Mathematics education through broadcasting

MATHEMATICS EDUCATION

THROUGH BROADCASTING

by

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A dissertation submitted in partial fulfilment
of the requirements for the award of the degree
of M. Sc in Mathematical Education at the
Loughborough University of Technology, January 1986.

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I would like to thank my wife and family for their patience during the writing of this dissertation, and my supervisor for the help he has given. I am grateful to the following people who have sent me leaflets or unpublished papers:

Eileen Allen and David Lee of the IBA
Ruth Ballin of the BBC Educational Broadcasting Services
Janice Dicks and Rod Smith of the BBC School Broadcasting Council
Ann Garfield of the University of Liverpool
Mary Hunter of Yorkshire Television
J. F. Murray of the Scottish Council for Educational Technology
Brian Nixon of Granada Television
Ted St. George of Central Independent Television
Naomi Sargent of Channel Four Television and
Sheena Young of Grampian Television

I declare that this dissertation is entirely my own work.

ABSTRACT

Over the last thirty years or more, contributions have been made to mathematics education by the broadcasting authorities in the United Kingdom, and indeed throughout the whole world. What can broadcasts do that other more intimate forms of instruction cannot? If broadcasts have a value in the mathematics classroom, is it recognised by the classroom teacher? This dissertation examines these and other issues, especially in the light of the recent development of the video cassette recorder which has made the use of television in schools much easier.

The problems associated with using broadcasts are described in a report on the introduction of mathematics series to the curriculum of one particular secondary school.

This dissertation also describes a small survey into the use of television and radio in the mathematics departments of secondary schools of one education authority. An attempt is made to find out what and how broadcasts are used and what influences that use. In this authority the number of programmes used seem to be higher than that estimated nationally by the annual survey of the BBC's Educational Broadcasting Services. Whether this difference is real or only due to the different wording of the questionnaires used in the two surveys cannot be determined with any confidence without further work.

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1. Three Questions

Why use broadcasting?

Right from the very beginning of radio and television, continuous developments in the field of electronics have been changing the whole nature of broadcasting; but no changes have been so rapid as those of the last twenty years. In this period of time we have seen the introduction of: the radio cassette recorder, local radio stations, VHF stereo radio, colour television, satellite links, the video cassette recorder, electronic news gathering, viewdata (Ceefax and Oracle), the video disc, breakfast and cable television, the Open University, and Channel 4. All these changes have gone towards increasing the quality and variety of broadcasting to such an extent that it now plays a much greater part in our lives. It's success as an entertainment medium can be seen in many ways, one being the closing down of local cinemas. This effect has magnified in recent years with the popularity of the domestic video cassette recorder (VCR) and the availability of films for hire. As a source of information and education the printed word: newspapers, magazines and books now faces strong competition from news reviews, documentaries, and breakfast television. In the field of radio we have seen national radio increasing to four services, most now being found on the high quality FM stereo wavebands, and the network of local radio stations is continually being expanded to provide a more individual service to the local community.

In the light of this increasing influence of broadcasting on our lives and on the lives of our children, should we not seriously consider the role it can play as part of the educational process within our schools? Of course school broadcasting is nothing new - there is probably not one school in the country which has not used radio or television at some time during the academic year, - but is the potential of broadcasting as an educational resource in schools fully realised?

It was with this question in mind that the BBC's Schools Broadcasting Council and the IBA's Educational Advisory Council set up a project in 1972 to study and evaluate the use of broadcasts in schools. 57 local authorities and 118 schools were asked to give particular attention to the use of the resource, and to carry out some form of self evaluation. The project was successful in one way at least, as C. G. Hayter (1974) wrote in his report:

"The value of broadcasts has been fully and progressively recognised by teachers during the course of the project. Their potential contribution in the classroom, and to curricular developments in the school, is most

effectively realised when the skill of the teacher is purposefully committed to their use . . . . "

A few years earlier the DES report 74 (1972) entitled 'The Use of Broadcasts in Schools' based on a survey by her Majesty's Inspectorate stated these points:

(i) the education given in schools would gain considerably from the more effective use of broadcasts,

(ii) there were difficulties in planning for the use of broadcasts within the syllabuses and within the timetable,

(iii) and that the supply of equipment limited its use in many areas of the school.

At the time of this report the use of radio broadcasts was familiar to the primary schools - they could easily arrange their fairly flexible timetables to fit in with the transmission times. Larger schools which could afford a colour television could use it in the same way, but with a smaller audience. In the secondary schools, timetables were fixed well in advance and there were enough constraints put on this by the availability of staff and rooms without a Mr. Jones wanting to show 'Secondary Mathematics' to form1A from 10.28 to 10.48 every Tuesday! Although there may have been one or even two television sets in their school most teachers felt that schools programmes were, to all intents and purposes, unavailable to them as a teaching aid.

Ten years ago things were beginning to improve as by then most secondary schools had a video tape recorder. But there werestill problems; its use was fairly complicated and it was necessary for a 'resources specialist' to learn how to record the right programme at the right time; and its use had to be booked - every half hour programme needs half an hour to show to a class and half an hour to record beforehand. Only the most determined teacher would make use of a whole television series!

But in the last few years we have seen a major change. The video cassette recorder (VCR) has been developed and is now a standard piece of furniture in very many homes. Its price is low enough for almost every school department to buy one. While inflation has rocketed the price of colour televisions has stayed at about the same level, even a 40 inch screen receiver for use with large audiences is not outside the limit of school finances. Statistics from the Educational Broadcasting Council analysed by Bates (1984, p 34) reported that over the period 1978 to 1982 the proportion of secondary schools having VCR's increased from 70% to 96%. During the same period the proportion of schools

using BBC television increased from 78% to 90% and using ITV series from 58% to 80%. More recent figures availablefrom the EBC in their 'Survey of Listening and Viewing in UK schools for 1983-84' show that although the number of schools using schools television has changed little, the proportion of secondary schools possessing at least one VCR has increased to 99%. In fact the average number of VCR's in the summer term of 1984 was 3 per secondary school.

The problems of timetable organisation are now disappearing. The VCR and colour televisions are more accessible to the classroom teacher and a combination of better design and greater familiarity has made them easier to use. Television as a major teaching resource in the classroom should now "take off"! But will it? If it does not, it will be because of a lack of enthusiasm by the teachers or their failure to accept the value of such a resource. There may be a need for teachers to be educated themselves to be shown what broadcasting can do, and to be taught how to use it. Over twenty years ago, Robert M. Diamond (1964, p 204) summed up the situation completely. If anything his statement is more relevant today than when it was written:

"Research has shown that the attitude of the classroom teacher plays a substantial role in the final success of any television teacher. A television lesson viewed by the class of a teacher who is resistant toward television has little chance of being effective. It is apparent that we must not only inform our teachers of the potentials of television but that we must also help them develop a positive attitude towards exploring the use of the medium within their own classrooms."

