to solve a particular problem. On occasion, individual research workers should be able to carry out their researches at the Centre. In most cases it would be more practicable to lend equipment to the research worker for use in his own department.

Instruction

443. The Centre should provide adequate courses of instruction on new methods and applications for its own junior staff and, provided the numbers were small, it should undertake the training of audio-visual technicians from university or college centres. Week-end and vacation courses should be organised for academic staff on such topics as the making of short teaching films, advances in the use of television for teaching, programming, language laboratory techniques, the use of overhead projectors and the planning of lecture theatres. Finally, the Centre should be enabled to organise national and international symposia on advances in audio-visual communication in both teaching and research.

Production and development

444. The production and development services are indispensable to the proper functioning of the Centre and the staff should test, modify and evolve methods and equipment, be prepared to give information and advice and to take an active part in instruction. But the production capacity of any centre whether national or local would inevitably be limited and the National Centre should only undertake a strictly limited amount of production for individuals.

445. The services included in the production section would cover photography, reprography, graphics, exhibits, sound recording and cinematography. To be fully effective the development services would require an electronic and mechanical workshop for performance testing, for maintenance, for the adaptation and modification of existing equipment and for the development of prototype apparatus.

Presentation

446. The Centre should have a large selection of equipment so that its staff could demonstrate all methods of presenting audio and visual information. Included in the selection should be television and video-tape equipment, examples of projection equipment, language laboratory units, teaching machines and programmes, microfilm readers and equipment for sound play-back and amplification. It clearly would not be feasible for a national centre to lend equipment to individual institutions, except perhaps for specialised experimental purposes.

447. The Centre should be so staffed that it could second personnel, not only for advice on location but also for actual experimentation in the design and installation of exhibition and teaching rooms. In the field of television, personnel should be seconded for investigation into the present techniques, and into the applications and effectiveness of instructional television.

Library

448. The library should collect and catalogue material and it should procure material for reference, loan or purchase. Its resources should not only include books, journals and theses but catalogues on films, video-tapes, slide collections, sound recordings and teaching programmes. It should be well stocked with charts, models and exhibits.

449. Clearly the National Centre would have to maintain a much more comprehensive collection of material than exists anywhere at present, and the critical appraisal of films for teaching purposes should be an essential part of its service. The Centre should have the facilities necessary for the collection and presentation of material; academic experts should be invited by the Centre to help assess its value. We believe that the present situation where films are appraised by individuals on a spare-time basis is not ideal, although existing voluntary bodies could play a most useful role both in an advisory capacity and as sources of information. If in practice it were not possible for subject experts to visit the Centre for the purpose of evaluating films, these should be sent to them for their assessment. We recommend that some financial arrangement should be made if a voluntary basis proved to be unsatisfactory.

450. We envisage that all requests for information or for the loan of material would be addressed to the National Centre. This would relieve research workers and teachers who have made films for their own departmental use of at least some correspondence about loans or copies. We recommend that university and college centres should inform the National Centre of all films made in their institutions which are likely to be of value for teaching purposes.

451. It has repeatedly been brought to our notice that the importation of films from abroad is a slow, cumbersome procedure, beset by customs obstacles. We strongly recommend that the National Centre should assume the responsibility for importing and exporting films and, if necessary, video-tapes needed for teaching purposes and that it should take steps to ensure that this was done with a minimum of delay. At present much valuable time is wasted by teachers because of the complexities and frustrations of current procedures.

452. Finally, we believe that the library facilities should be intimately linked to the other services outlined in this Chapter, and we recommend that the library should form an integral part of the National Centre.

Organisation and scope of the Centre

453. Our terms of reference were limited to higher scientific education but it does not follow that the scope and responsibilities of the National Centre should be so limited. It is clear from Chapter 9 that the language laboratory can serve the needs of both arts and science students. This is true of most other audio-visual aids and we would expect our recommendations to be viewed in this light. But the argument was taken a stage further in the evidence we received from the National Committee for Audio-Visual Aids in Education* and its executive body the Educational Foundation for Visual Aids. Their representatives stressed that there was not always a clear demarcation in the use of audio-visual aids between the requirements of higher and

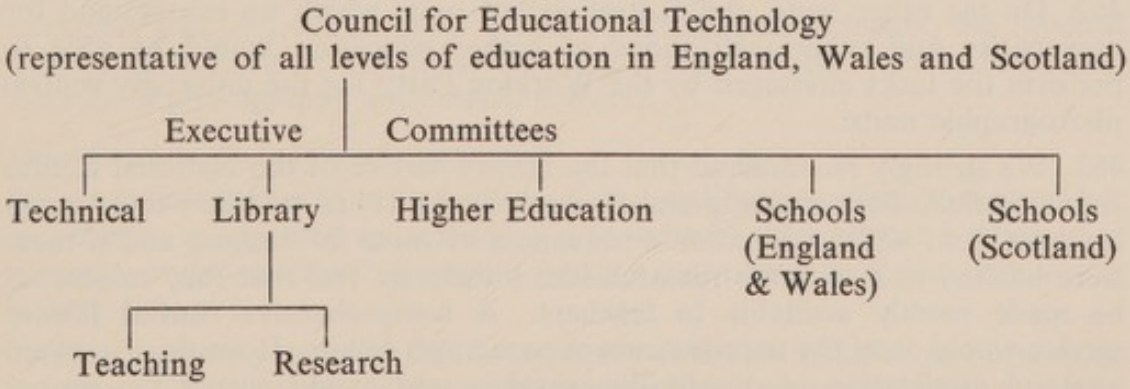
* The functions of this organisation, and of its Scottish counterpart, are set out in paras. 185 to 193.

other forms of education. Films in science, for example, were often equally valuable for use in sixth forms of grammar schools, in technical colleges and for first-year undergraduates in universities. While there were special requirements for higher education, audio-visual techniques were common to education at all levels. It was represented to us strongly that the setting up of an organisation for higher education alone would lead to difficult problems in the demarcation of users, to wasteful duplication and to an undesirable dichotomy in the field of audio-visual aids.

454. We have considered this argument most carefully and believe it to be a valid one. We have stated in other sections of this Report that, in general, we prefer strong central facilities to a number of smaller units (paras. 412 and 421) and we can foresee the dangers inherent in a situation where two broadly similar organisations are forced to compete both for finance and for skilled staff. In principle, therefore, we foresee that important advantages would accrue over the whole field of education if the National Centre were to incorporate, and benefit from the experience of, the existing organisations primarily concerned with schools. These two organisations—the National Committee for Audio-Visual Aids in Education with the Educational Foundation for Visual Aids in England and Wales, and the Scottish Film Council and its associated bodies in Scotland—are the only two whose activities cover the whole field of audio-visual aids.

455. To serve all the needs of higher scientific education both in England and Wales, and in Scotland, the governing body of the Centre, which we suggest should be called the Council for Educational Technology, should be fully representative of the academic staffs of universities, colleges of advanced technology, central institutions, training colleges and colleges of education. It should have executive committees to cover the three broad divisions into which its work would fall—technical and advisory services, library services and general executive matters—and there should be the closest co-operation between them. If the Centre were also to cover the needs of the schools and further education establishments there would need to be separate, additional executive committees for England and Wales, and for Scotland, where the educational systems are very different. The Council would, of course, need additional representatives from schools and from further education establishments.

456. On the assumption that the National Centre could cover all levels of education we think it could be administered on the following lines:—



457. A suggested staff complement for the higher education functions of the

National Centre is given in Appendix 6 and an estimate of the cost of the Centre in Chapter 12.

458. In deciding on the location of the National Centre there are certain criteria which will have to be satisfied. The site must be readily accessible by rail, road and air; it should be within easy reach of electronic industries, centres of photography and television studies; and as far as possible it should be in a central position geographically for universities all over Great Britain. Preferably it should be on the outskirts of a city which academic staff might be expected to visit for other purposes. Several locations in England and Scotland were considered, among them Birmingham, Edinburgh and Manchester, but on balance we came reluctantly to the conclusion that major interests would best be served by choosing London. The needs of the Scottish schools and further education establishments would, however, best be met by a continuance of the facilities at present provided for them in Scotland.

459. It was suggested to us in evidence that a national centre might be attached to an institution of higher education. Apart from the difficulty of deciding which institution would be the most appropriate, we believe that this proposal would not endow the National Centre with the status and degree of independence which we consider essential to the proper performance of its many functions. We are therefore unable to accept this proposal.

THE FILM IN SCIENTIFIC RESEARCH

460. The report of the Working Party of the Department of Scientific and Industrial Research which was published in October, 1963, made recommendations which have some bearing on our proposals for a National Centre. These recommendations were:—

(a) that a Central Research Photographic Unit be established, preferably located in an existing research establishment;
(b) that university central photographic units be set up to stimulate photographic activities in research departments and to develop the use of film in research; and
(c) that a research-film library should be set up, possibly in an existing institution which has some experience of film distribution.

461. We do not believe that our proposed National Centre should in any way affect the setting up of a Central Research Photographic Unit since the requirements of this Unit would be highly specialised, but there would be the need for very close co-operation between the Centre and the Unit.

462. On the other hand, the central service units which we recommend for universities and other institutions of higher education would be able to perform the tasks envisaged by the Working Party for the university central photographic units.

463. We strongly recommend that the library service of the National Centre should include both teaching and research films. There are likely to be many research films which will contain sequences of value in teaching and if these were located in a separate research-film library we feel that they might not be made readily available to teachers. A comprehensive central library service would meet the requirements in paragraph 460(c). It would also avoid wasteful duplication of distribution services and would ensure the proper degree of co-ordination.

CHAPTER 11

PROVISION FOR TRAINING

HEADS OF CENTRAL SERVICE UNITS

464. In Chapter 10, we recommended that central service units be established in institutions of higher education and outlined the services which an ideal unit should provide. It is clearly difficult to estimate the number of such centres which will be established in the immediate future but, whatever the number, the development and efficiency of any unit will depend primarily on its director. Men of suitable personality, with the requisite knowledge and experience, will have to be found quickly. Since only a few will be required, it should be possible to recruit them from academic staff, from industry, from the armed services, from the film and television field or by promotion from existing central units, and, if they were appointed soon, the training of other potential directors could be undertaken concurrently. For this purpose, such training as exists should be improved and used in the immediate future, with more formal provision to be arranged as soon as possible, and certainly no later than 1970. Should it prove impossible to obtain a sufficient number of directors of central units from the sources suggested, trainees should be sought among new science graduates and others with equivalent qualifications (see para. 466).

465. In the recruitment of young graduates, the recommendation of tutors or of secretaries of appointments boards would be of major importance. While not wishing, themselves, to engage in teaching or in research a number of graduates may wish to collaborate with those who do. Enquiries at appointments boards, together with appropriate advertisements offering the prospect of a satisfying career, should produce enough suitable applicants.

466. If enough trainee-directors cannot be recruited from the universities, industry or from the film and television field, there are several other training grounds from which suitably qualified non-graduates can be sought. These include the one-year diploma course in photographic science at The Polytechnic, Regent Street; teacher-training colleges which have specialised courses in audio-visual aids; the Royal College of Art's special course on television and film design; government research establishments; the Medical Photographic Service; and those technical colleges which offer full-time day courses in photography and related subjects.

Qualifications and experience required

467. Applicants should possess some of the qualifications listed below. They can hardly be expected to possess all, for some of these demand a degree of maturity and breadth of experience which cannot be expected of very young trainee-directors:—

(a) a university degree. This is especially desirable in university centres in order to understand the university milieu. Pure or applied science, social science or medicine are particularly appropriate disciplines;

(b) some expertise in photography or the ability to acquire it readily;
(c) a critical ability to assess film or *cctv* as media of expression and communication. Experience of film-making at any level will be an advantage;
(d) experience of reprographic techniques;
(e) a knowledge of the visual and graphic arts;
(f) some experience of the use of audio-visual aids in education;
(g) some appreciation and knowledge of modern educational methods, including programmed instruction; and
(h) some ability in administration and in budgeting for a department.

Short-term training arrangements

468. The trainee-director should be attached for one year to an existing audio-visual unit where he can gain the necessary experience. Suitable centres include; the Department of Photography at Newcastle University, the Television Centre at the University of Leeds, the Central Photographic Section of the National Physical Laboratory, the Film Unit of the Department of Animal Genetics at Edinburgh University, the Film Unit of the National Coal Board, the Film Library of the Atomic Energy Authority, the Departments of Medical Illustration at the Westminster Hospital, Guy's Hospital and the Manchester Royal Infirmary. There are several other units which could undertake training.

469. A number of special courses should be taken to supplement earlier training. It would probably not be necessary for a trainee-director to attend all the courses suggested here, for much would depend on the qualifications and experience he already possessed. Useful courses would include:—

(a) *photography*. The Polytechnic, Regent Street offers a one-year diploma course in photographic science and several technical colleges provide instruction to Institute of British Photographers Intermediate standard. We suggest that special arrangements should be made for science graduates to have shortened courses with appropriate examinations. In addition, trainees could attend special courses at commercial firms, and conferences arranged by the Royal Photographic Society's Technical and Scientific Group. The London School of Medical Photography might also be asked to offer specialised short courses;
(b) *cinematography*. Courses already exist at The Polytechnic, Regent Street and at Harrow Technical College. There is a course on Film and Television at the Royal College of Art, parts of which, especially those on production technique, would be of particular value. The large cine laboratories could be asked to allow trainees into their various departments, and the Slade School could also be invited to arrange a short course. In addition, the trainee-director should be encouraged to attend some of the numerous extra-mural courses on the art and critique of the cinema, and the tutor at his home department should prescribe a course of reading and film viewing;
(c) *closed-circuit television*. Now that television centres have been established at the Universities of Leeds and Strathclyde, it may be possible for trainee-directors to gain experience there. Such experience could also be acquired at a number of training colleges which have *cctv* installations and at the Scottish Academy of Dramatic Art in Glasgow where there is a studio course;

(d) *audio-visual aids*. We recommend that special short courses should be provided at a limited number of institutions with the appropriate facilities. Among such institutions are Goldsmith's College, London, the Bolton and Wolverhampton Technical Training Colleges and the Institute of Education of the University of London;

(e) *graphic arts and commercial art*. The trainee should spend two or three weeks in a college of art, an advertising agency or in a studio either engaged in display work, or in the studio attached to a printing works. The prime need here would be to see the art of typography, to understand how graphic artists work and the skills and materials they employ. Simple tasks could then be undertaken by the trainee at his home centre. The purely artistic side of the work could be balanced by a short course on the technology of the graphic arts, either in an industrial firm or at the London School of Printing, which could be asked to arrange short, intensive courses;

(f) *reprography*. Until courses are available at technical colleges, the trainees should go to several sources for experience. Their own university library, or another which operates a microfilm or photo-copying service, would cover part of the curriculum in this subject. In addition, there are several photo-copying units: in the University of London, in several commercial firms, at the British Museum, at the Royal Society of Medicine and elsewhere. Thorough grounding in drawing office replication and offset lithography could be acquired at a number of commercial organisations and at some colleges.