Attempting to discover the influences which govern the use of broadcasting in the mathematics classroom, such as teacher attitudes and recording facilities, was one reason for the setting up of a small research study enquiring into the secondary mathematics departments of a local authority. The findings are discussed in a later chapter of this dissertation.

What has broadcasting to offer?

In order to answer that question we must at some stage separate radio from television. The two media are obviously connected in the technical aspects of production and transmission, but in terms of the aims, production, and use of educational programmes, they are quite different. Television, stimulating two of our senses is generally the more powerful, however, radio has the advantage in some curriculum areas where the visual image is required to be left to the pupils imagination.

Both, have the capacity to distribute knowledge and experience to

very large audiences. If required, using booster transmitters and satellite links, there is no limit to the audience size - as demonstrated by events such as Royal Weddings and World Cup Finals. On a per-capita basis costs are therefore very low. On a smaller scale, in higher education closed circuit television is sometimes used to enable one lecture to be seen and heard by hundreds of students either by transmitting 'live' to different rooms throughout the establishment or by recording and showing to different audiences at a later time. Using the same technical advantages broadcasting can be used for distance learning, where for geographical reasons the audience is spread out and perhaps sufficiently isolated to make normal schooling impossible. In this country, apart from at the Open University, distance learning is of no particular importance to educational programmes, but in many parts of the world it is the prime reason for their existence. In Australia for example the responsibility for the education of children on outback sheepstations lies squarely on the shoulders of the radio and television authorities.

Television has the advantage over radio of visualisation. Through this medium pupils can be exposed to many kinds of visual stimuli - film, cartoon, photographs, drawings, animation as well as the electronic wizardry that has made television itself into an art form. The techniques used in scientific research are also available as educational aids - slow motion filming, infra red photograph and time-lapse techniques. As a teaching aid all these visual experiences enhance the understanding and interest of the subject. The television camera has been used both for entertainment and educational reasons as a 'hidden eye'. The recent BBC 'fly on the wall' productions have been very successful where unobtrusive observation is necessary. The same technique used to record and broadcast the play of a tennis match where the camera often sees more than the umpire, is used in medical schools to record the intricacies of a delicate operation and to transmit the picture using closed circuit television to a roomful of students. A. Hancock (1971, pp 40 - 47) describes how television is used in a similar way in some American teacher training colleges to record the actions of both teachers and pupils in the classroom. This can obviously help the teacher and his colleagues to improve their lessons and learn by their mistakes.

Radio, on the other hand, offers opportunity for pupils to practice listening skills. In a similar way to reading a book, without a visual image the scene has to be pictured in the mind, developing the child's imagination. Radio is useful in teaching foreign languages; the presenter speaking in his native tongue is obviously preferable to the

classroom teacher with his natural English accent. The visual image of television can be a disadvantage in the field of education according to R. W. Jones (1975) of Radio Merseyside:

"The moving picture certainly achieves a seeming reality, but this reality, as with any medium is selective according to the taste and programme judgement of the producer. There is a danger therefore on over exposure to the purely audio-visual media may dull the mind into a non-discriminating acceptance of what is being communicated. Often it is likely that an educational programme may be judged in the minds of young viewers, with the same conditional attitudes as that operating when they enjoy light entertainment."

Local radio has a lot to offer in the education of the local community, according to Angie Mason of the IBA (1984). She points out five areas in which the new local radio stations are assisting the local schools:

Transition Education - the problems of leaving school, where to go, local opportunities.

Education for International Understanding - links with twinned communities abroad.

Political Understanding - democratic structures at the local level, local politics.

Uses of the new technology - quizzes, competitions and phone-ins helping to educate young people about information technology.

Local history and culture - local people, places and events.

As local radio is finding its feet, it is continually exploring new ways in which to create an alternative service to national radio, and education seems to be playing a major role in this development. The interesting work of several local stations in the field of mathematical education is described later in this work.

Radiovision is an important variation on sound broadcasting, linking radio to a visual image in the form of a filmstrip. It has been a form of resource material since the early days of schools radio. One teacher comment from the BBC/ITV study described earlier (C. G. Hayter, 1974) is worth noting:

"Interest and enthusiasm in group work are easier to stimulate and hold when more than one sense is being employed at the same time. Radiovision is the most pliable transmitted resource in the hands of the teacher". It is also of course a very cheap resource and probably for that reason is used in many primary schools without a VCR. The filmstrips

however do have to be purchased and there is a practical problem of recording as radio cassette recorders do not seem to be easily available with automatic timers to control their operation - a feature which is available on almost all VCR's.

Broadcasting in general has the advantage that resources are centralised. Broadcasting stations can buy or make expensive models or use expensive equipment to help demonstrate a particular point, which could never have been able to be bought by individual schools. Similarly, production teams can tour the world to bring back pictures of particular places. One only has to see the techniques used in the 'Tomorrows World" programme or the pictures and places shown in David Attenborough's "Life on Earth" to realise that as an educational tool there really is no competition! Broadcasting has the potential to cross the frontiers of time as well as space. BBC radio has recently broadcast old archive recordings of conversations and interviews showing public reaction to certain events in the past as they happened. These insights into our past society have obvious educational value.

The high standards of broadcasting which children are used to at home in terms of technical quality and interest do however mean that they are reluctant to accept anything less from programmes used at school. Broadcasting companies are reluctant to spend as much on each hour of school programmes as they do on peak time evening shows, which have greater potential audiences and can command more money from overseas sales. However they must be careful not to lower their standards. Robin Moss (1983, p 35) seems to think they have done so. He says: "Traditionally, audiences for educational programmes are relatively small, which implies that their budgets are inferior to those for entertainment, and that a career in this area is rarely the prime objective of an aspiring producer or dierector. As a result educational broadcasting is traditionally duller than programmes transmitted for larger audiences at peak viewing or listening periods".

Educational Broadcasting has its disadvantages and limitations. One would be that the television cannot answer back. There is only a one way communication link and therefore the degree of contact between pupil and teacher is limited. There is no check on understanding as the presenter cannot question his audience, nor they him. Another problem is that the programme is designed for the average child in the group; it cannot vary in speed or depth to cater for the whole range of ability found in the classroom. The best it can do is for the programme

to be made very short or divided into sections so that the classroom teacher may stop the tape and discuss points with the class before continuing. Producers and their educational advisers have begun to realise these problems and have tried to solve them. One solution may be to abandon the teacher/presenter style altogether and to use more visual material such as animation or computer graphics, as an additional resource for the classroom teacher, not as his replacement.

How successfully can broadcasting educate?

The influence of radio and television in today's society is just one of many contributing factors which determine our knowledge, beliefs, values and attitudes. There are three major areas which concern researchers working in this field: the effects of advertising, the possible damage from sex and violence on the screen, how well radio and television can educate. There is general consternation especially from parents with regard to their children about the harmful effects in the first two areas, and more research has been done here than in the educational field.

How well can radio and television educate? Anthony Bates (1984, p 12) writes:

"Broadcasting has been used for a wide variety of educational purposes. It has been used to reduce illiteracy, poverty and disease, for national recovery, to create a sense of national identity, and to educate those who otherwise would have received no education at all. It is important then to evaluate its success".

The amount of published research into the evaluation of British educational broadcasting has been very small, especially considering the size of the financial resources spent on productions. However the BBC and IBA considered it important enough in 1978 to send representatives to a seminar to exchange views, methods, and experiences of programme evaluation. Bates and Gallagher (1978, p 8) in their report of that conference describe three types of evaluation in common use:

> Piloting, which is the making of a programme or part of a programme and showing it to 'experts' (teachers or broadcasters, not necessarily both) for their comments.
>
> Pre-testing or developmental testing which is the showing of programmes in draft or finished form to representatives of the intended audience; and finally:
>
> Formative Evaluation which is much broader and may contain a range of techniques including applying research from similar programmes or from previous series to new productions.

One programme - making organisation in America which has carried

out considerable evaluation of its work along the lines described above, is the Childrens Television Workshop (CTW) which produced the very successful (financially and educationally) 'Sesame Street' programmes for the pre-school child. A more detailed account of its work is described elsewhere (Lesser (1974)), but briefly for the first series of Sesame Street, CTW held extensive pre-programme planning sessions between producers, advisers, researchers and educationalists; and programme segments were pre-tested on the target audience for 18 months prior to broadcasting. The impact of the first year of the series was tested by the Educational Testing Service on 943 children, 731 of whom were classed as 'disadvantaged'. Two tests were carried out, one before and one after the series. The gain in scores between the two were found to be directly related to the amount of viewing, younger children achieving the largest gain. In the second year test sights were chosen where Sesame Street was broadcast via cable television, non cable residents being used as controls. The previous years findings of high educational impact were supported.

One educational body in this country which has spent some time on research is the Open University. Described as the largest multimedia educational establishment in the world, it relies heavily on instruction through broadcasting. However its research tended to concentrate on how best to use broadcasts, not whether this method of teaching is better than any other. Its methods, using case studies and student responses are described by Bates (1983, pp 57 - 77). From these it was able to draw conclusions about the transmission times, the integration of broadcasts with texts, the relevance of the programmes, and the usefulness of the associated notes. In general, research findings did suggest that broadcasting does have an important role in assisting adult learning at the Open University.

The evaluation carried out by broadcasting companies and the O.U. do tend to be restricted to the success or failure of particular series and they seem to accept the fact that radio and television have more to offer than other learning methods. The job of evaluating educational broadcasting in general has tended to be left in the hands of university researcher and other academics particularly in the U.S.A. Ten years ago, Romiszowski (1974, p 223) commenting on recent research, stated:

"There are hundreds and hundreds of reported studies comparing television with traditional methods, but with as yet, no conclusive results"

but he also adds that most of them are -

"subjective and poorly designed. Those which are properly controlled, generally repeat the pattern of 'no significant difference' found earlier in the bulk of research into film".

More recently Bates (1984, p 11) pointed out that educational broadcasts have a more important role to play in developing countries, and are in fact often seen as an essential indicator of development. Perhaps because of the considerable resources required both financially and in terms of skilled manpower . . . . .

"there is much more published research on educational broadcasting in developing countries than in Britain. Consequently there is much to be learned from the experience of such countries and it is a critical review of the use of educational broadcasting in developed countries that is long overdue."

2. The Development of Educational Broadcasting Abroad

It was not long after the British Broadcasting Corporation was formed, that it realised the assistance it could give to the education of pupils in schools. It broadcast its first trial radio series to schools in 1926, which was the first of its kind worldwide. The standard was set for schools broadcasting which has continued in this country to the present day: that is the programmes were of the same high standard of production which characterised the rest of the broadcasting service, and were designed to be additional resource material for the classroom teacher, not intended in any way to replace him. In Europe, Sweden and later other countries, followed Britain's lead, allocating part of their day-time radio transmissions to special programmes aimed at pupils in school. At about the same time, but in a different way, various states of the U.S.A. experimented with new educational radio stations, called 'schools of the air'.

Throughout the world, as work in this new area developed through both radio and later television transmissions, not all countries produced the same quality of service that we are used to in this country today. Quality is related to financial resources; many governments, when faced with the prospect of having to pay for the then unproven luxury of an educational broadcasting service, decided to pass the responsibility onto commercial sponsorship. Thus, the fluctuations of the market place, the competition between advertisers of successful entertainment programmes and those of limited audience educational programmes, caused a general lowering of standard and in some places a complete collapse of the educational service.

Other differences which may be found are that of style and presentation of programmes, which are often produced to different objectives. In some developing countries, programmes are broadcast to replace teachers in the classroom, either because there is a shortage of teachers, or because the teachers require educating as well as the pupils. In some distance learning project the pupils are not even in school, but are being educated in their homes by the presenter in the studio far away.

In many parts of the world, as in the U.K, educational radio developed naturally into educational television when the time came. But this was also a time for expansion, for those who could see little value in education over the radio, could not surely dismiss the visual image of television quite so quickly. Not only has television been used to

educate children in schools, but also adults at home. What we see today is educational broadcasting in its maturity: a host of different broadcasting stations around the world offering a varied educational service, each designed for the particular needs of the community. This ranges from the use of radio to teach the English Language to the adult population in China, to the multi-media campaign in the Pacific Islands to develop an awareness of nutritional importance and to encourage the breastfeeding of infants.

The U.S.A.