Long-term training arrangements

470. Careful co-ordination of the courses listed in the previous paragraph would be necessary, and eventually it would be more practicable and effective to have a combined six-month course of instruction and practical work in a single institution. Without this, good central departments are not likely to develop. A course should be planned for a graduate standard of entry, and we recommend that its early establishment should be discussed by the University Grants Committee, the Department of Education and Science and the Scottish Education Department with appropriate institutions, such as The Polytechnic, Regent Street, one of the colleges of advanced technology, or a teacher-training college with a special interest in technical education, namely Bolton, Huddersfield, Wolverhampton or Garnett, London. Some training systems have already been developed in private and public corporations. Such training could properly be held to be the function of some of the academic institutions mentioned here. When the course recommended in this paragraph has been established the need for outside training schemes will tend to disappear.

Status and grading

471. Central units will vary according to the institution: some will serve all the faculties in a university, others may be concerned mainly with the production of scientific teaching material. To ensure that each unit has proper academic status, the directors should receive immediately, or attain later, a rank equivalent to that of senior lecturer and in the largest institutions he might even attain to a higher status (see also para. 432).

ANCILLARY STAFF

472. Depending on the size of the institution they serve, some central units

will be larger than others. The larger ones would need deputy directors, and it is for these posts that young science graduates would be most suitable. They would have the opportunity to acquire the skills and experience necessary for later promotion to director. The size of the department would also decide the number of technicians and the secretarial staff required. For the guidance of institutions, Appendix 7 records the staff employed in 1965 in a large central unit serving a civic university of approximately 5,000 students and in a smaller unit serving a London medical school of just over 1,000 students.

TECHNICIAN TRAINING

473. Training provision for technicians in the field of audio-visual aids is slight. Eventually the training of some technicians should be undertaken by the central units themselves (para. 428) but, for the short-term, other training arrangements will be needed. To attract suitable personnel it will be necessary to establish a number of senior posts (see para. 476).

474. Technical colleges should undertake the training of technicians for central units, bearing in mind that these technicians will require not only a knowledge of technique but of its application. For instance, Wandsworth Technical College has at present a course on cinema projection. This in itself would not be sufficient training for a technician in a central unit, but it would constitute a step towards it, especially if it could be followed by further training in television or in film-production studies. We were informed by Wandsworth Technical College that intensive courses of 3-4 weeks' duration could be arranged for potential technicians at central units. We would propose that Wandsworth and other technical colleges in different regions should be asked to establish such courses and that the City and Guilds of London Institute be invited to examine the possibility of offering an appropriate certificate.

475. There is likely to be a great demand for audio-visual technicians both in university departments and in schools. A good basic course for these could be provided by the existing City and Guilds course for laboratory technicians if the subject audio-visual aids was added as one of the fields of specialisation in the second part of the course. Such technicians would be well qualified to supervise the use and general maintenance of the more common equipment such as tape recorders, projectors, portable *cctv* cameras and monitors. Technicians with the Electrical or Electronic Technicians' Certificate or the Radio Servicing Certificate would be more suitable for more detailed maintenance. Consideration should be given to creating special endorsement courses in audio-visual aids suitable for technicians of all the above types and these might lead to the certificates recommended in paragraph 474.

476. In addition to general technicians, a number of specialists in film, *cctv*, offset printing and other fields will be needed in central units. These would no doubt be difficult to recruit and to retain on technicians' grades. It may therefore be necessary to appoint in most units two or three Experimental Assistants, Experimental Officers or Departmental Assistants, as appropriate, to head the various sectional services. These posts may have to be filled from the appropriate industry. Those who showed the ability to enlarge their speciality could be given the opportunity for further training over the broader field.

477. It is extremely important for student teachers to obtain an appreciation of audio-visual techniques and we therefore suggest that all teacher-training institutions should stress and demonstrate the value of these techniques in their courses.

478. For university and college teachers we recommend that courses should be arranged during the vacations at the National Centre, at university institutes and departments of education and at technical and training colleges.

479. Departments of suitable institutions, such as the Royal College of Art and University of Leeds might be asked to arrange a summer school for academic staff, in groups of 12-20 on a week's course. There they could be shown how to introduce appropriate pictorial illustrations, animated and otherwise, captions and film sequences into television lectures. There could be group discussion, and as much practice as possible in production and the handling of equipment.

RECOMMENDATIONS

480. To meet the immediate need, directors of central units should be sought among the academic staff and in existing central units in universities, in industry, in the armed services and in the film and television fields (para. 464).

481. Permanent training provision for potential directors should be arranged at an early date with appropriate institutions (para. 470).

482. A director should normally have a rank equivalent to that of senior lecturer (para. 471).

483. Deputy directors for larger units and trainee-directors should be sought among young science graduates (para. 472).

484. In view of the great shortage of technicians, special training arrangements should be made at technical colleges with the assistance of the City and Guilds of London Institute (paras. 474 and 475).

485. Summer schools and other vacation courses in the use and potential of communication media should be arranged for teachers (paras. 478 and 479).

CHAPTER 12

FINANCE

486. It has been extremely difficult to estimate the cost of implementing our recommendations, since many of them underline deficiences in existing institutions and do not attempt to lay down hard and fast standards for the future. Indeed it would have been unrealistic for us to attempt this. It has been pointed out already (para. 28) that our enquiry did not reveal the *amount* of audio-visual equipment at present in use, so that even if it had been practicable to lay down standards for each type of institution the amount of additional equipment required to meet those standards would have been largely a matter of conjecture. We hope our Report will greatly stimulate the use of audio-visual aids. We realise that in large measure this will depend on the enthusiasm of individual teachers and on the funds which will be made available but we are convinced that institutions of higher education should actively develop the use of audio-visual aids and should be given the necessary funds for this purpose.

487. Our recommendations for a national centre and for central service units in individual institutions are more precise because we have been able to draw on the experience and advice of existing organisations and units. Even so the National Centre might eventually require a larger staff than is proposed in Appendix 6. It is not possible to forecast accurately at this stage just how large this organisation might become, but a centre of the size we recommend ought to be developed by 1968. Beyond that its further expansion will depend on its success during the initial stages, on the degree of co-operation achieved with the central service units and on the amount of public money available.

THE NATIONAL CENTRE

Recurrent costs

488. A staff of the size shown in Appendix 6 would cost approximately £130,000 per annum in salaries. To this must be added other recurrent costs, notably those of film production and cataloguing, the printing and dissemination of information on all audio-visual matters, and the testing and development of equipment. It would be unrealistic to hazard a detailed estimate but these recurrent costs (excluding salaries) could be as much as £100,000 per annum. Possible developments, for example more extensive use of video-tape recorders and the need for a central library of video-tapes, would inevitably result in higher costs.

Capital costs

489. It is difficult also to estimate the accommodation that would be needed to house this organisation and we can only do so by reference to existing organisations of a somewhat similar nature. For instance, the Audio-Visual Facility at Atlanta, which serves the U.S. Public Health Service, occupies some

25,000 sq. ft. and houses equipment valued at $500,000. In England and Wales the National Committee for Audio-Visual Aids in Education and the Educational Foundation for Visual Aids, whose present activities include but little provision for higher education, have an audio-visual centre, a film library and administrative offices which total about 27,000 sq. ft. On the basis of this comparison, and on the assumption that the recommended National Centre would serve education at all levels, it seems reasonable to assume that a minimum of 35,000 sq. ft. would be required. A building of this size, excluding the cost of the necessary land, is estimated at approximately £200,000. The price of land would depend on the location and the design of the Centre. In addition there is the cost of equipment, estimated at a further £150,000. Much of the equipment required would be highly specialised and expensive and would need to be amortised over a shorter period than most capital equipment. In our estimate we have assumed a period of five years, which implies a cost of replacing obsolete equipment of £30,000 per annum.

Total cost

490. The estimated total cost of developing the National Centre may be summarised as follows:—

	£
Recurrent Costs	
Salaries and wages	130,000 per annum
Materials, services and miscellaneous costs	100,000 per annum
Replacement of obsolete equipment	30,000 per annum
Total	£260,000 per annum
Initial capital costs	
Building, *excluding land*	200,000
Initial equipment	150,000
Total	£350,000

491. Some income will be derived from the hiring and selling of visual material but this will be small since the charges made should be based only on material cost.

Sources of finance

492. It is essential that the National Centre should be financed solely from public funds. Present organisations in the field of audio-visual aids range from voluntary organisations, which exist on slender resources, to one which depends on commercial activities for a substantial part of its income. Despite the enthusiastic efforts of their officers the voluntary organisations are unable to devote the time and money which they consider necessary to their tasks. Involvement in trading activities inevitably arouses suspicions of bias when advice is offered on the choice of audio-visual equipment. Neither of these methods of financing the National Centre could result in a lively, independent organisation and we strongly recommend that it should be fully supported from public funds so that it will not need to rely on donations from private sources or from trading activities. If the Centre were to serve *all* levels of education it would seem appropriate for it to receive its grant direct from the Department of Education and Science and from the Scottish Education Department.

Central purchasing and standardisation

493. A substantial increase in the use of audio-visual equipment throughout the educational system could lead to the need for a central purchasing authority. If this were so, we would recommend the setting up of a completely separate organisation financed initially by a capital grant from public funds. This organisation would maintain close liaison with manufacturers and with the development section of the Centre, and it would ensure the necessary degree of standardisation of equipment so that audio-visual material prepared in one institution could readily be used in others. We doubt however whether such a purchasing authority should be set up before the National Centre had had an opportunity to consider the need for it, but it would be wasteful and highly frustrating if immediate steps were not taken to ensure that audio-visual material was widely interchangeable.

CENTRAL SERVICE UNITS IN INDIVIDUAL INSTITUTIONS

Recurrent costs

494. The size of the central service units would no doubt vary considerably from one institution to another depending on its size, and on the use made of aids in teaching and research. We are therefore not able to suggest a staffing complement. As pointers we record that the staffing cost of the Department of Photography at the University of Newcastle upon Tyne is about £32,000 per annum, and that of the Department of Medical Illustration at Guy's Hospital Medical School, about £10,000 per annum. These are well-organised central units, but neither of them has yet reached the limit of its potential. A unit of the kind we recommend would cost up to £50,000 per annum and on this basis, and on the assumption that all universities and colleges of advanced technology will have a central service unit, the recurrent cost might total about £2m. per annum. In training colleges and colleges of education the central units would be smaller than in the universities and colleges of advanced technology, but even if all teacher-training establishments had a *cctv* installation we would not expect the total cost of their central units to exceed £750,000 per annum.

Capital costs

495. No firm estimate can be made of the total capital cost of setting up central service units. In some institutions there may exist accommodation which could readily be adapted for use as a central unit. The type and amount of equipment required would depend on existing provision and would also vary considerably. In institutions which decide to set up *cctv* installations the cost of these would represent a major part of the total expenditure. These considerations, together with the great variation in the size of establishments, the range and complexity of their respective disciplines, and the degree of physical separation of faculties, will cause the cost of individual units to range from £10,000 to £200,000. In these circumstances our estimate of the total capital cost of establishing central service units can only be tentative. A sum of £7m. is not an unreasonable estimate but it might well be appreciably more.

Total cost

496. The total cost of setting up central service units can be estimated as follows:—

Recurrent Cost	£2¾m.
Capital Cost	£7m.

These figures would, of course, be reduced where existing central units or visual aids sections could form the nuclei of central service units in some institutions. New central service units would probably develop gradually and the total expenditure might be spread over a number of years.

497. It is important to remember when considering these estimates that the activities of the central service units in universities would be available to all departments and not simply to those in the faculties of science, medicine and technology.

PERIPHERAL UNITS

498. In exceptional circumstances certain faculties, by reason of their physical separation from the main site of the university, or because of special needs, may wish to maintain their own audio-visual units (para. 419). It would not be desirable, nor do we think it would be necessary, for them to duplicate the costly facilities of the central service unit. Such services as they would provide should not require expensive equipment and we have not attempted to estimate separately what their total cost might be. To some extent it will be included in the following paragraphs.

ADDITIONAL EQUIPMENT

499. In Table 5 of Appendix 2 we show the number of departments or institutions which expressed a desire for particular audio-visual aids. Since we did not in our enquiry ask for a statement of the amount of equipment installed, nor the amount desired, the information in Table 5 does not enable us to make a reliable estimate of the total cost of additional equipment. However, on the assumption that each department might be content with only one of each kind of aid, we would estimate the *minimum* cost of additional equipment as £600,000. A realistic estimate, however, might be substantially larger.

OTHER COSTS

500. There are financial implications in several other of our recommendations, especially in those concerned with training (Chapter 11). In general, the cost of training courses at the National Centre and in the central service units will be covered by our estimates of the running costs of those organisations. Where this is not so, as in the recommendation that courses for technicians should be available in technical colleges, the cost would largely be covered by the salaries of the full-time teachers. We would not expect the total cost of such courses to be great. Their beneficial effect would, however, be considerable.

GENERAL

501. Mainly for the reasons given in paragraphs 486 and 487 it would be misleading to summarise our estimates in a single table. We believe that they

give a broad indication of the sums which would be required for audio-visual aids, although for the reasons we have given they must inevitably lack precision. While smaller sums, provided they are not substantially smaller, could undoubtedly be used to good effect, we believe that the creation of a well-equipped National Centre and of efficient central service units leading to a much wider use of audio-visual aids, are vital if we are to make the fullest and best use of our teachers in the years ahead.

CHAPTER 13

SUMMARY OF MAIN RECOMMENDATIONS

502. In the course of our enquiries we have seen many notable examples of the use of audio-visual aids in this country and abroad, and we have heard of many interesting developments which are contemplated. We have become increasingly convinced that these aids can help to improve the quality of teaching, and to ease and enrich learning processes.

503. We hope that those in our universities and colleges who have little knowledge or experience of these aids will examine our proposals objectively. They call for a sustained effort and for much financial support over a number of years.

504. For convenience we give below a list of our main recommendations, the most outstanding of which are the establishment of a National Centre and of central service units in institutions of higher education (Chapter 10).

505. CHAPTER 5: FILM

(a) Determined efforts should be made to overcome the present shortage of suitable teaching films at higher educational levels. Enthusiasts in cinematography in various institutions should be encouraged to produce teaching films of general value in their disciplines, working in close co-operation with their central units and in consultation with colleagues in other institutions who have like interests (para. 223).