Without the organised structure and planning policies of a government funded broadcasting company as we have in the U.K, other countries which relied on commercial enterprise had no united approach to the development of an educational service and individual projects often ended in financial failure. P. Saettler (1968) describes the problems of several initiatives in America. The Ohio State University and Station WLW of Cincinnati set up the Ohio School of the Air in January 1929 - a daily broadcasting service to schools financed by Ohio State. It grew steadily until January 1931 when the Ohio legislature began to reduce its support. Six years later finance was completely curtailed and the service closed down. Two other commercial ventures broadcast nationally, and lasted rather longer: RCA Educational Hour began on 26th October 1928 and in its first year had more than three million listeners. It continued until 1942. The American School of the Air began on 4th February 1930 launched over the CBS network. In its best years it was broadcasting to 22 nations in the Western Hemisphere. It lasted until 1940. These two national projects ended because sponsors were not convinced that radio had that much value in the classroom, and they would rather see their products advertised during programmes of a more general interest with higher audience ratings.

Educational radio, as opposed to broadcasts for schools, developed through educational stations set up by the major universities, some as experimental stations as early as 1912 with short news or weather reports. The Radio Division of the US Department of Commerce began issuing broadcasting licences in 1921. The first granted to an educational institution was to the Latter Day Saints University of Salt Lake City. A number of other institutions applied soon after. These establishments used their service to broadcast campus bands and drama productions, as well as lectures. According to Saettler, some administrators saw the station simply as a publicity exercise hoping

that enrolement on courses would increase, whereas many were indifferent about its educational advantages, and few saw any great potential in educational radio. These views were reflected in those of the national administration, and there was little support for any governmentally controlled broadcasting supported by the taxpayer. One reason why educational radio stations did not survive was that limited audiences meant that they could not compete financially, or maintain the same production standards as general output commercial stations.

Television in America, as with radio, grew up in many different areas of the continent. When TV companies felt they had something to offer in the field of education, they started to make educational programmes for schools, or for children and adults at home; but because skills formed in this area were geographically diverse, progress was slow. . . Robert M. Diamond (1964), a United States authority wrote:

"The quality of instructional programming will improve while the number of live programs produced by individual educational or community stations will decline. The need for high-quality programs will necessitate a weeding-out process to eliminate unsatisfactory productions. Superior programs will be made available to stations by such organizations as National Educational Television (NET)."

NET did not become a possibility until funding had become available from sources other than commercially interested parties. This was to follow from the Educational TV Facilities Act of 1962 and the Public Broadcasting Act of 1967. These two acts helped the cause of Educational Television (ETV) in the USA more than anything else in its history. George Tressel and colleagues summarised the laws as follows (Tressel et al 1975, P 8)

"the public laws seek:
development of noncommercial educational broadcasting,
availability to people throughout the United States,
participation and support by the federal government,
programming responsive to the needs of the people,
programming freedom, imagination and initiative,
program production on both local and national levels, and
freedom from extraneous interference and control."

Following these acts, money was made available from the federal government and in the form of grants from other organisations, and gradually a successful service was formed. Now, in the eighties, the Public Broadcasting Service provides the national transmission links for

the ETV stations, most of which receive and transmit the PBS signal to their local communities, as well as contributing their own programmes to the network. Similarly, National Public Radio serve the many non-commercialradio stations across the country. The programmes transmitted during the daytime are generally of use to schools or younger children at home, whereas those after school hours or at weekends are of a general educational nature. There is, of course much competition between the PBS and the commercial channels, as there is between the commercial channels themselves.

Europe

Educational broadcasts in Europe, with one or two notable exceptions have had a long tradition of providing enrichment material for teachers use in the classroom. They were also regarded right from the beginning as being the responsibility of all stations, irrespective of whether they were commercially funded or government controlled. Britain and the Scandinavian countries developed an extensive pattern of schools radio broadcasts before the advent of television. This experience naturally gave them a head start when the new medium arrived, but other countries were not slow in following suit. Some had the advantage of a centralised educational system, the curriculum being controlled by government departments. Thus the syllabus of any particular subject area is the same in any school throughout the country, and it is relatively easy to match the content of a school television series with the work being done by the pupils in the classroom. France provides the best example of such a system. ORTF, the national network produce schools broadcasts in consultation with the Ministry of Education. The first weekly programme began in the Paris area in October 1951. By 1961 this had been expanded to eleven programmes per week serving 5000 schools across the whole country. These were mostly of an enrichment nature, but during this year the French educational authorities began experimenting with programmes of a more direct instructional style. One such pilot project was a series of mathematics teaching programmes broadcast to the Lille district, which turned out to be so successful that it became a permanent feature of French educational television.

Italy saw the possibility of direct teaching through television a few years earlier than the French. They saw itas a way of supplementing the poor school facilities in the rural areas of the south of their country. In 1958 'Telescuola', the 'television school' started broadcasting over the national network. It started big - enrolling 50,000 students in its first year. The programmes were of an instructional

nature, following courses given in vocational training schools, but were directed towards teenagers who perhaps because of location could not attend such schools. By 1961 Telescuola was operating 34 hours each week and had expanded its courses to include more academic subjects. In 1960 the service branched out into adult education, by creating a series of programmes to reduce illiteracy. The initial project consisted of $1\frac{1}{2}$ hours of programming each week on reading, writing, and arithmetic. It attracted a regular audience of about 40,000 viewers. One problem which was forseen by the directors of Telescuola was that it was essential to encourage their audience to form good study habits, and to continue the courses through to the end. To help in this way, a special feature of the service both for teenagers and adults was to encourage the formation of local viewing groups under a group leader; a successful initiative which later became an important feature of many adult literacy projects in other countries, including the U.K. These groups produced helpful discussions between students, and also helped individual members of the population who had no television, but wished to participate.

The European Broadcasting Union was formed in February 1950 with twenty one members. In 1961 it held its first international conference on school broadcasting in Rome. According to Dizard (1965, P 213):

"The Italians were able to provide a live demonstration of how ETV was being used every day to meet some of their own pressing educational requirements. Their demonstrations had the most dramatic impact on delegates from Asia, Africa, and Latin America; a number of them returned home and attempted to apply Telescuola's lessons, not always successfully, to their own fledgling television stations."

Japan

One country which has for many decades achieved a reputation for its commitment to educational broadcasting is Japan. It was the first country in the world to fully integrate television into the educational curriculum in every year of schooling and throughout every subject area. Japanese school curricula are centrally controlled and broadcasts are scheduled so that they directly fit into the classroom activities, thus teachers in Japan did not have the timetabling difficulties in using broadcast material which their colleagues in the U.K. experienced before the VCR was established in schools.

The development of a general broadcasting service was very similar to the way progress was made in Britain (see McCavitt, 1981). Radio Broadcasting was started in 1925 by the Tokyo Broadcasting Station which

was later to become the public body Nippon Hoso Kyokai (NHK) - Japan Broadcasting Corporation. In 1953 NHK began television broadcasting, soon followed by private companies. Today the NHK service is funded by income from receiver fees, and other commercial companies rely on advertisers revenue.