(b) The films produced should be submitted to the appropriate assessing panel of the National Centre for inclusion in its catalogue, and should then be made easily available by hire or purchase to other institutions in the country (paras. 449–450).

(c) If sequences from research films are thought to be of value for teaching purposes, extracts of the film should be sent to the appropriate assessing panel at the National Centre for appraisal. The selection of suitable sequences should then be the task of the National Centre (para. 216).

(d) Research films should be made available through the National Centre to other institutions (para. 216).

(e) The National Centre should arrange for the processing and printing of films at a reasonable cost (para. 215).

(f) Where a permanent record is required of a lecture or talk which has been televised and recorded on video-tape, it should be transferred on to film. Films should also be made of appropriate educational programmes after negotiation with the broadcasting company concerned (para. 217).

(g) When a longer film is made, it should preferably have a magnetic sound track so that teachers can either retain the original commentary or record their own (para. 210).

(h) All educational films imported from abroad should be exempt from import duty. Their appraisal should be undertaken at the National Centre which should also be responsible for procuring such films as are deemed

to be of value, translating or dubbing them when necessary (paras. 218–221).

(i) Consideration should be given to the preservation of master copies of films and tapes which are clearly of educational value (para. 222). N.P. (See also paras. 506 (f), (g) and (h)).

506. CHAPTER 6: PROJECTION AIDS

(a) The central service units should hold a stock of overhead projectors for use by individual lecturers and should assist with the production of transparencies or, when required, should produce them in the unit (para. 250).

(b) Overhead projectors should form part of the standard equipment of lecture theatres and, where possible, they should be built into the lecture bench (para. 250).

(c) Built-in projectors should be low-mounted so as not to obscure the vision of any member of the class and the lens should not be detachable (para. 250).

(d) The design of projectors should be such that overlays are interchangeable (para. 250).

(e) Central service units should maintain a stock of cassette-loaded projectors for use by individual lecturers in smaller lecture rooms and in laboratories, and also by individual students for private study and revision, perhaps in association with tape-recorded material (para. 260).

(f) Central service units should provide facilities for the production of short, single-concept films (para. 261).

(g) The library services of the central service units should catalogue and store copies of these films for use in their own institutions and should ensure that details of them are notified to the National Centre for inclusion in the national catalogue (para. 261).

(h) The library services of the National Centre should make provision for the scrutiny of all teaching and research films submitted for inclusion in the national catalogue and for the extraction of those sections which would be particularly suitable for 8 mm cassette-loaded projectors (para. 262).

507. CHAPTER 7: TELEVISION

(a) The experiment involving inter-university discussions between Cambridge University and Imperial College, London, should be repeated between separate colleges, within individual colleges and on a regional basis (para. 321).

(b) Institutions setting up extensive *cctv* installations should consider whether a good-quality video-tape recorder is likely to prove to be economic despite the present high cost and should look for advice to the National Centre (para. 325).

(c) If *cctv* is used for large overflow classes, the students should be subdivided into small groups with a junior lecturer or demonstrator in charge to answer questions and lead discussions. The formal lecture should be short enough to allow adequate time for discussion (para. 335).

(d) The value and potential of *cctv* are manifest and we would urge institutions to take full advantage of them (para. 336).

(e) In the field of teacher training we think that film and *cctv* are by no means mutually exclusive and we recommend that urgent consideration be given to the production of films specifically for teacher training (para. 338).

(f) The educational uses of *octv* should be closely studied by a body representative of both educational and broadcasting interests (para. 347).
(g) A closer co-operation should be established between the broadcasting organisations and those engaged in higher education (para. 347).
(h) An allocation of channels in the UHF band should be made to several universities for experiments in local educational broadcasting (para. 349).

508. CHAPTER 8: PROGRAMMED INSTRUCTION

(a) Universities, training colleges and technical colleges should carry out research into the possible uses of programmed instruction in their respective spheres and on the techniques of applying it. Such research should include computer-based teaching machines, and should involve the use of programmed instruction as part of the planned application of educational technology as a whole (para. 387).
(b) University departments of education and teacher-training colleges should conduct in-service courses in programmed instruction and in programme writing, and thus increase the supply of good programmes. It is of great importance that teachers should be released for this kind of training (para. 388).
(c) Institutions of higher education should consider providing some programmed courses for first-year students (para. 389).
(d) At all levels, in subjects where considerable factual information has to be assimilated, use should be made of programmed instruction, so that teachers can spend their time in assisting students to use their knowledge rather than in helping them to acquire it (para. 390).
(e) In teacher-training establishments, students should be taught programmed instruction as a 'special method' and should learn the basic principles of programming (para. 391).
(f) Appropriate establishments should be encouraged, and, where necessary, financially assisted, to play their part in validating new programmes (para. 392).

509. CHAPTER 9: LANGUAGE LABORATORIES

(a) Where the demand for language teaching in scientific and other departments would not justify a separate language laboratory installation, modern-language departments should provide for the needs of other departments (para. 412).
(b) There are several ways in which oral instruction by means of a master tape could be combined with other forms of visual aid or with programmed instruction, but there is need for more research into which medium is best suited to any particular teaching situation. This could be carried out both by the National Centre and by the universities and colleges themselves. The central service units should help to initiate experiments in individual university departments in collaboration with the National Centre and with university departments of education (para. 413).

510. CHAPTER 10: LOCAL AND NATIONAL CO-ORDINATION

(a) Central service units should be given adequate facilities to enable them to improve teaching and strengthen communication throughout the field of higher education (para. 414).

(b) The services provided by the central unit should cover the whole field of communication (para. 415).
(c) The central units should supply the National Centre with information on research apparatus and techniques used in their institutions and so maintain a two-way link between the universities and colleges and the National Centre (para. 425).
(d) In close co-operation with subject experts and with appropriate institutions, central units should initiate and organise new research in the field of teaching methods (para. 427).
(e) Some of the large university centres should accept graduates who wish to train in educational technology. In this field they would naturally work in conjunction with the university's own department or institute of education and other appropriate departments (para. 428).
(f) The central service unit should have proper academic status within the university, with representation on appropriate university committees (para. 432).
(g) A National Centre should be established, to concentrate on services which cannot be rendered satisfactorily by smaller units, on the exploitation of new aids, on the training of staff for university or college central units, on providing a co-ordinated cataloguing and library service and a comprehensive information and advisory service (para. 435).
(h) The Centre should be able to advise on experiments and on research in audio-visual techniques, as well as on the applications of aids for instruction (para. 440).
(i) The Centre should provide adequate courses of instruction on new methods and applications for its own junior staff and, provided the numbers were small, it should undertake the training of audio-visual technicians from university or college centres (para. 443).
(j) The Centre should have a large selection of equipment so that its staff could demonstrate all methods of presenting audio and visual information (para. 446).
(k) The library of the National Centre should collect and catalogue material for reference, loan or purchase. This material should not only include books, journals and theses but catalogues on films, video-tapes, slide collections, sound recordings and teaching programmes (para. 448).
(l) University and college centres should inform the National Centre of all films made in their institutions which are likely to be of value for teaching purposes (para. 450).
(m) The National Centre should assume the responsibility for importing and exporting films and, if necessary, video-tapes needed for teaching purposes, and should take steps to ensure that this is done with a minimum of delay (para. 451).
(n) The library should form an integral part of the National Centre (para. 452).
(o) The library service of the National Centre should include both teaching and research films (para. 463).
(p) To serve all the needs of higher scientific education both in England and Wales, and in Scotland, the governing body of the Centre, which we suggest should be called the Council for Educational Technology, should be fully representative of the academic staffs of universities, colleges of advanced technology, central institutions, training colleges and colleges of

education. If the Centre were to cover all levels of education there would need to be additional representatives of schools and further education establishments (para. 455).

511. CHAPTER 11: PROVISION FOR TRAINING

(a) To meet the immediate need, directors of central units should be sought among the academic staff and in existing central units in universities, in industry, in the armed services and in the film and television fields (para. 464).
(b) Permanent training provision for potential directors should be arranged at an early date with appropriate institutions (para. 470).
(c) A director should normally have a rank equivalent to that of senior lecturer (para. 471).
(d) Deputy directors for larger units and trainee-directors should be sought among young science graduates (para. 472).
(e) In view of the great shortage of technicians, special training arrangements should be made at technical colleges with the assistance of the City and Guilds of London Institute (para. 475).
(f) Summer schools and other vacation courses in the use and potential of communication media should be arranged for teachers (para. 478 and 479).

512. CHAPTER 12: FINANCE

(a) Institutions of higher education should actively develop the use of audio-visual aids and should be given the necessary funds for this purpose (para. 486).
(b) It is essential that the National Centre should be financed solely from public funds (para. 492).

ACKNOWLEDGEMENTS

513. We wish to express our gratitude to all those who have so kindly helped us in our enquiries both at home and overseas. A list of those who gave evidence to us is given in Appendix 1, but there may be others to whom we talked informally and whose names are not listed. We also extend our thanks to them.

514. We owe a particular debt of gratitude to Mr. C. J. Duncan of the University of Newcastle and Mr. C. E. Engel of Guy's Hospital Medical School, upon whose evidence much of Chapters 10, 11 and 12 is based and who have been untiring in their advice and assistance.

515. We have benefited greatly from the expert advice and wise guidance of our assessors, in particular Mr. H. W. French of the Department of Education and Science and Mr. A. J. Mee of the Scottish Education Department.

516. No enquiry, and certainly no report of this kind, comes to fruition without the devotion of its Secretary. We have been especially fortunate to have as Secretaries Mrs. Eleri Cahan of the University Grants Committee and Mr. Donald Basey of the Department of Education and Science. They have collected and reduced to a lucid form a great mass of information, arranged many journeys efficiently and written the first draft of the greater part of

this Report. We are deeply grateful to them for their devotion, skill and cheerfulness.

Signed: Brynmor Jones (*Chairman*)
G. Barclay
A. L. D'Abreu
M. W. Humphrey Davies
D. J. Johnston
H. Lipson
E. W. Parkes
C. W. Tonkin
C. M. Yonge

D. M. Basey
Eleri W. Cahan } *Secretaries*

July, 1965.

APPENDIX 1

BODIES AND INDIVIDUALS WHO SUBMITTED EVIDENCE

A. *Bodies who submitted evidence to the Committee. Those marked with an asterisk gave oral evidence.*

*Association of Teachers in Colleges and Departments of Education:
Mr. K. G. Collier, Principal, College of the Venerable Bede, Durham;
Mr. D. G. Mills, Avery Hill Training College;
Mr. D. Bassett, Loughborough Training College.

*Association of Teachers in Technical Institutions:
Mr. E. L. Britton, General Secretary;
Dr. J. H. Elliott, Leeds College of Technology;
Mr. R. Goodman, Brighton College of Technology;
Dr. D. van Abbé, Cambridge College of Art and Technology.

*Association of University Teachers:
Mr. H. J. Perkin, Manchester University;
Dr. W. Mays, Manchester University;
Mr. A. L. Binns, Hull University;
Mr. B. C. Brooks, University College, London;
Dr. S. Doniach, Queen Mary College, London.

*British Film Institute:
Mr. S. Reed, Secretary.

*British Universities Film Council:
Mr. E. B. Simpson, Chairman;
Professor G. E. H. Foxon, Vice-Chairman;
Miss K. M. Dyce-Sharp, Honorary Secretary;
Mr. W. J. Fairbairn, Treasurer.

*Central Office of Information:
Mr. A. A. Vesselo, Films and Television Division.

Department of Health, Education and Welfare, Washington.

E.M.I. Electronics Ltd.

Kodak Ltd.

*National Committee for Audio-Visual Aids in Education:
Sir William Alexander, Treasurer, National Committee and Chairman, Joint Executive Committee;
Dr. J. A. Harrison, Director, Educational Foundation for Visual Aids.

National Science Foundation, Washington.

*National Union of Students of the Universities and Colleges of England, Wales and Northern Ireland:
Mr. A. Rhys Hughes, President;
Mr. J. Daley, Vice-President;
Mrs. S. M. Greenall, Executive Secretary.

*Nuffield Foundation Unit for the History of Ideas:
Dr. Stephen Toulmin;
Dr. June Goodfield.

Organisation for Economic Co-operation and Development, Paris.

*The Rank Organisation:
Mr. J. P. Collis, Managing Director.
Radio Corporation of America (Great Britain) Ltd.
*Royal College of Art:
Mr. M. Clarke, Department of Film and Television.
*Scientific Film Association:
Mr. B. Chibnall, Vice-Chairman of the Association and Editor of the British National Film Catalogue;
Mr. E. J. Cooper, General Secretary;
Professor Bryan Brooke, Chairman, Medical Committee.
*Scottish Film Office:
Mr. D. M. Elliott, Director, Scottish Film Council and Scottish Central Film Library;
Dr. J. B. Barclay, Assistant Director of the Department of Extra-Mural Studies, Edinburgh University and Vice-Chairman Scottish Central Film Library;
Mr. C. M. Boyle, Headmaster, Crookston Castle Secondary School, Glasgow.
*Scottish Union of Students:
Mr. I. Honeyman;
Mr. D. Stewart.
Thorn Electronics Ltd.

B. *Individuals who submitted evidence. Those marked with an asterisk gave oral evidence.*

Professor P. R. Allison, Department of Surgery, University of Oxford
*Mr. H. Asher, Department of Physiology, Birmingham University.
Dr. J. Beeston, Director of Academic Communications Facility, University of California.
Professor D. Bindra, Department of Psychology, McGill University, Montreal.
Dr. H. J. J. Braddick, Department of Physics, University of Manchester.
*Mr. A. M. P. Brookes, Department of Engineering, Cambridge University.
Professor Sir Lindor Brown, Department of Physiology, University of Oxford.
Professor G. Brownlee, Department of Pharmacology, King's College, University of London.
Mr. M. Bruce, Director of Extra-Mural Studies, University of Sheffield.
Professor J. M. Cassels, Department of Physics, University of Liverpool.
Professor C. Cherry, Department of Electrical Engineering, Imperial College of Science and Technology.
Mr. D. G. Chisman, Royal Institute of Chemistry.
Professor A. L. Cochrane, Department of Tuberculosis and Chest Diseases, Welsh National School of Medicine.
*Mr. K. G. Collier, Bede College, Durham.
Professor G. K. T. Conn, Department of Physics, University of Exeter.
Mr. S. P. Corder, Department of English Literature, University of Leeds.