The national corporation began its commitment to education in 1931 when its Radio 2 network was inaugurated to present mainly educational and cultural programs. Today, programmes are broadcast to all schools, from infant to senior high, and in the home a service is provided for the pre-school child, the university student, the housewife, and for the physically and mentally handicapped. Early school broadcasts were of the "enrichment" style which could be used or not by the classroom teacher. Soon however, the emphasis was placed on direct instruction and such programmes are now an essential part of the pupils educational experience. Textbooks in many subjects have been written to integrate the television instruction into the rest of the classroom activities.

In 1962 NHK set up the first school in the world to grant examination diplomas based on radio and television instruction. Its campus is in Tokyo where pupils take exams, and meet their tutors, but their classroom is their home and the communication link is the television and radio service as well as postal correspondence. Its style is similar to Britain's Open University, but it was formed several years earlier and its awards are of a lower academic level. The school's students are either teenagers who have left high school but wish to continue their studies, or adults who for one reason or another missed the opportunity of obtaining school diplomas earlier in their lives.

In 1965, to commemorate the 49th anniversary of the start of radio in Japan, an international competition was established to promote improvements in educational broadcasts. Known as the Japan Prize, it is given for programmes of an educational nature from any country, and is awarded by an international jury of scholars and educationalists. It is the first and only international competition for educational radio or television programmes.

Developing Countries

In the early 60's many developing countries were beginning to look closely at how broadcasting could help in educating the population. Some had no broadcasting service at all, some had only radio. In many cases, the radio or television network was used almost entirely as an entertainment medium. In parts of Africa, there was a serious shortage of trained teachers and some means of supplementing the school curriculum

was desperately needed. Kenya, towards the end of 1959 had no television service but wished to start regular broadcasts for educational reasons -

"to assist in overcoming the appalling educational problems which Kenya had to face both in the schools and in the adult field" - John Proud 1967).

A planning commission was set up, of which Proud was the chairman, and eight years later Kenya was not only broadcasting to schools, but also to teachers, to help, in conjunction with Nairobi University, to increase their professional qualifications.

The ETV projects of some developing countries could not be described as a success. Often the number of skilled personnel and the amount of technical and financial resources were not fully realised, and as a result the poor quality broadcasts contributed little to the educational needs of the population. Many projects depended on low cost imported film material which even if it had proven educational value in the country of origin, was of limited use elsewhere. This was the finding of Tony Dodds and colleagues working at the International Extension College which was set up to provide advice and support on distance teaching for education in the third world. They stated (Dodds et al. 1972) -

"an emphasis on academic subjects imported from Europe is linked to a reverence for academic qualifications. Both have at best a limited relevance to the lives that most students are going to live. They do nothing to equip them to change and improve conditions in the rural areas where most of them are destined to stay. There is little emphasis on technical and vocational subjects or on rural skills, and the pattern of teaching makes few conscious efforts to train students to solve by themselves the practical problems they are likely to face in later life."

Much help in setting up ETV services was given to developing countries by the Centre for Educational Television Overseas (CETO), set up in the U.K. It was launched in 1962 with £460,000 raised from sponsors to be spent over a five year period. During this time a considerable amount of research was done into the educational needs of developing countries. Tangible help given by CETO included the production of package programmes (both for school and for home use), training courses run in the U.K. for overseas personnel, and the availability of experts to help on site with the setting up of the educational service.

Robin Moss (1983, p 37) however, points out that it is not enough to organise just one end of the transmission system. Looking back to twenty years of educational broadcasts, he refers to a three year study of broadcasting in the third world, the results of which were published in 1979 . . . .

"The survey showed that in Africa, all broadcasting systems were modelled on European structures; in South America, most broadcasting systems were like those of the USA; in Asia, European-style systems were influenced by American approaches. The authors noted the irony that in many countries millions of dollars had been invested in expensive productionand transmission equipment, without any comparible concern to ensure reception facilities."

In the use of broadcasting to educate the population in their homes, one question is of prime importance: Is there a radio or television set available for them to use? Although organizations such as CETO certainly helped the formation of ETV is developing countries continual success from an educational point of view is not so easily achieved.

Some important mathematics projects

Mathematics is often part of any educational broadcasting service whether in a developing country, or in any other. Sometimes it is part of an adult literacy or numeracy project, teaching basic counting skills to people at home. Sometimes it is part of broadcasts to schools either as an extra resource for the teacher, or as direct instruction, in which case the teachers often learn almost as much as the pupils. It was in this latter style that the Basic Skills Pilot Project was set up in 1980 in Thailand. Described by Klaus Galda (1984), it was set up to develop an extensive set of radio programmes and printed material to help overcome learning difficulties in schools, in mathematics and the Thai language. Two problems existed in primary schools of the country - lack of training among a large number of teachers; and achievement levels in the north-east of the country about one half of those in the more forward regions of Bangkok and the central plain. During the late 1970's the Ministry of Education together with the World Bank planned the Fifth Education Project for Thailand. One of the main objectives was to strengthen the radio system to produce a network of eleven radio transmitters exclusively dedicated to educational programmes to cover virtually the whole country. On completion, one of the first uses it was put to was the transmission of the Basic Skills Project. A set of 160 twenty five minute radio programmes on mathematics was prepared in the form of a dialogue between the radio teacher and the pupils. Answers were either voiced as a class, or written down on specially prepared worksheets. This style also served as a pedogogical model to help train the classroom teacher in teaching mathematics. After each broadcast the pupils worked for fifteen minutes with the teacher following the prepared Basic Skills Pilot Project manual. The series was broadcast to two regions - Bangkok and the northeast area of Kalasin and Maha Sarakham - the two regions which previously had shown the greatest difference in achievement levels. The results of the project were clear cut: the pupil improvement was greater in the areas where radio was used compared with the normal teaching in other areas, especially in the north east region where radio had helped to close the gap in mathematical attainment between the north east and the central plain. The project was clearly successful and was enlarged to cover all areas. In final form the programmes and extension material covered all the mathematics curriculum of the primary schools.

Similar projects to teach mathematics to school children over the radio have been set up in Nicaragua and the Philippines. The Nicaraguan Radio Mathematics Project was set up in 1975 for teaching mathematics to children in primary schools, the main objective being to provide low cost resources to help the teacher in the classroom. Over the years 'modern' mathematics was included and served also as inservice training for the teacher. Results showed that the broadcasts reduced the number of pupils who had to repeat the course and also that the costs per pupil were less than by traditional methods of teaching. (see Young et all, 1980, p 47).