Mr. G. N. Critchley, Department of Fuel Technology and Chemical Engineering, University of Sheffield.
Mr. P. G. Cull, Department of Illustration, St. Bartholomew's Hospital Medical School.
Professor E. G. Cullwick, Department of Electrical Engineering, University of St. Andrews.
Professor D. Daiches, Department of English Literature, University of Sussex.
Professor P. I. Dee, Department of Natural Philosophy, University of Glasgow.
Mr. Thorold Dickinson, Slade School of Fine Art.
Professor J. Drever, Department of Psychology, University of Edinburgh.
Messrs. Dreyfus and Bradley, Wayne State University, Detroit.
*Mr. C. J. Duncan, Department of Photography, Newcastle upon Tyne University.
*Sir Arthur Elton, Bt.
*Mr. C. E. Engel, Department of Medical Illustration, Guy's Hospital Medical School.
*Dr. A. C. Eurich, Fund for the Advancement of Education, New York.
Mr. T. J. Fletcher, H.M.I.
Professor E. D. Fraser, Department of Psychology, Aberdeen University.
*Fulbright Fellows:
Professor S. L. Becker, Iowa University;
Professor K. Christiansen, University of Florida;
Professor R. P. Crawford, Queen's College, New York;
Professor S. T. Donner, Stanford University;
Professor E. E. Willis, University of Michigan, Ann Arbor.
Professor F. Goldby, Department of Anatomy, St. Mary's Hospital Medical School.
Mr. R. H. Goodman, Brighton College of Technology.
Drs. J. and V. Graves, Hon. Directors, Medical Recording Service and Sound Library, The College of General Practitioners.
Professor T. C. Gray, Department of Anaesthesia, University of Liverpool.
Mr. L. P. Greenhill, Director, University Division of Instructional Services, Pennsylvania State University.
Dr. J. H. E. Griffiths, Department of Physics, University of Oxford.
Professor H. J. Habakkuk, Department of Modern History, University of Oxford.
Professor D. W. Harding, Department of Psychology, Bedford College, University of London.
Sister W. E. Hector, Principal Tutor, St. Bartholomew's Hospital, London.
Professor A. Hemmingway, Department of Physiology, University of Leeds.
Professor J. H. Hutchinson, Department of Child Health, University of Glasgow.
Dr. J. B. Jepson, Courtauld Institute of Biochemistry, Middlesex Hospital Medical School.

Professor G. O. Jones, Department of Physics, Queen Mary College, University of London.
Professor A. S. Johnston, Department of Radiodiagnosis, University of Leeds.
Mr. E. Junge, William Lennard Concerts Limited, London.
Professor H. Kay, Department of Psychology, University of Sheffield.
Mr. K. Kiga, Keio University, Tokyo.
Professor F. W. Landgrebe, Department of Pharmacology, Welsh National School of Medicine.
Professor P. T. Landsberg, University College of South Wales and Monmouthshire.
Mr. J. P. R. Laslett, University of Cambridge.
Mr. R. Lefranc, Institut Pédagogique National, Paris.
Mr. J. L. Lewis, Malvern College.
Professor M. M. Lewis, Institute of Education, University of Nottingham.
*Mr. E. Lucey, Research Film Unit, Department of Animal Genetics, Edinburgh University.
Professor J. A. Macdonald, Department of Botany, University of St. Andrews.
Professor A. O. Mack, Sutherland Dental School, University of Newcastle.
*Dr. E. Mendoza, Department of Physics, University of Manchester.
Dr. I. R. Merrill, University of California Medical Centre, San Francisco.
Mr. M. L. Meyer, Postgraduate Department of Applied Mechanics, University of Sheffield.
Dr. J. H. Middlewiss, Department of Radiology, University of Bristol.
Dr. R. B. Morrison, Department of Education, Reading University.
Professor Sir Nevile Mott, Department of Physics, University of Cambridge.
Dr. E. Myers, Cultural Attaché, United States Embassy, London.
Professor J. Nutting, Department of Metallurgy, University of Leeds.
Professor W. D. M. Paton, Department of Pharmacology, University of Oxford.
Mr. G. Rawcliffe, Lecturer in Professional Studies, Blackpool Technical College.
Professor A. E. Ritchie, Department of Physiology, University of St. Andrews.
Mr. H. D. Roberts, City of Cardiff Training College.
*Professor R. J. Scothorne, Department of Anatomy, Newcastle University Medical School.
*Dr. B. Schofield, Department of Physiology, Newcastle University Medical School.
*Professor B. F. Skinner, Harvard University.
Dr. A. A. Smith, Department of Metallurgy, King's College, University of London.
Professor F. W. Spiers, Department of Medical Physics, University of Leeds.
Professor E. Stengel, Department of Psychiatry, University of Sheffield.
Mr. Noel Stevenson, Managing Director, Scottish Television Ltd.

Professor E. A. Stewardson, Department of Physics, University of Leicester.
Professor L. M. Stolurow, Department of Psychology, University of Illinois, Urbana.
Mr. K. Suzuki, University of Tokyo.
Professor A. M. Taylor, Department of Physics, University of Southampton.
Professor V. A. Venikov, Department of Power Engineering, Higher Technological Institute, Moscow.
Professor M. D. Vernon, Department of Psychology, University of Reading.
Dr. N. Livingstone Ward, London Hospital Medical College Dental School.
Professor R. Warwick, Guy's Hospital Medical School.
Professor C. Wells, Department of Surgery, University of Liverpool.
Professor G. Westby, Department of Psychology, University College, Cardiff.
Professor D. Whitteridge, Department of Physiology, University of Edinburgh.
Dr. A. W. Williams, Clinical Medical School, University of Oxford.
Mr. J. E. Yarborough, Advertising Manager, C.I.B.A. Laboratories.
*Professor J. R. Zacharias, Department of Physics, Massachusetts Institute of Technology.

APPENDIX 2

RESULTS OF THE SURVEY

The following tables show the results of the survey carried out in April, 1963, which provided the background information essential to the Committee's enquiry. During the ensuing two years, however, there has been an increasing interest in the use of audio-visual aids and, while the broad, overall picture may be little changed, in some respects the tables are now out-of-date. Care should therefore be taken if particular figures are to be used.

The tables are based on the replies to a questionnaire sent to institutions of higher education in Great Britain including five technical colleges in England. Questionnaires were completed by individual departments of universities, medical and dental schools, colleges of advanced technology, technical colleges and central institutions. Institutions without a departmental organisation—training colleges, institutes of education, university departments of education and colleges of education—completed one questionnaire each. In all 1,137 questionnaires were completed.

Percentages are included in Tables 1 and 2 to show the proportion of institutions and departments using the various types of audio-visual aids. These percentages are grouped according to a broad subject classification (Table 1) and to the type of institution (Table 2). Our questionnaire, however, did not ask how many aids of any particular kind were in use in individual departments since we wished to find the area rather than the volume of usage. This should be borne in mind when comparing the percentages in these two tables.

Our questionnaire is reproduced as part of this Appendix.

QUESTIONNAIRE
Audio-Visual Aids in Higher Education

The use of Audio-Visual aids for teaching and research in the pure and applied sciences (including medicine, dentistry and psychology)

Name of Institution or Institute of Education
Department or Teacher Training College

Leave blank

Please tick where applicable. Where questions are sub-divided please enter one tick only against the appropriate sub-division

Question number		AID			Closed-circuit television	Video-tape recorder	Film projector 35 mm	Film projector 16 mm	Film projector 8 mm	Filmstrip projector	8 mm cassette-loaded projector	Epidiascope	Still camera	Cine camera	Image intensifier	Tape recorder	Teaching machine (linear)	Teaching machine (branching)	Language laboratories (if used by science and technology students)	Other aids (please specify)			
	Aid reference number				01	02	03	04	05	06	07	08	09	10	11	12	13	14	15				
1	Which aids do you possess?			1																			1
2		Which aids are used for teaching?		1																			1
3	Teaching use	Which additional aids would you like to have for teaching?		1																			1
4		How often, on average, are the aids used?	1 or 2 times a term 3 to 10 times a term 11 to 30 times a term More than 30 times a term	1 2 3 4																			1 2 3 4
5		What proportion of teaching staff use the aids?	More than 75% 40% to 75% Less than 40%	1 2 3																			1 2 3
6		For which size of class do you find the aids most useful in teaching?	Under 5 students 5 to 20 students 21 to 60 students Audience over 60	1 2 3 4																			1 2 3 4
7		Is colour an important factor in the use of the aids?	YES NO	1 2																			1 2
		What is the student reaction to the use of the aids?	Unenthusiastic Moderately enthusiastic Very enthusiastic	1 2 3																			1 2 3
9		For which teaching function do you find the aids most suitable?	Arousing interest Providing information Explaining Assisting memory Training in practical or mental techniques	1 2 3 4 5																			1 2 3 4 5
10	Research use	Which aids are used for research?		1																			1
11		Which additional aids would you like to have for research?		1																			1
12		How often, on average, are the aids used?	1 or 2 times a term 3 to 10 times a term 11 to 30 times a term More than 30 times a term	1 2 3 4																			1 2 3 4
13		Is colour an important factor in the use of the aids?	YES NO	1 2																			1 2
14		What is the student reaction to the use of the aids?	Unenthusiastic Moderately enthusiastic Very enthusiastic	1 2 3																			1 2 3

Leave blank

Name of Institution .....

Department (where applicable) .....

				PLEASE TICK APPROPRIATELY	
15	Is suitable and up-to-date material (e.g. films) available other than that which you produce yourselves?		YES NO		1 2
16	Do you have problems or difficulties with regard to	recruiting technicians for operation and maintenance?	YES NO		1 2
17		servicing equipment (except by Institution's own staff)?	YES NO		1 2
18		obtaining projector operators?	YES NO		1 2
19		facilities, space, etc.	YES NO		1 2
20	Would you like to see a National Body established, particularly for cataloguing films, providing consultancy service, hiring equipment and materials?		YES NO		1 2
21	Do you have a group experimenting in new ways of using these aids?		YES NO		1 2
22	If the answer to the above question is 'YES', what is the group doing?				
23	If you have indicated, in answer to question 3 and 11 overleaf, that you would like to have additional aids, what are the reasons for desiring them?				

The following questions relate to the Institution (or Institute of Education) as a whole rather than to each Department (or Teacher Training College) and should be answered (on the questionnaire only) by the Vice-Chancellor, Principal or Director, as the case may be.

24	Do you have a central audio-visual unit advising Institution or Institute as a whole on production and use of materials and equipment?	
25	Do you have a film production unit? If, so, for which Departments is it mainly used? Are the films produced used for teaching, research or both?	
26	Would you consider that the work being done in this field is of sufficient interest and importance to justify a visit by members of the Committee?	

Signature of Vice-Chancellor, Principal or Director or other Authorised Officer .....

Date: .....

Table 1
Number and percentage (a) of completed questionnaires showing the use of the following aids

			Epidiascope	Television		Recorders		Language Laboratory	Film Projectors					Slide and other Projectors				Photographic Equipment					Image Intensifier	Teaching Machines		Display Materials	Radio Receiver	Other Aids	Number of Questionnaires Completed
				Closed-circuit	Open-circuit Receiver	Sound Tape	Video-tape		35 mm	16 mm	8 mm	Cassette-loaded	Filmstrip	Slide	Micro-projector	Overhead	Other	Still camera	Cine camera	Photomicrographic	Photoradiographic	Other		Linear	Branching				
Science																													390
	For teaching	No.	256	22	1	107	—	7	31	202	16	10	183	120	26	13	6	194	49	3	2	3	9	2	1	30	—	16	
		%	66	6	—	27	—	2	8	52	4	3	47	31	7	3	2	50	13	—	—	—	2	—	—	8	—	4	
	For research	No.	51	13	—	88	—	5	6	60	6	—	44	42	14	3	2	220	80	5	3	3	10	1	2	15	—	5	
		%	13	3	—	23	—	1	2	15	2	—	11	11	3	—	—	56	21	1	—	—	3	—	—	4	—	1	
Engineering and Technology (b)																													174
	For teaching	No.	146	26	1	68	—	3	22	146	23	11	126	58	9	9	3	97	52	—	—	1	2	2	—	14	—	7	
		%	84	15	—	39	—	2	12	84	13	6	72	33	5	5	2	56	30	—	—	—	1	1	—	8	—	4	
	For research	No.	23	12	—	73	—	4	8	57	10	—	30	20	8	1	4	142	79	—	—	8	3	1	—	2	—	2	
		%	13	7	—	42	—	2	5	33	6	—	17	12	5	—	2	82	45	—	—	—	2	—	—	1	—	1	
Medicine (b)																													322
	For teaching	No.	208	39	—	141	3	—	45	217	26	14	134	97	43	10	4	176	104	9	—	2	28	3	1	20	—	13	
		%	65	12	—	44	1	—	14	67	8	4	42	30	13	3	1	55	32	3	—	1	9	1	—	6	—	4	
	For research	No.	31	13	—	124	2	—	21	79	11	4	38	29	22	1	1	172	91	11	—	3	27	7	2	4	—	9	
		%	10	4	—	39	1	—	7	25	4	1	12	9	7	—	—	53	28	3	—	1	8	2	1	1	—	3	
Dentistry																													30
	For teaching	No.	17	3	—	14	—	—	4	19	4	—	10	13	2	—	—	23	11	1	—	—	1	1	—	3	—	1	
		%	57	10	—	47	—	—	13	63	13	—	33	43	7	—	—	77	37	3	—	—	3	3	—	10	—	3	
	For research	No.	1	—	—	13	—	—	1	5	3	—	2	4	1	—	—	20	5	2	—	—	1	—	—	1	—	1	
		%	—	—	—	43	—	—	3	17	10	—	7	13	3	—	—	67	17	7	—	—	3	—	—	3	—	3	
Veterinary Studies																													28
	For teaching	No.	20	—	—	9	—	—	1	25	2	2	12	13	5	—	—	16	12	1	1	—	2	—	—	3	—	5	
		%	71	—	—	32	—	—	4	89	7	7	43	46	18	—	—	57	43	4	4	—	7	—	—	11	—	18	
	For research	No.	3	—	—	5	—	—	—	10	—	1	—	4	3	—	—	18	12	2	1	—	1	—	—	1	—	2	
		%	11	—	—	18	—	—	—	36	—	4	—	14	11	—	—	64	43	7	4	—	4	—	—	4	—	7	
Agriculture																													38
	For teaching	No.	26	—	—	8	—	—	10	20	4	—	26	8	2	—	1	21	14	1	—	—	—	—	—	2	—	2	
		%	68	—	—	21	—	—	26	53	11	—	68	21	5	—	3	55	37	3	—	—	—	—	—	5	—	5	
	For research	No.	6	—	—	1	—	—	2	7	1	—	5	4	2	—	—	28	6	—	—	—	1	—	—	—	—	—	
		%	16	—	—	3	—	—	5	18	3	—	13	11	5	—	—	74	16	—	—	—	3	—	—	—	—	—	