Recent success at increasing the use of broadcast material in schools, especially in mathematics, can be found in Malaysia. A television service to schools was launched in 1972, which eight years later had expanded to 28 separate television series, each of nineteen 15 or 20 minute programmes covering the whole school curriculum and age range. Broadcasters were concerned that the use of the broadcast material was low compared with the financial outlay. Programmes had to be broadcast twice each day as some children attended school only in the morning while others attended only in the afternoon. In 1979 a pilot scheme was set up to try to increase the use of the programmes. Video Tape recorders were issued to thirty pilot schools (twenty secondary and ten primary) and VCR cassettes of two complete series were distributed, one of the secondary series being in mathematics. The results were overwhelming. Margaret Gallagher (1982) describes how, of the two primary series, three times as many programmes were used using VCR cassettes as had been used during the previous year using direct broadcasts. In the secondary schools the use of one series increased by a similar amount, but the use of programmes in the mathematics series increased by ten times the previous years usage! Teachers were under no obligation to use the programmes but many described the advantages of the cassette format - more flexible, they can be used any time of day, they can be easily repeated, and it was possible to break down the programme into separate sections instead of showing them continuously.

For many years, many countries have experienced serious difficulties in persuading qualified mathematicians, scientists and engineers to enter the teaching profession rather than to accept more lucrative positions in commerce and industry. In order to ensure the continuation of mathematics teaching in schools it has been necessary to use teachers who are qualified in other areas of the curriculum. To help them to

transfer their skills from one subject to another, a certain amount of retraining is necessary. In an experiment carried out in France during the years 1963-1967 an attempt was made to carry out this education of mathematics teachers using television. It was also the age of "new mathematics" and the second purpose of the experiment was to introduce this new material to all mathematics teachers, whether qualified or not. (see Council for Cultural Co-operation, 1967), pp 63-79). Two types of broadcasts were devised to meet these needs: supplementary programmes to be viewed in the classroom with the pupils, and separate information broadcasts for teachers. Those for the classroom consisted of three 20 minute television programmes each week on mathematics, two for class 6 (11 year olds) and one for class 3 (15 year olds). There was no attempt to cover the whole syllabus for that year, but rather the programmes illustrate how teachers can explain certain 'new' topics and how they can be integrated into the rest of the mathematics curriculum. The broadcasts for teachers were of the form of a dialogue between university mathematicians and secondary school teachers, discussing recent developments.

Little evaluation of the effectiveness of the teacher broadcasts was carried out, but several surveys were made of the pupils success at learning from television which showed favourable conclusions. The experiment was continued after the initial three year experiment and the subject content of the teacher broadcasts was enlarged to include new initiatives in other areas of the primary and secondary curriculum.

France was not the only country to feel the need to educate mathematics teachers in the ways of 'new' maths during the sixties. In Britain, the BBC made contributions to this area which are discussed in later chapters.

3. School Radio and Television in Britain

General Development

British Broadcasting is well known the whole world over for the diversity and quality of its programmes. Over the years of working in the field of education, the same care and attention to detail, if not the same financial resources, has been put into educational programmes. These have been made for a variety of audiences, from the pre-school child, through the years of compulsory schooling, to the education of teenagers and adults at home.

Broadcasting in Britain is controlled by two organisations; the British Broadcasting Corporation which is financed by receiver licences, and the Independent Broadcasting Authority which is the controlling body for some sixty or more independent radio or television broadcasting companies, financed by advertisements. The BBC operates two national television services, BBC 1 and BBC 2, and four national radio channels, Radio 1, 2, 3 and 4. None of the six services exist solely for educational use, but educational programmes made by the BBC may be broadcast on either television channel or on any of the radio bands. The IBA is somewhat different. Its television commitment on one of its two channels consists of issuing fixed term contracts to independent television companies to broadcast in certain regions of the country, or to specialise in certain broadcasting areas, i.e. national news bulletins. Some of these separate companies produce educational programmes for particular audiences which may then be shown not just in its own region but over the whole country. This distribution is controlled under government licence by IBA. The newly acquired second independent television channel has been given by IBA to the specially formed Channel Four Television. This company does not produce its own programmes but buys or commissions programmes from sources within this country and abroad and organises their broadcast. Part of Channel Four's contract commits 15 per cent of air time to educational programmes. At present this is carried out in the field of adult education.

At the local level there are two networks of local radio stations. The BBC has currently 31 local radio stations, while the IBA controls 48 independent ones. The amount and type of educational broadcasting at this local level depend very much on the station personnel. Some try to involve themselves with the local schools, others see their role more directed towards the family at home.

Educational Broadcasting in Britain does not stop there! 1969 saw the opening of the Open University. It was formed as an educational institution which would give any member of the population a chance to obtain a qualification leading to degree level. In particular there was a need to provide high level courses for adults who, for whatever reason, were not able to enrole at the other established campus universities which tend to cater for youngsters straight out of sixth forms. The Open University specialise in multi-media teaching methods using television, radio, video and audio cassettes, postal correspondence, meetings and discussion groups. Its mathematics courses are beyond the scope of this dissertation, but it must be said that through its work in the field of multi-media education it has made valuable contributions to the state of educational technology in this country. Experience gained by the OU has filtered through to the broadcasting companies own work in broadcasting for schools and adult education.

The first time programmes were made solely for the purpose of educating was during 1924 and it was of course broadcast over the radio by the BBC which had been formed two years earlier. The first ever broadcast to schools was as a brief experiment in Glasgow in 1924, but the field was taken more seriously one year later when the BBC appointed Miss Mary Sumerville to take special responsibility for schools, and the first regular series went out in 1926. After a few years of use or misuse of radio in schools the BBC and the Kent Educational Authority set up an enquiry funded by the Carnegie Trust. It sent out questionnaires to 72 Kent schools and found that in general teachers were very critical of the educational value of the programmes the BBC had distributed. There was obviously a need for consultation with the teaching profession. The Kent Enquiry led to two important developments: In 1929 the Central Council for Schools Broadcasting was created which in 1947 was reorganised to form the Schools Broadcasting Council for the UK with related councils in Scotland, Northern Ireland and Wales; and in 1930 the first Education Officer was appointed by the BBC to be the communication link between the two professions: broadcasting and teaching.