Table 1 (*continued*)
Number and percentage (a) of completed questionnaires showing the use of the following aids

		Epidiascope	Television		Recorders		Language Laboratory	Film Projectors					Slide and other Projectors				Photographic Equipment					Image Intensifier	Teaching Machines		Display Materials	Radio Receiver	Other Aids	Number of Questionnaires Completed
			Closed-circuit	Open-circuit Receiver	Sound Tape	Video-tape		35 mm	16 mm	8 mm	Cassette-loaded	Filmstrip	Slide	Micro-projector	Overhead	Other	Still Camera	Cine camera	Photomicrographic	Photoradiographic	Other		Linear	Branching				
Education (c)																												155
For teaching	No.	144	2	26	145	—	1	6	148	29	26	154	12	36	4	6	80	60	2	—	—	5	15	5	1	11	7	
	%	93	1	17	94	—	1	4	95	19	17	99	8	23	3	4	52	39	1	—	—	3	10	3	1	7	5	
For research	No.	6	1	2	32	—	—	1	13	9	2	18	—	5	—	1	26	25	—	—	—	—	11	4	1	—	4	
	%	4	1	1	21	—	—	1	8	6	1	12	—	3	—	1	17	16	—	—	—	—	7	3	1	—	3	
All departments																												1137
For teaching	No.	817	92	28	492	3	11	119	777	104	63	645	321	123	36	20	607	302	17	3	6	47	23	7	73	11	51	
	%	72	8	2	43	—	1	10	68	9	6	57	28	11	3	2	53	27	1	—	—	4	2	—	6	1	4	
For research	No.	121	39	2	336	2	9	39	231	40	7	137	103	55	5	8	626	298	20	4	14	43	20	8	24	—	23	
	%	11	3	—	30	—	—	3	20	4	—	12	9	5	—	—	55	26	2	—	1	4	2	—	2	—	2	

(a) The percentages shown are related in each instance to the number of completed questionnaires shown in the end column.
(b) The Department of Photography at Newcastle upon Tyne University and the Departments of Photography and Medical Illustration at Guy's Hospital Medical School are included under Medicine; the Visual Aids Department at Birmingham College of Advanced Technology is included under Engineering and Technology.
(c) Training colleges, institutes and university departments of education, and colleges of education.

Table 2
Number and percentage (a) of completed questionnaires showing the use of the following aids

Type and Number(b) of Institutions		Epidiascope	Television		Recorders		Language Laboratory	Film Projectors					Slide and other Projectors				Photographic Equipment					Image Intensifier	Teaching Machines		Display Materials	Radio Receiver	Other Aids	Number of Question-naires Completed
			Closed-circuit	Open-circuit Receiver	Sound Tape	Video-tape		35 mm	16 mm	8mm	Cassette-loaded	Filmstrip	Slide	Micro-projector	Overhead	Other	Still camera	Cine camera	Photomicrographic	Photoradiographic	Other		Linear	Branching				
Universities and colleges (25) (Great Britain)																												840
For teaching	No.	571	63	1	282	3	—	92	520	55	29	380	281	78	23	12	445	203	15	2	6	37	5	1	58	—	35	
	%	68	8	—	34	—	—	11	62	7	3	45	33	9	3	1	53	24	2	—	1	4	1	—	7	—	4	
For research	No.	107	34	—	271	2	—	35	201	24	5	110	98	47	5	5	527	242	20	3	11	43	7	2	20	—	18	
	%	13	4	—	32	—	—	4	24	3	1	13	12	6	1	1	63	29	2	—	1	5	1	—	2	—	2	
Colleges of Advanced Technology (9) (England and Wales)																												75
For teaching	No.	52	13	—	39	—	9	10	58	8	6	53	17	1	8	2	45	24	—	1	—	5	3	1	7	—	5	
	%	69	17	—	52	—	12	13	77	11	8	71	23	1	11	3	60	32	—	1	—	7	4	1	9	—	7	
For research	No.	5	2	—	24	—	8	2	11	5	—	4	1	1	—	2	43	21	—	1	3	—	2	2	2	—	—	
	%	7	3	—	32	—	11	3	15	7	—	5	1	1	—	3	57	28	—	1	4	—	3	3	3	—	—	
Technical colleges (c) (5) (England and Wales)																												27
For teaching	No.	24	11	1	11	—	1	4	22	5	—	23	7	4	—	—	10	5	—	—	—	—	—	—	3	—	1	
	%	89	41	4	41	—	4	15	82	19	—	85	26	15	—	—	37	19	—	—	—	—	—	—	11	—	4	
For research	No.	2	2	—	3	—	1	—	2	1	—	2	2	—	—	—	10	4	—	—	—	—	—	—	1	—	1	
	%	7	7	—	11	—	4	—	7	4	—	7	7	—	—	—	37	15	—	—	—	—	—	—	4	—	4	
Institutes of education and university departments of education (23) (England and Wales)																												23
For teaching	No.	21	—	2	23	—	1	3	23	5	8	23	2	4	1	—	14	8	—	—	—	—	3	3	—	1	1	
	%	91	—	9	100	—	4	13	100	22	35	100	9	17	4	—	61	35	—	—	—	—	13	13	—	4	4	
For research	No.	—	—	—	4	—	—	—	2	1	—	2	—	—	—	—	2	2	—	—	—	—	2	2	—	—	—	
	%	—	—	—	17	—	—	—	9	4	—	9	—	—	—	—	9	9	—	—	—	—	9	9	—	—	—	
Training colleges (124) (England and Wales)																												124
For teaching	No.	116	2	24	115	—	—	3	117	23	13	123	8	29	3	6	59	49	2	—	—	5	11	2	1	10	5	
	%	94	2	19	93	—	—	2	94	19	10	99	6	23	2	5	48	40	2	—	—	4	9	2	1	8	4	
For research	No.	6	1	2	27	—	—	1	10	8	2	15	—	5	—	1	24	22	—	—	—	—	8	2	1	—	4	
	%	5	1	2	22	—	—	1	8	6	2	12	—	4	—	1	19	18	—	—	—	—	6	2	1	—	3	

Table 2 (*continued*)
Number and percentage (a) of completed questionnaires showing the use of the following aids

Type and Number(b) of Institutions		Epidiascope	Television		Recorders		Language Laboratory	Film Projectors					Slide and other Projectors				Photographic Equipment					Image Intensifier	Teaching Machines		Display Materials	Radio Receiver	Other Aids	Number of Questionnaires Completed
			Closed-circuit	Open-circuit Receiver	Sound Tape	Video-tape		35 mm	16 mm	8 mm	Cassette-loaded	Filmstrip	Slide	Micro-projector	Overhead	Other	Still camera	Cine camera	Photomicrographic	Photoradiographic	Other		Linear	Branching				
Central institutions (8) (Scotland)																												40
For teaching	No.	26	3	—	15	—	—	7	29	7	2	35	4	4	1	—	27	10	—	—	—	—	—	—	4	—	3	
	%	65	8	—	38	—	—	18	72	18	5	88	10	10	3	—	68	25	—	—	—	—	—	—	10	—	8	
For research	No.	1	—	—	6	—	—	1	4	1	—	3	2	2	—	—	20	6	—	—	—	—	—	—	—	—	—	
	%	3	—	—	15	—	—	3	10	3	—	8	5	5	—	—	50	15	—	—	—	—	—	—	—	—	—	
Colleges of education (6) (Scotland)																												8
For teaching	No.	7	—	—	7	—	—	—	8	1	5	8	2	3	—	—	7	3	—	—	—	—	1	—	—	—	1	
	%	88	—	—	88	—	—	—	100	13	63	100	25	38	—	—	88	38	—	—	—	—	13	—	—	—	13	
For research	No.	—	—	—	1	—	—	—	1	—	—	1	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	
	%	—	—	—	13	—	—	—	13	—	—	13	—	—	—	—	—	13	—	—	—	—	13	—	—	—	—	
All institutions (200)																												1137
For teaching	No.	817	92	28	492	3	11	119	777	104	63	645	321	123	36	20	607	302	17	3	6	47	23	7	73	11	51	
	%	72	8	2	43	—	1	10	68	9	6	57	28	11	3	2	53	27	1	—	—	4	2	—	6	1	4	
For research	No.	121	39	2	336	2	9	39	231	40	7	137	103	55	5	8	626	298	20	4	14	43	20	8	24	—	23	
	%	11	3	—	30	—	—	3	20	4	—	12	9	5	—	—	55	26	2	—	1	4	2	—	2	—	2	

(a) The percentages shown are related in each instance to the number of completed questionnaires shown in the end column.
(b) The figures in brackets show the number of institutions which completed the questionnaire.
(c) Enquiries were made of the following five colleges: Northern Polytechnic, Hendon College of Technology, Huddersfield College of Technology, Croydon Technical College and Nottingham and District Technical College.

Table 3
Utilisation of aids

	No. of institutions or departments using the following aids									
	Epidia-scope	Closed-circuit television	Tape recorder	Language laboratory	Film(1) projector	8 mm loop(2) projector	Slide projector	Overhead projector	Cine camera	Teaching machine
Teaching use										
Average use										
1 or 2 times a term	162	20	101	—	250	8	16	3	77	5
3 to 10 times a term	237	36	90	—	380	19	51	5	67	6
11 to 30 times a term	138	14	76	1	173	11	84	9	23	5
More than 30 times a term	185	9	95	8	117	13	150	13	23	2
More than one of above categories	3	—	1	—	4	—	1	1	—	—
All categories equally	2	—	—	—	—	—	1	—	—	—
Not stated	90	13	129	2	76	12	18	5	112	12
Proportion of teaching staff using the aid										
More than 75%	224	7	51	1	224	13	164	12	34	2
40% to 75%	181	14	94	—	237	11	77	4	27	2
Less than 40%	293	57	228	9	424	29	50	16	120	19
Not stated	119	14	119	1	115	10	30	4	121	7
Aid found most suitable for class										
Under 5 students	11	4	33	—	7	2	7	—	27	3
Of 5 to 20 students	206	23	138	3	154	27	39	4	26	8
Of 21 to 60 students	188	21	56	—	298	8	80	11	33	3
Over 60 students	86	17	17	—	176	5	44	8	15	1
More than one of above categories	80	10	43	—	120	8	31	1	8	—
All categories equally	64	4	30	—	74	2	56	5	16	—
Not stated	182	13	175	8	171	11	64	7	77	15
Research use										
Average use										
1 or 2 times a term	25	6	55	—	86	—	11	1	75	2
3 to 10 times a term	39	12	96	—	92	2	34	3	88	7
11 to 30 times a term	24	9	38	—	46	4	17	1	42	6
More than 30 times a term	12	10	79	9	26	—	26	—	41	5
More than one of above categories	3	—	2	—	4	—	1	—	4	—
All categories equally	—	—	—	—	—	—	—	—	—	—
Not stated	18	2	66	—	56	1	14	—	48	8

(1) Including 8 mm, 16 mm, and 35 mm projectors.
(2) 8 mm Cassette-loaded projector.

Table 4(a)

Institutions or departments using: (a) Closed-circuit television

	Type of institution							
	Universities (Gt. Britain)	Colleges of advanced technology	Institutes and university departments of education	Training colleges	Technical colleges	Central institutions	Colleges of education	All institutions
Number of questionnaires completed	840	75	23	124	27	40	8	1,137
Teaching use								
Number using this aid	63	13	—	2	11	3	—	92
Number who would like this aid	228	27	11	50	4	6	5	331
Average use: 1 or 2 times a term	10	4	—	—	4	2	—	20
3 to 10 times a term	26	5	—	—	4	1	—	36
11 to 30 times a term	10	3	—	1	—	—	—	14
More than 30 times a term	8	1	—	—	—	—	—	9
More than one of above categories	—	—	—	—	—	—	—	—
All categories equally	—	—	—	—	—	—	—	—
Not stated	9	—	—	1	3	—	—	13
Proportion of teaching staff using the aid								
More than 75%	6	—	—	1	—	—	—	7
40% to 75%	14	—	—	—	—	—	—	14
Less than 40%	33	13	—	1	7	3	—	57
Not stated	10	—	—	—	4	—	—	14
Aid found most suitable for:								
Class under 5 students	4	—	—	—	—	—	—	4
Class of 5 to 20 students	10	4	—	2	6	1	—	23
Class of 21 to 60 students	16	4	—	—	—	1	—	21
Audience over 60	12	3	—	—	1	1	—	17
More than one of above categories	8	—	—	—	2	—	—	10
All categories equally	3	1	—	—	—	—	—	4
Not stated	10	1	—	—	2	—	—	13
Research use								
Number using this aid	34	2	—	1	2	—	—	39
Number who would like this aid	101	8	5	24	1	—	—	139
Average use: 1 or 2 times a term	5	1	—	—	—	—	—	6
3 to 10 times a term	9	1	—	—	2	—	—	12
11 to 30 times a term	8	—	—	1	—	—	—	9
More than 30 times a term	10	—	—	—	—	—	—	10
More than one of above categories	—	—	—	—	—	—	—	—
All categories equally	—	—	—	—	—	—	—	—
Not stated	2	—	—	—	—	—	—	2

Table 4(b)
Institutions all departments using: (b) Film projectors (1)

	Type of institution							
	Universities (Gt. Britain)	Colleges of advanced technology	Institutes and university departments of education	Training colleges	Technical colleges	Central institutions	Colleges of education	All institutions
Teaching use								
Number using this aid	667	76	31	143	31	43	9	1,000
Number who would like this aid	194	16	6	37	3	5	—	261
Average use: 1 or 2 times a term	207	12	4	7	6	12	2	250
3 to 10 times a term	271	31	13	39	10	14	2	380
11 to 30 times a term	87	12	9	45	6	13	1	173
More than 30 times a term	41	12	2	46	8	4	4	117
More than one of above categories	4	—	—	—	—	—	—	4
All categories equally	—	—	—	—	—	—	—	—
Not stated	57	9	3	6	1	—	—	76
Proportion of teaching staff using the aid								
More than 75%	154	8	7	24	9	18	4	224
40% to 75%	144	15	8	48	13	7	2	237
Less than 40%	280	49	11	61	6	16	1	424
Not stated	89	4	5	10	3	2	2	115
Aid found most suitable for:								
Class under 5 students	5	—	—	2	—	—	—	7
Class of 5 to 20 students	80	18	3	32	11	8	2	154
Class of 21 to 60 students	207	18	12	36	5	16	4	298
Audience over 60	142	6	4	18	2	4	—	176
More than one of above categories	66	13	3	26	6	4	2	120
All categories equally	47	5	2	9	3	8	—	74
Not stated	120	16	7	20	4	3	1	171
Research use								
Number using this aid	260	18	3	19	3	6	1	310
Number who would like this aid	87	3	1	4	—	2	—	97
Average use: 1 or 2 times a term	76	2	1	4	—	3	—	86
3 to 10 times a term	73	8	1	9	—	1	—	92
11 to 30 times a term	35	6	1	1	3	—	—	46
More than 30 times a term	24	1	—	1	—	—	—	26
More than one of above categories	4	—	—	—	—	—	—	4
All categories equally	—	—	—	—	—	—	—	—
Not stated	48	1	—	4	—	2	1	56

(1) Includes 8 mm, 16 mm and 35 mm projectors.

Table 4(c)

Institutions or departments using: (c) 8 mm cassette-loaded projector

	Type of institution							
	Universities (Gt. Britain)	Colleges of advanced technology	Institutes and university departments of education	Training colleges	Technical colleges	Central institutions	Colleges of education	All institutions
Number of questionnaires completed	840	75	23	124	27	40	8	1,137
Teaching use								
Number using this aid	29	6	8	13	—	2	5	63
Number who would like this aid	47	7	5	32	2	4	1	98
Average use: 1 or 2 times a term	5	1	1	—	—	—	1	8
3 to 10 times a term	7	1	5	5	—	—	1	19
11 to 30 times a term	6	2	—	2	—	1	—	11
More than 30 times a term	7	1	—	2	—	—	3	13
More than one of above categories	—	—	—	—	—	—	—	—
All categories equally	—	—	—	—	—	—	—	—
Not stated	4	1	2	4	—	1	—	12
Proportion of teaching staff using the aid:								
More than 75%	10	—	—	—	—	1	2	13
40% to 75%	3	2	1	4	—	—	1	11
Less than 40%	13	3	5	6	—	—	2	29
Not stated	3	1	2	3	—	1	—	10
Aid found most suitable for:								
Class under 5 students	—	—	1	—	—	1	—	2
Class of 5 to 20 students	8	3	4	8	—	—	4	27
Class of 21 to 60 students	6	—	—	1	—	1	—	8
Audience over 60	4	1	—	—	—	—	—	5
More than one of above categories	3	1	2	1	—	—	1	8
All categories equally	2	—	—	—	—	—	—	2
Not stated	6	1	1	3	—	—	—	11
Research use								
Number using this aid	5	—	—	2	—	—	—	7
Number who would like this aid	10	1	1	7	—	1	—	20
Average use: 1 or 2 times a term	—	—	—	—	—	—	—	—
3 to 10 times a term	1	—	—	1	—	—	—	2
11 to 30 times a term	4	—	—	—	—	—	—	4
More than 30 times a term	—	—	—	—	—	—	—	—
More than one of above categories	—	—	—	—	—	—	—	—
All categories equally	—	—	—	—	—	—	—	—
Not stated	—	—	—	1	—	—	—	1

Table 5
Number of completed questionnaires stating a desire for the following aids

Type and number[a] of institutions		Epidiascope	Closed-circuit television	Tape recorder	Language laboratory	Film projector	8 mm Cassette-loaded projector	Slide projector	Overhead projector	Cine camera	Teaching machine	Number of completed questionnaires
Universities and colleges (25) (Great Britain)	For teaching	49	228	111	13	194	47	10	17	162	99	840
	For research	10	101	101	7	87	10	1	1	166	37	
Colleges of advanced technology (9) (England and Wales)	For teaching	6	27	9	5	16	7	—	4	17	20	75
	For research	—	8	6	2	3	1	—	—	11	10	
Technical colleges (5) [b] (England and Wales)	For teaching	—	4	4	2	3	2	1	2	5	4	27
	For research	—	1	1	—	—	—	—	—	3	4	
Institutes of education and university departments of education (23) (England and Wales)	For teaching	—	11	—	11	6	5	1	1	8	21	23
	For research	—	5	—	5	1	1	—	—	5	10	
Training colleges (124) (England and Wales)	For teaching	2	50	2	16	37	32	—	7	43	73	124
	For research	—	24	2	9	4	7	—	—	13	39	
Central institutions (8) (Scotland)	For teaching	4	6	6	1	5	4	—	1	9	6	40
	For research	—	—	6	—	2	—	1	—	11	—	
Colleges of education (6) (Scotland)	For teaching	—	5	—	1	—	1	—	—	1	1	8
	For research	—	—	—	—	—	—	—	—	—	3	
All institutions (200)	For teaching	61	331	132	49	261	98	12	32	245	224	1137
	For research	10	139	116	23	97	20	2	1	209	103	

[a] The figures in brackets show the numbers of institutions who completed the questionnaire.

[b] A sample only: see footnote [c] to Table 2.

Table 6
Replies to general questions

		Type of institution							
		Universities (Gt. Britain)	Colleges of advanced technology	Institutes and university departments of education	Training colleges	Technical colleges	Central institutions	Colleges of education	All institutions
Is suitable and up-to-date material (e.g. films) available	Yes	527	50	18	100	23	32	8	758
	No	241	19	5	21	3	8	—	297
	Not stated	72	6	—	3	1	—	—	82
Are there problems with regard to: (a) recruiting technicians?	Yes	154	14	7	20	8	13	—	216
	No	561	46	13	83	17	23	8	751
	Not stated	125	15	3	21	2	4	—	170
(b) servicing equipment?	Yes	80	9	3	21	1	2	—	116
	No	636	52	18	101	24	34	8	873
	Not stated	124	14	2	2	2	4	—	148
(c) obtaining projector operators?	Yes	76	7	3	14	1	—	—	101
	No	638	58	17	100	22	36	8	879
	Not stated	126	10	3	10	4	4	—	157
(d) facilities, space, etc.?	Yes	260	41	14	54	11	12	5	397
	No	476	28	7	62	15	28	3	619
	Not stated	104	6	2	8	1	—	—	121
Do you have a group experimenting in new ways of using aids?	Yes	583	57	19	104	17	33	5	818
	No	155	10	3	10	8	4	2	192
	Not stated	102	8	1	10	2	3	1	127
Number of establishments submitting questionnaires		25	9	23	124	5	8	6	200
Number of completed questionnaires		840	75	23	124	27	40	8	1,137

APPENDIX 3

ESTABLISHMENTS VISITED BY THE COMMITTEE

A. *Great Britain*

(i) *Universities*

Birmingham University:
- Department of Education.
- Department of Electrical Engineering.
- Department of Mechanical Engineering.
- Department of Histology.
- Department of Physiology.
- Library.

Cambridge University:
- Department of Engineering.

Edinburgh University:
- Research Film Unit, Department of Animal Genetics.

Glasgow University:
- Dental School.

London University:
- Guy's Hospital Medical School;
  - Department of Biology;
  - Department of Medical Illustration.
- Imperial College of Science and Technology.
- Royal Veterinary College.
- Westminster Hospital Medical School;
  - Department of Medical Illustration.
- Institute of Dermatology.

Manchester College of Science and Technology:
- Department of Physics.
- Department of Modern Languages.

Manchester University:
- Department of Physics.
- Audio-Visual Aids Unit.

Newcastle upon Tyne University:
- Royal Victoria Infirmary.
- Department of Photography.
- School of Dentistry.

Royal College of Science and Technology: Glasgow*
- Television Studio.
- Library.

(ii) *Colleges of Advanced Technology and Central Institutions*

Birmingham C.A.T:
- Department of Physics.
- Audio-Visual Aids unit.

Scottish College of Commerce, Glasgow.

---

* Strathclyde University since August 1964

(iii) *Technical Colleges*

Wandsworth Technical College.

(iv) *Training Colleges*

Avery Hill Training College, London.
Brentwood Training College, Essex.
Bolton Technical Training College.

(v) *Other Institutions*

Mullard Limited.
National Audio-Visual Aids Centre, Educational Foundation for Visual Aids.
Nuffield Foundation Unit for the History of Ideas.
Scottish Film Office.
Thomson Television International Limited.

B. *Overseas*

(i) *Germany*

Institut für den Wissenschaftlichen Film, Göttingen.
Technische Hochschule, Aachen.

(ii) *United States of America*

Washington:
- Walter Reed Army Medical Center.
- National Institute of Health.
- Bethesda Naval Hospital.
- Federal Communications Commission.
- National Educational Association.

Pennsylvania State University.
Boston:
- Educational Services Incorporated, Watertown.
- Massachusetts Institute of Technology.
- Harvard Medical School.
- Harvard University.

New Jersey:
- Bell Telephone Laboratories.

New York:
- Hunter College.
- New York University.
- New York Institute of Technology.
- Fund for the Advancement of Education.

APPENDIX 4

TYPICAL COSTS OF CLOSED-CIRCUIT TELEVISION EQUIPMENT

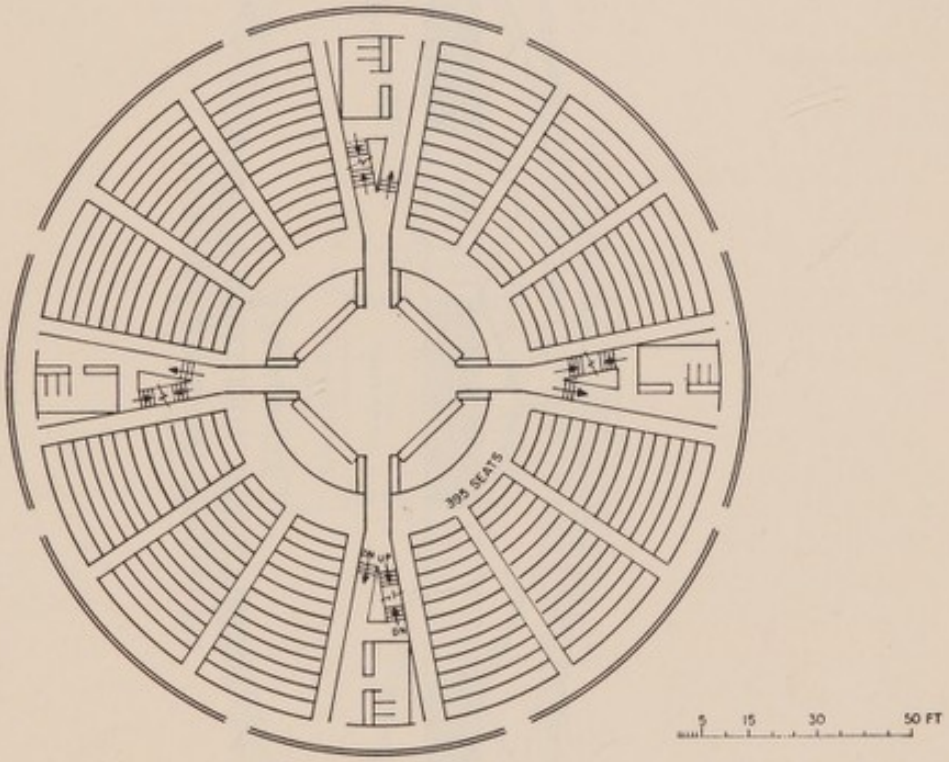
In this Appendix we give an idea of the approximate costs of the major items in a closed-circuit television installation. They should be used only as a very rough guide; actual costs will depend very much on the purposes for which the installation is designed and on the quality of reproduction required.

	£
1. *Camera*	
(a) Industrial type camera with good quality vidicon tube	160
Replacement vidicon tube	50
(b) High definition camera with sensitive vidicon tube	400
Replacement vidicon tube	80
(c) Very high quality camera with viewfinder	1,000 or more
2. *Lenses*	
(a) Fixed focus	20–40
(b) Zoom	80–160
3. *Turret*	
To carry three lenses	35
4. *Remote control*	
(a) For camera focus and/or zoom	20–100
(b) For other facilities	up to 400
5. *Camera tripod*	
With pan and tilt head	20–50
(The range of camera mountings is very wide and the cost can vary greatly)	
6. *Receivers*	
(a) Video monitors	60–150
(b) Television receivers	70–160
7. *Video-tape recorders*	
(a) Broadcast quality	15,000 or more
(b) High quality portable	5,000
(There are lower-priced recorders than these but they suffer from a loss of picture definition and a degree of incompatibility with one another (paras. 324 and 325)).	

8. *Cable*	
Standard co-axial cable	from 1s. 0d. a yard
Coaxial cable plus 4 connectors (camera beam, target and focus, plus signal)	from 2s. 3d. a yard
Cable with 12 conductors (pan, tilt and additional control facilities)	from 3s. 0d. a yard
Cable with 25 conductors	from 15s. 0d. a yard

APPENDIX 5

DRAWINGS OF THE INSTRUCTIONAL AUDITORIUM BUILDING AT PENNSYLVANIA STATE UNIVERSITY (para. 78)



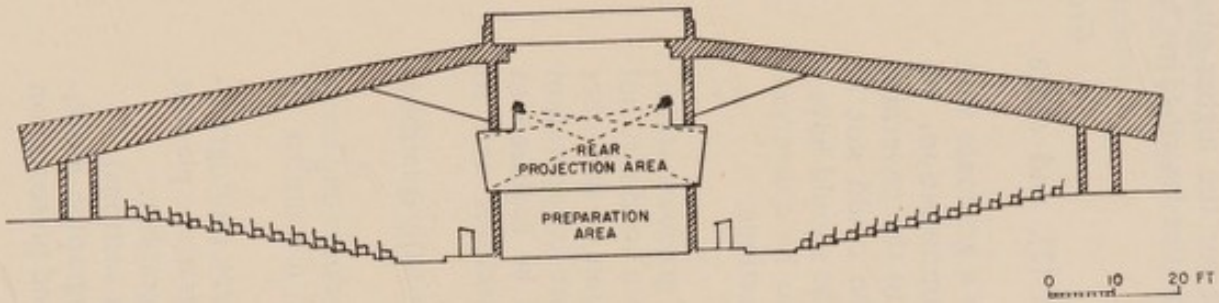
FLOOR PLAN
INSTRUCTIONAL AUDITORIUM BUILDING
THE PENNSYLVANIA STATE UNIVERSITY

0 10 20 FT

ELEVATION

INSTRUCTIONAL AUDITORIUM BUILDING

THE PENNSYLVANIA STATE UNIVERSITY



CROSS SECTION

INSTRUCTIONAL AUDITORIUM BUILDING

THE PENNSYLVANIA STATE UNIVERSITY

APPENDIX 6

STAFF OF THE NATIONAL CENTRE

A suggested staff complement for the higher-education functions of the National Centre, based on the activities described in Chapter 10, is as follows:—

	No. of Staff	
Administration	*Graduate**	*Non-graduate*
Director, administrative officers (2), and office staff (7)	3	7
The Director should ideally be a graduate with experience in audio-visual communication. He would be directly responsible to the governing body of the Centre. While he could not be expert in all audio-visual aids, he should have a sufficient knowledge of them to be conversant with the work of the various sections.		
Heads of sections		
Heads of sections should be of graduate status, not only experienced in their own speciality but also with a sufficient appreciation of the other specialities to be able to ensure co-operation between sections. They would be required to organise the work of their sections and to direct investigations.	8	—
The librarian should be professionally qualified.	1	—
Technical staff		
There should be a number of graduate engineers or experimental officers, with a number of suitably qualified technicians.		
Recording and electronic engineers, photogrammetrist, script writer (film), programme planner (television), and research photographer.	7	—
Artists (graphics and exhibitions sections)	1	4
Instructors (reprography, photography, graphics, cinematography, television and presentation sections)	3	8
Assistant librarians	1	2
Appraisal officer (library)	1	—
Television operators	1	1
Technicians	—	16
Photographers and cinematographers	—	13
C/F	26	51

* or graduate status.