Today, we have of course schools television as well as schools radio, and we have contributions from the independent companies as well as those from the more established BBC. Currently the IBA offer forty or more television series for schools from its regional production companies and the BBC transmit about one hundred and eighty series, divided about evenly between radio and television. Usually schools

series are accompanied by teachers notes and sometimes pupils workbooks are available. The BBC often produce colour filmstrip for use with its radio programmes and create what is known as Radiovision. The research unit of the BBC's Educational Broadcasting Services conducts enquiries into listening and viewing in schools for both the BBC and the IBA (jointly funded). The EBS Survey of Listening and Viewing in UK Schools for 1983-84 report that 97% of primary and 96% of secondary schools used schools television during the Autumn Term 1983.

The BBC schools broadcasting service is controlled by the Schools Broadcasting Council for the UK which consists of about thirty-seven members drawn from a variety of educational organizations. Within the Council, the Primary and Secondary Programme Committees direct the development of programmes within those two areas. Production teams are aided by the Educational Officers of the Educational Broadcasting Services who assess what future series are needed and provide feedback from teachers on how current programmes are being used. The IBA has a similar body, The Educational Advisory Council to look after all independent educational initiatives. However there is a second tier of educational advisers and education officers in the separate companies that produce the programmes. Not all regional companies work in the educational field, those that do tend to concentrate on certain areas. For example, in mathematics, Yorkshire Television has concentrated on adult numeracy in recent years while ATV (now Central TV) have produced programmes for induction classes of infant schools.

There is only an informal link between the IBA's Educational Advisory Council and the BBC's Schools Broadcasting Council, but there is an unwritten agreement not to make similar series aimed at the same audience. In practise, the programmes of the two organizations overlap if at all, only in the most trivial of ways. Both willingly participate in ETV conference in this country, the most significant ones being perhaps that held in 1966 at the Isle of Thorns where copyright was an important issue, and the International conference on Evaluation and Research in Educational Television and Radio held at the Open University in 1976. The BBC and ITV, jointly fund the Research Unit of the EBS as mentioned earlier, and in 1974 jointly sponsored a project to determine to what use TV and Radio broadcasts were put in schools. (Hayter (1974)).

Mathematics Broadcasts

When school television started in 1957 the work it could do in the field of mathematics was not immediately obvious. Radio had considered

it outside its range, although it had tried out a short series for sixth forms. Even on television producers could not easily visualise what teachers were asking for - imaginative supplements to the work done in the classroom. Nevertheless, by the end of the first year, a team of school television producers at the BBC including Mr Donald Gratten, (later to become the Controller of Educational Broadcasting) whose academic background and teaching experience lay in science and mathematics came up with the first series. It was a five programme series called simply "Mathematics" and was broadcast for lower secondary pupils. For the first few years the work done in all subject areas was very much experimental and "Mathematics" was no exception - there was still much to learn. However, the School Broadcasting Council considered that mathematics was a field of promise, and a second series "Mathematics and Life" was made along similar lines but brought down to the level of lower ability pupils. This was broadcast in 1961 and was considered to be more of a success than the first series. While "Mathematics" was being transmitted in 1958, Independent Television showed its first mathematics series for schools called "World of Figures". It was intended for general secondary school audiences but evidently had little impact for during the following years the independent companies concentrated their efforts on the primary age range.

The next initiative from the BBC came in the form of a series for 'A' level students. The SBC's Programme Committee had had letters from practising teachers drawing their attention to the shortage of specialists who could teach mathematics at the sixth form level in what was then mainly Grammar Schools. At about the same time Donald Gratton had submitted a request to produce programmes for sixth formers, possibly thinking that it was easier to practise with bright pupils than it was with the less able. The result of these communications was the production of ninety-six programmes broadcast twice weekly over a five term period. This series was different to the general style of programmes that were made before and also different to those that were to follow - the programmes were designed to teach, not to be an extra resource for the teacher. In fact it was hoped that the series could be used without the classroom teacher, where one was not available. A teacher with twenty years experience of sixth form mathematics was employed to plan and present the lessons, and to produce student notes. Kenneth Fowdry (1967, p 20) described the reaction among the production team:

""Pure Mathematics" went against the grain, not a little. It was foreign to our conception of television's function; it did not give the producer much scope . . . . Our expert staff recruit planned the course and duly appeared in the studio with virtually nothing except four cameras, five blackboards and innumerable bits of chalk . . . ."

"Pure Mathematics" was shown from Autumn 1962 to April 1964 and repeated for the following academic year with the sixth term given to a short series "Modern Mathematics", again for sixth formers. The complete two year course was received fairly well in hundreds of schools but usually supplemented with work provided by the teacher. It is a pity that no other work in Pure Mathematics for sixth forms has been broadcast for schools since 1965. Many teachers have shown a desire for such a series by using Open University programmes in recorded form to supplement 'A' level work, against copyright regulations. (See Lynne Graham, 1983).

These experiments in direct teaching gave way after a few years to another series for sixth forms: "Mathematics in Action" which was back to the enrichment style. This series of twenty-eight programmes, shown weekly, was transmitted from 1965 to 1970. It dealt with areas of practical mathematics: Statistics, Logic and Computers. In its first year it was repeated in the evenings for adult audiences in association with a correspondence course. During the same five years experiments with radio and mathematics were tried again - eight short programmes were made for 11 - 12 year old entitled simply "Mathematics". Pupils' pamphlets and teachers notes were available and it was successful enough to be repeated several times.

Meanwhile as the sixth form series were being made a second team was involved with a project lower down the school. "Middle School Mathematics" was a set of 28 programmes aimed at the middle years of secondary schooling (not for Middle Schools which was then a thing of the future). Modern Mathematics was beginning to appear in secondary schools and the BBC lost no time in fulfilling a need to educate not just the pupils but the teachers as well. The series introduced 'new' topics like Binary Number, Vectors and Transformation Geometry, and were shown in a very visually stimulating form using specially shot film, animations and models which we recognise as being essential ingredients of an educational programme shown today. The series was first shown in 1963, and with revision made in the light of critical feedback from teachers, lasted until 1967.

Simultaneously, the field of Primary School Mathematics was being explored by ITV School Television, in a series produced by Associated Television Ltd (ATV). In formulating ITV policy on the role educational television should play in the world of education, the Educational Advisory Council, the Head of School Broadcasting, and the production staff came to the conclusion that television in schools could best be used in the following ways (Charles Warren, 1967):

"by taking the children outside the four walls of the classroom show them the real world outside,

by stimulating practical activity and relating simple demonstrations and experiments to their wider application, and

by the synthesis of specialised resources of research, illustration and dramatised presentation."

With these points in mind the mathematics series produced by ATV "Primary Mathematics" was designed for 9 - 11 year olds to show the relevance of mathematics to the world around them. Concepts were illustrated using everyday situations which pupils of that age experience. As a first attempt it was a reasonable success. It was a three term series, first shown in 1964 with annual repeats until 1967.