	B/F	26	51
Office staff (*in the sections*)			
Secretaries		—	5
Typists		—	9
Clerical staff		—	4
Other staff			
Draughtsmen		—	3
Electrician and carpenter		—	2
Machine operators and printers		—	9
Storekeepers and packers		—	10
		26	93

APPENDIX 7

STAFFING DETAILS OF TWO EXISTING CENTRAL UNITS
(para. 472)

A. *A central unit which serves a civic university of approximately* 5,000 *students*

Director	1
Photography and television	
Departmental assistant	1
Television assistant	1
Medical artist	1
Technicians	9
Laboratory assistants	7
Secretaries (2 part-time)	4
Printing	
Manager	1
Technicians	8
Laboratory Assistants	3
Secretaries	2
Total staff	38

The cost today of equipping this Department would be approximately £25,000.

B. *A central unit which serves a London medical school of just over* 1,000 *students*

Photographer to Medical School	1
Senior medical photographer	1
Photographer	1
Photographic printer	1
Projectionist	1
Assistant (part-time)	1
Medical illustrators (one part-time)	3
Secretaries (one part-time)	2
Total staff	11

The cost today of equipping this Department would be approximately £8,000.

APPENDIX 8

THE DESIGN OF ACCOMMODATION REQUIRED FOR THE USE OF AUDIO-VISUAL AIDS

1. Few institutions of higher education have been planned for the effective use of audio-visual aids. In older buildings particularly a large-scale use of audio-visual apparatus is often inhibited by the difficulties of bringing it easily into action. The introduction of closed-circuit television frequently involves the *ad hoc* provision of coaxial cable connections, installed, all too obviously, as an afterthought. Whilst such improvisation is necessary in old accommodation, it will be inexcusable if a comparable situation were to develop in buildings which are being erected now. New university and college buildings should incorporate an ample provision of electrical power for the educational technology of today, and they should be sufficiently flexible in structure to cope with the possible developments of tomorrow.

Cabling

2. The first essential is a suitable arrangement of electrical supplies. All lecture rooms should have a sufficient number of socket outlets to provide for the use of a variety of aids, in addition to whatever is needed for demonstration apparatus. Sockets should be located so as to avoid long trailing leads. Outlet points should be provided for both front and back projection and in a position convenient for overhead projection. Sockets should be of the same type, so that equipment can be moved from room to room without the need to change connectors. Projectors and receivers should be provided with fused plugs, the fuses being of suitable ratings.

3. New lecture theatres and lecture rooms should be planned for the present or future use of open-circuit or closed-circuit television (or both). All rooms should therefore be linked by coaxial cable in such a way that the cable can readily be brought to a connector panel when television is required in a particular room. For *octv* it would be necessary to connect to a receiving aerial system or to the distribution panel of a pre-amplifier system.

4. Since it is impossible to predict with accuracy the future development of audio-visual methods, it is most important that both the electrical supplies and the television coaxial cabling should be installed in a manner which gives a high degree of flexibility. This can readily be achieved by using trunking, either under floors, or along walls. It can also be placed above false ceilings in rooms or corridors, using acoustic tiling which can readily be removed. Wiring installed in the cavity can thus be easily modified to provide the required service at the desired points in the room. Vertical ducts which are similarly accessible will also be required.

Lighting

5. Whilst lighting must obviously be so planned as to conform to the recommended standards of light intensity on writing surfaces, there is the additional problem of providing it in such a way as to minimise reflections on television receivers and picture screens. It is important also that pendant lighting

should not be in the projection path between projector and screen. This may appear to be a glimpse of the obvious, but unfortunately there are many examples of this defect which involves raising lights to unusual working positions. This, in turn, restricts room planning and affects lighting conditions at working-surface level. These problems are often best solved by using light fittings flush-mounted to the ceiling, with arrangements for directing the light so that it is evenly distributed without falling directly on to viewing screens.

6. It is often desirable—and in major lecture theatres essential—to provide for light control at the lectern. When forward projection is used it is usually necessary to limit external lighting by an efficient black-out. Where large theatres are to be used primarily for formal lectures the black-out problem can be eliminated by a design of theatre which has no windows.

Ventilation and air-conditioning

7. As well as in such theatres, the widespread use of audio-visual aids, with their attendant need for black-out arrangements, may necessitate air-conditioning in smaller lecture rooms. Although this may not always be easy, care should be taken to ensure adequate ventilation and the architect should be fully briefed.

Programmed instruction

8. As far as we are aware, no accommodation has been specifically designed in Great Britain with the use of programmed instruction in mind. Fortunately, (as far as the structure of centres of higher education is concerned) it does not appear that its introduction would involve any major or difficult planning considerations. Figure 1 indicates a possible arrangement for a subject with which laboratory work is associated.

9. As students at the carrels finish a machine assignment, they move to desks in the centre of the room, to work at the written exercises which may succeed the programme and the teacher spends much time with them during this phase. The programme might require the students to move to the laboratory to do relevant practical work, which is also programmed. The rooms should be 'en suite' so that the teacher can move easily between the 'machine-tutorial' rooms and the laboratory. Unless—as in certain engineering laboratories—the incidence of noise makes them essential, there need be no dividing walls between the three rooms. If some form of barrier between the rooms is necessary as a security precaution it could perhaps be of expanded metal, or made partly of glass.

Room shapes

10. It is generally agreed that, if there is a major development in the use of programmed instruction in higher education, there will still be a very important place for group teaching. There is therefore the need to consider whether the rectangular shaped room shown in Fig. 1 is the most functional one; or whether, on the assumption that much more use will be made of audio-visual aids, some other shape might not be better.

11. Figure 2 shows a screen of width W, for showing slides or film. There is general agreement that, to avoid undue strain, the minimum viewing distance is 2W, and the maximum is 6W. The maximum viewing angle (relative to the

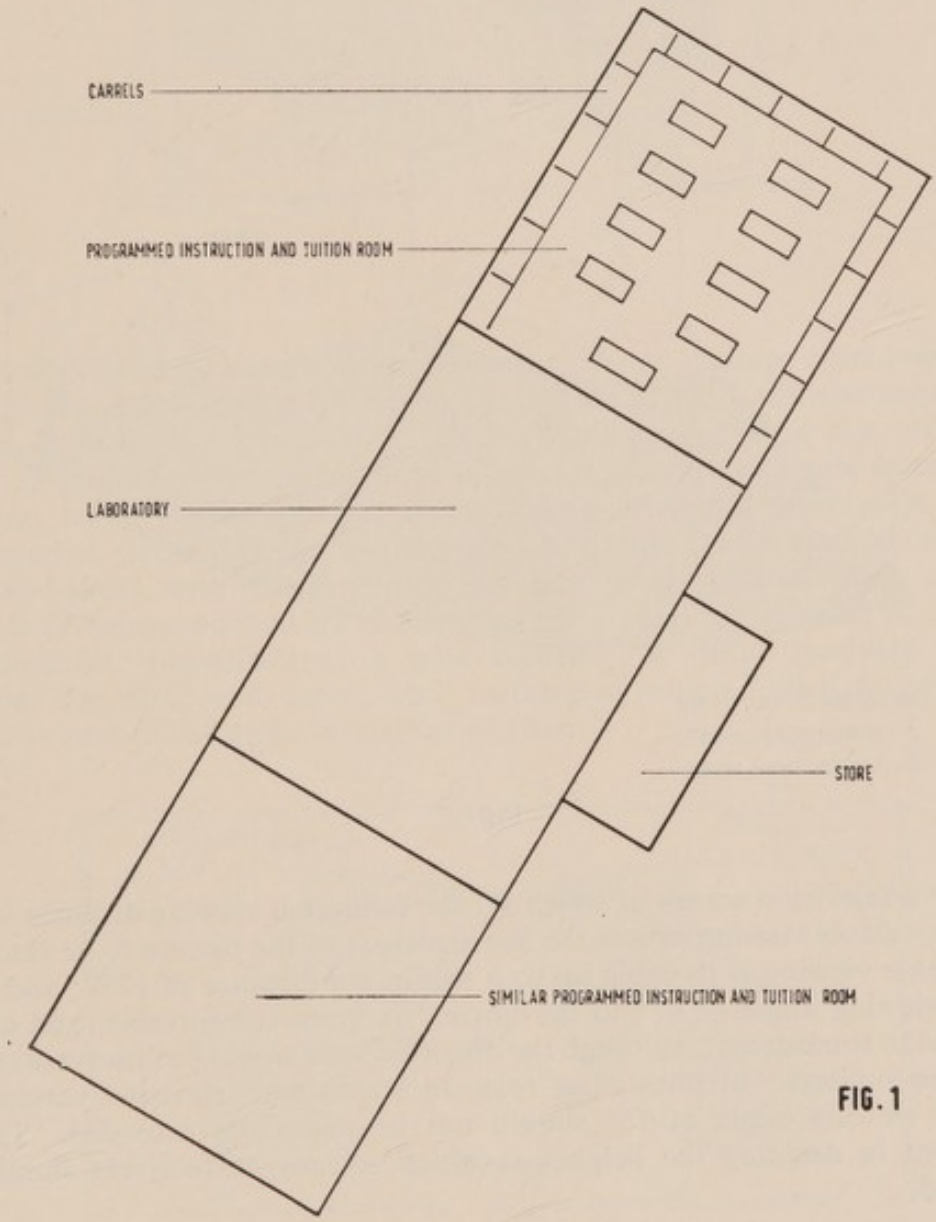

CARRELS
PROGRAMMED INSTRUCTION AND TUITION ROOM
LABORATORY
STORE
SIMILAR PROGRAMMED INSTRUCTION AND TUITION ROOM

FIG. 1

vertical plane normal to the screen) depends somewhat upon the material being viewed, and upon whether the screen is matt or beaded; but 45° is a good working figure.

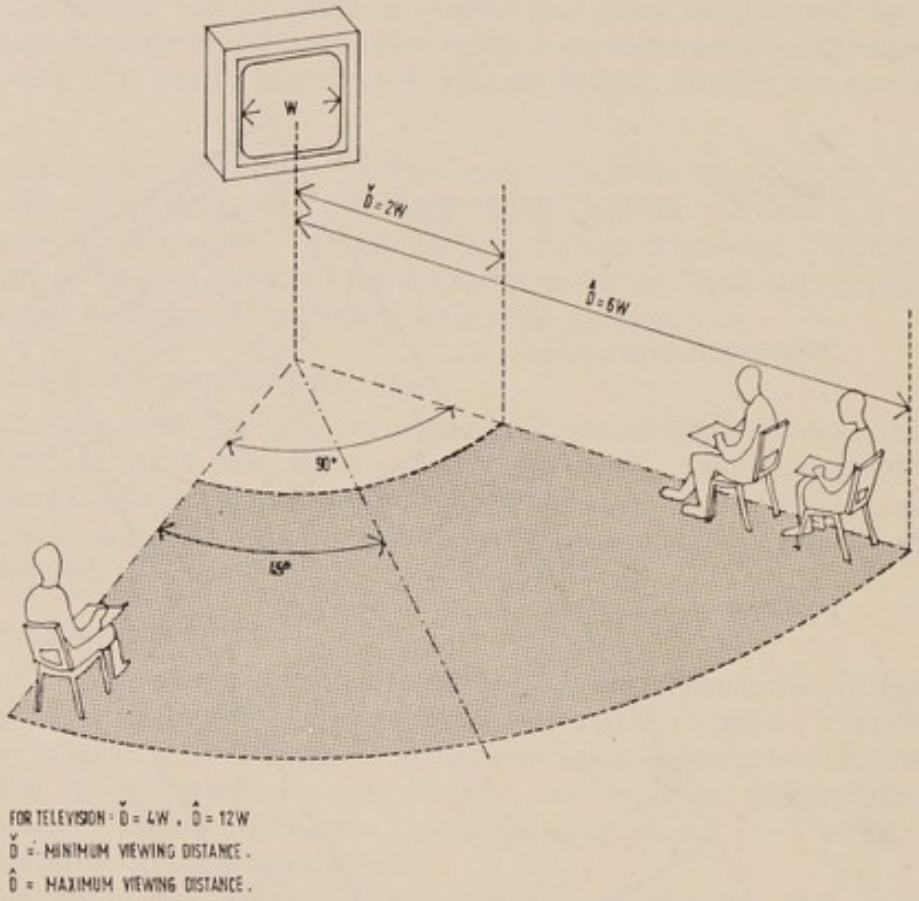


FIG. 2.

12. For a television screen of width W, the minimum viewing distance is 4W, since any closer viewing causes the line structure of the picture to be resolved. Acceptable viewing is possible up to a maximum distance of 12W; and here, too, a viewing angle of 45° to the normal is quite comfortable, and can be exceeded to some extent, although the distorted view would be disadvantageous for some subjects. In both cases (picture screen and television screen), an upward viewing angle of 15° should not be materially exceeded. This is important in deciding the heights at which screens or receivers should be mounted.

13. It will be seen that for the two cases, there is a very convenient relationship between the figures quoted for viewing distances. For example, in the case of a room equipped with a television screen 24 inches wide, and with a film screen four feet wide, the minimum distance is eight feet, and the maximum 24 feet, in both cases. In such a room, the viewing area (shown shaded) would accommodate about 30 students using tablet-chairs (i.e., chairs with an arm, perhaps swivelled, suitable for note taking), or 24 students with separate writing tables and chairs, but it need not be rectangular.

14. Figure 3 shows an arrangement of two adjacent lecture rooms between

two parallel walls, the desirable shape being achieved by making the other walls non-parallel. (The rooms here are arranged for back projection.)

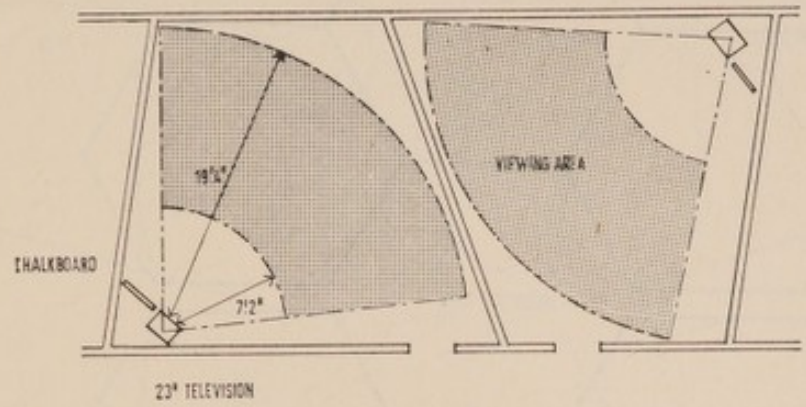


FIG. 3.

15. Figure 4 shows a somewhat similar arrangement, perhaps more acceptable to architects and builders, for whom parallel walls and walls meeting at right angles, have certain advantages. Here the triangular area can provide a common projection room (for front projection). In the example from which this was taken the installation at the lectern area was unusual in that it embodied a screen (S) for an overhead projector (O.P.) and another for films and slides, with remote control for slide changing; a television monitor capable of being switched from reception of an *octv* transmission to internal closed-circuit transmissions; a tape recorder; a radio receiver; storage facilities for films and tapes; and chalkboard which folded to cover the whole or part of the audio-visual installation.

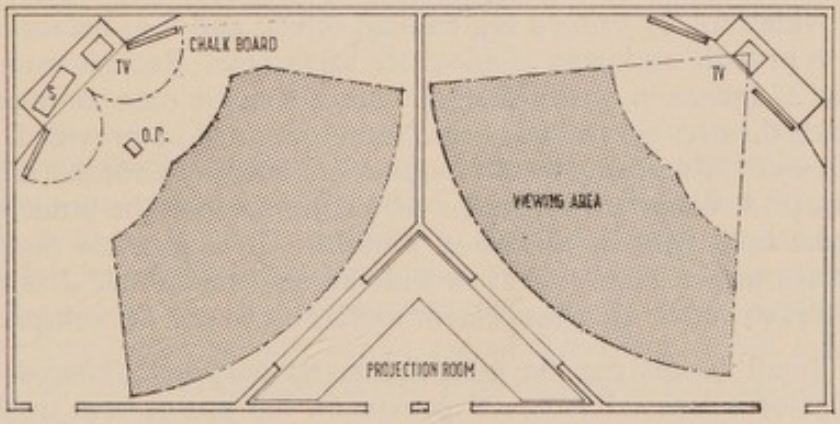


FIG. 4.

16. The useful parts of the lecture rooms shown in Fig. 4 lead to the idea of the hexagon as a good functional shape and to the concept of a teaching block of the shape shown in Fig. 5. Here, the hexagonal area in the centre could serve as a common projection room. Whilst we know that such arrangements are planned, we have not seen a building of this type. A similar arrangement exists in Milan, where wedge-shaped rooms radiate from the central vertical axis of a cylindrical tower.

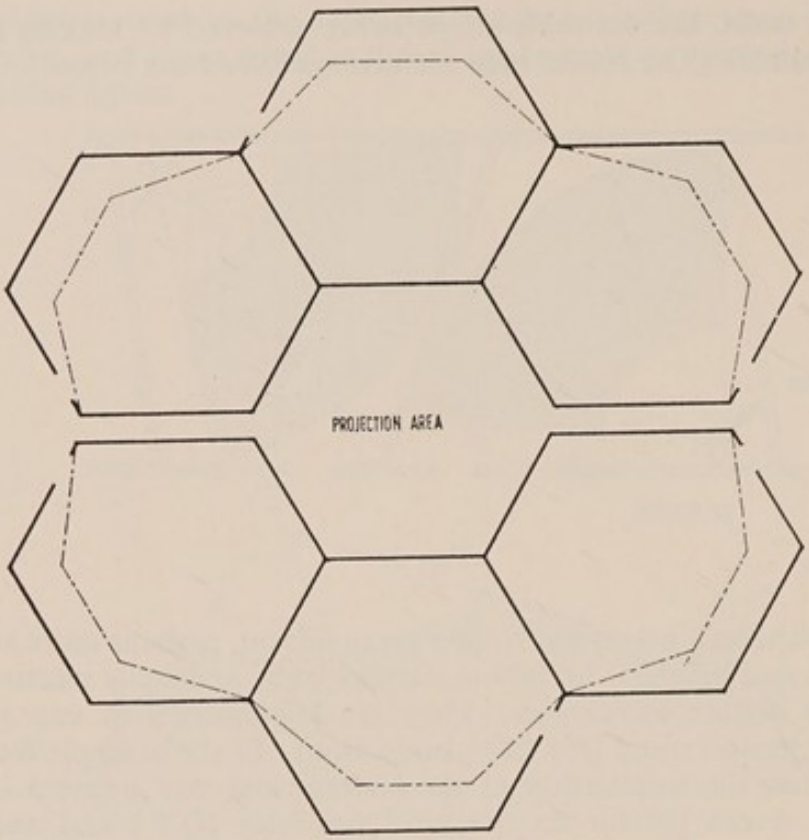


FIG. 5.

Large lecture theatres

17. In the designing of large lecture theatres where it is planned to use audio-visual aids, a special problem arises. Provided that projection rooms are well designed, there is no difficulty with film or slides, since the large student-area can be provided for by using a big enough screen and a projector sufficiently powerful to provide an image of adequate brightness. But television receivers larger than 27 inches in screen-diagonal are not made on a commercial basis. Thus in such theatres several television monitors must be provided. A lecture room for about 150 students would require four monitors but this is distracting for students. A better arrangement would be to seat the students in four small rooms each with its television monitor. It is possible that television projection for larger lecture theatres will shortly be available at a reasonable price and this would be an arrangement preferable to one of multiple monitors.

18. Since small rooms can be used for many purposes, whereas the large theatre is often a 'special purpose' provision, the use of *cctv* in this way is an attractive proposition. It can enable a reduction to be made in the total provision of large lecture theatres in a university or college: a commendable economy, since the usage factor of these theatres is generally small. The proper solution to the problem of the large lecture theatre should be sought by minimising their number and maximising their use. This would result in the right provision and distribution of lecture theatres for an institution rather than for a faculty or department. For example, when a theatre is required for lectures in two different subjects, one immediately following the other, any necessary preparation for the second lecture could be done with an arrangement such as that given in Fig. 6. This shows a lecture theatre with a rotatable

stage, which enables the demonstrations for a second lecture to be prepared while the first lecture is in progress.

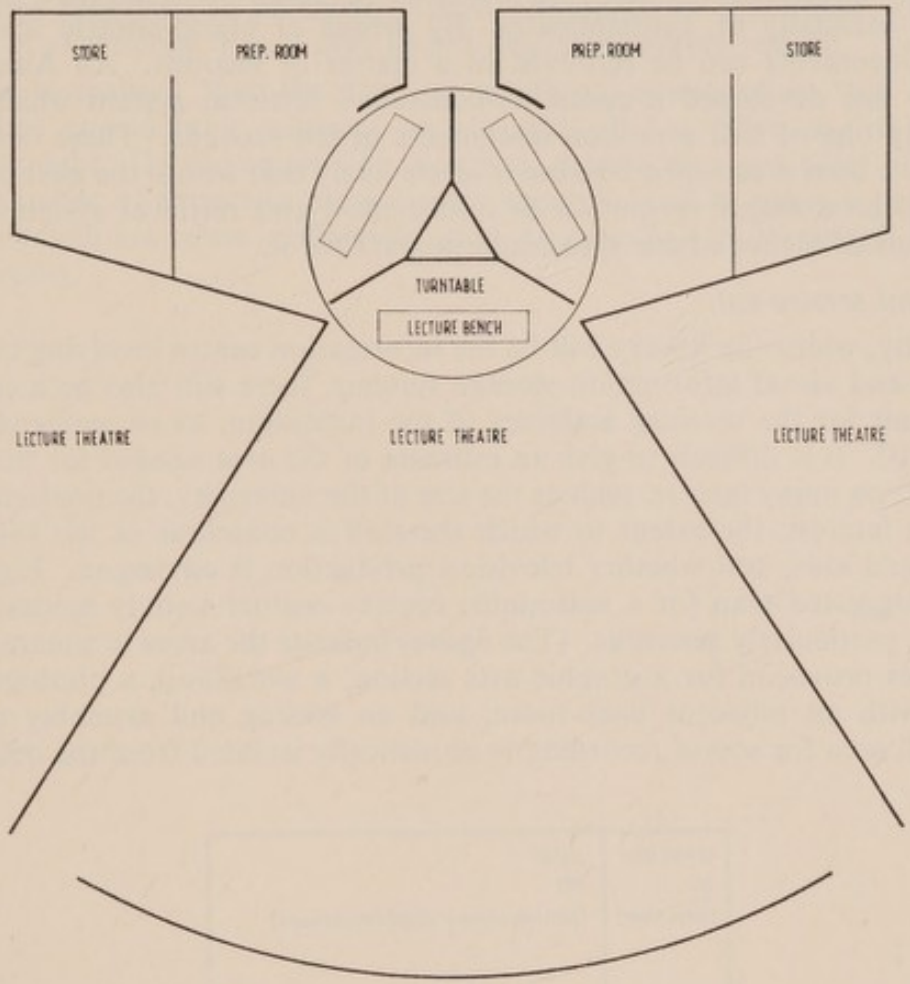


FIG. 6.

The library

19. The library is the institution's information centre and information should be stored there on tape, film and microfilm as well as on the printed page. Although such libraries are as yet few in number, some do exist and the students are fairly accustomed to using microfilm readers. The advantages of storing on microfilm are so obvious and the rate of book publication so considerable that future growth in the use of microfilm would seem to be inevitable. New libraries should therefore be designed, with carrels suitably wired for microfilm readers.

20. It is perhaps not too fanciful to look a little further ahead as far as the photographic storage of information is concerned. One large firm of outfitters in this country has transferred the accounts of all its customers—some 2,500,000 documents—on to 16 mm microfilm. This has not only enabled the records to be kept in one filing cabinet, but has allowed seven and a half tons of paper to be discarded. It is estimated that all the information in a good-sized university could be compressed, by the use of microfilm, into the space of two cubic yards.

21. Such compression brings in its wake a formidable information-retrieval

problem. But microfilm can now be readily stored in accessible ways. One possibility is the aperture card, on which a film frame is held on a standard 80–column punched card carrying indexed information. The card can be retrieved manually or automatically. By means of photo-electric scanning devices documents can be retrieved in a matter of seconds. An American company has developed a computer-controlled retrieval system which will locate any one of half a million documents in ten seconds. These developments have been mentioned because it seems likely that within the next decade there will be a major revolution in information and retrieval systems, and institutions of higher education should prepare for it.

The central service unit

22. Finally, whilst the library will be the information centre involving the use of audio and visual information-storage systems, there will also be a central service unit for the *teaching* activities of the institution, as recommended in Chapter 10. It is difficult to give an estimate of the area needed for this, for it depends on many factors, such as the size of the university, the predominant academic interest, the extent to which the staff is conscious of the value of audio-visual aids, and whether television production is envisaged. Figure 7 gives a suggested plan for a reasonable centre—neither unduly modest nor, certainly, particularly generous. (The figures indicate the areas in square feet.) It includes provision for a graphic arts section, a workshop, a photography section with an adjacent dark-room, and an editing and assembly room. The small area for sound recording is acoustically isolated from the office by

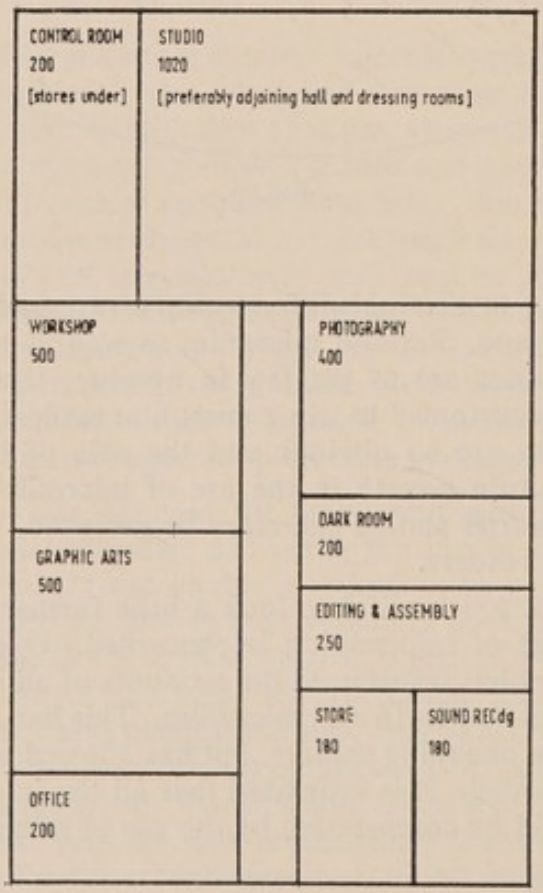


FIG. 7.

the store. Whilst provision is made for actual television production, the area is relatively small. It must be emphasised here that there is far too little experience at present of the precise needs of a university audio-visual centre for firm proposals to be made. There is the need to experiment and, in the light of experience, Fig. 7 may have to be considerably revised.

23. It is realised that the kind of provision envisaged in this Appendix involves considerable expense, and finance all too often is the enemy of forethought. On the credit side, however, there is the possibility of reducing the number of expensive large lecture theatres, and of other large teaching areas which are often inefficiently used, as described in paragraph 18 of this Appendix.

Printed in England for Her Majesty's Stationery Office, by
J. W. Arrowsmith Ltd., Bristol 3.

Dd. 120700. K.48.

Published by

HER MAJESTY'S STATIONERY OFFICE

To be purchased from

York House, Kingsway, London w.c.2
423 Oxford Street, London w.1
13A Castle Street, Edinburgh 2
109 St. Mary Street, Cardiff
39 King Street, Manchester 2
50 Fairfax Street, Bristol 1
35 Smallbrook, Ringway, Birmingham 5
80 Chichester Street, Belfast 1
or through any bookseller

S.O. Code No. 27-383