ATV continued to work in the area of Primary Mathematics (more recently as Central Television) and produced several series:

"Towards Mathematics"	circa 1967
"Figure it out"	1971
"Leapfrog"	1978 - 1981
"Basic Maths"	1979
"Junior Maths"	1984 -

Leapfrog was a series for 7 to 9 year olds and was an innovation as far as style was concerned. Each of the twenty eight 15 minute programmes contained six to eight items which followed on from each other with little or no introduction. The same items occurred regularly throughout the series in a repeated or developed form. Large sections of the programmes were without spoken material, but music was used effectively with the animated sequences. Three presenters were used but speaking together rather than to the camera. The series was planned to present a wealth of mathematical experiences which generally could not have been offered in the primary school. "Leapfrog" was one of the five series evaluated by David Womack in his IBA Fellowship study (1980 - 1983). He comments:

" . . . . in spite of the disappointing response to Leapfrog, the series undoubtedly encouraged pupil initiative and persuaded teachers to employ a wider range of activities in mathematics teaching, particularly in the curriculum area of art and craft".

"Leapfrog" was first shown during the academic years 1978 - 79 and after two repeats was replaced by "Basic Maths" which was written and produced by the same team at ATV with the same aims and philosophy. Both series were accompanied by a teacher's booklet which contained a wealth of practical ideas and follow-on suggestions.

The current offering from the same stable, which is now Central Television, is "Junior Maths". Aimed at a similar age range, (7 and over), the series contains 28 15 minute programmes, each taking one single mathematical idea and exploring it in a variety of ways using graphics, cartoons, film sequences, fantasy stories, games, and practical activities. Extensive use is made of the microcomputer in the studio and in the filmed sequences of children working in a classroom. Specially written computer software is also available to accompany the series.

Grampian Television has produced two school series in mathematics: "Mathman" and "More Mathman". The first was transmitted in 1971 and aimed at reception classes at infant level and consisted of simple number work. The aim was not to teach mathematics but to present mathematical situations within a storyline. Each programme was entirely studio based and was in the form of a play, acted out by four characters, one of which was the robot Mathman. As well as a mathematical content there was deliberate inclusion of language development and stories.

Some evaluation was undertaken in schools obtaining comments from both teachers and pupils. Consequently the programmes were completely remade and a few years later were complemented by a second series "More Mathman" aimed at six year olds. The two series were only broadcast in Scotland, probably due to the language problem of the young audience, but they did last some seven or more years.

Work in the reception class area was taken over in the early 1980's by Granada Television, "1..2..3..GO!" was a series of eighteen programmes for children in their first year of school and was broadcast from 1981 to 1984. Each ten minute programme concentrated on one theme, for example, programme one introduced the numbers 1, 2 and 3, programme two looked at 4 and 2 and the relationship between them. By programme ten the first ten numbers had all been introduced. The other programmes concentrated on number activities involved in time, money, length, and shape. Each programme involved three elements: a sequence involving two glove puppets, Punch and Judy; a story about a small boy Sam and his

pet mouse Squeak; and a number song accompanied by animated film. 'Sam and Squeak' books were available for schools to buy which reproduced exactly the stories told during the programmes. The teachers guide contained many suggestions for follow up work and the music and lyrics for the songs.

Reports from teachers called for further work in this area and the series was replaced in January 1985 by a new series for the same age group "Lets Go Maths". Twenty programmes each of 10 minutes duration followed a similar format to its predecessors.

Over the years since 1968 the BBC has moved into the primary area wherever it has seen a need, as well as continuing its work for the secondary schools. It has always taken care not to breach the agreement it has with the IBA not to create competition with independent companies in the education field. The tables on following pages show the BBC's enormous contribution to mathematical education in schools over the past twenty years. Due to agreements broadcasting companies have with the actors unions a particular series is usually replaced after a run of no more than three years. The following series for the same age range is often similar in style but with some changes as a result of feedback from teachers in schools. Some new series however seem to be so similar to the one it replaced in terms of mathematical content that one could be forgiven for thinking that the money could be better spent producing programmes for a different school audience. The results of the questionnaire sent to teachers in charge of mathematics in secondary schools discussed in a later chapter, show that the great majority of teachers who feel there is a need for more mathematics programmes would like to see them produced with different mathematical content to those currently broadcast. Apart from union agreements, other reasons put forward for remaking complete series are that the presenters and characters' clothes are soon out of fashion; and where prices of articles are given, these are soon out of date. However, it would seem reasonable that with careful planning a series should last as long as teachers expect their textbooks to last - more than three years!

To describe each series produced by the BBC would make tedious reading, however, some are worth mentioning in more detail. "Mathscore One" and "Two", currently broadcast are the result of much experience over three previous series of producing material for the 9 - 11 year age range. The style of the programmes is of two regular presenters Roger and Elaine involved in a short story which shows mathematics in

BBC SCHOOLS MATHEMATICS SERIES - PRIMARY

Year	Series	Audience Age	No of Progs	Medium
1965-68	Primary School Mathematics	9-11	20	TV
1969-77	Maths Workshop Stage 1	9-10	14	TV
1970-77	Maths Workshop Stage 2	10-11	14	TV
1977-81	Its Maths	9-10	14	TV
1982-	Mathscore One	9-10	10	TV
1983-	Mathscore Two	10-11	10	TV
1967	Mathematics Around You	7- 9 low ability	8	TV
1976	Keep up with the Times	7- 9	8	TV
1980	Maths in a box	6- 7	14	TV
1982	Maths Songbook	6-11	5	Radio
1980-82	Maths with a Story Series 1	8-10	8	Radio (Vision)
1983-	Maths with a Story Series 2	8-10	8	Radio (Vision)
1983-84	Johnny Ball's Maths Games Series 1	10-11	10	Radio
1984-	Johnny Ball's Maths Games Series 2	10-11	10	Radio

use in everyday life. The story is interrupted occasionally with classroom film or animated sequence explaining a particular point.

A similar style is used in the secondary series for the slow learners in the 14-16 age range. "Maths Counts" contains more humorous characters and more is made of the relationship between them. The present series replaced "Everyday Maths" and is so similar to it both in style and content that one wonders, as mentioned earlier, whether the financial resources have been wisely spent.

The storyline in the two radio series for juniors "Maths with a Story" is very much fantasy with such unlikely characters as Tiddles the Gorilla, Sir Absolutely Accurate, Count Backwards, Melisa, and Lucky Terry Twister and Co. But behind the fun and games are deep lying mathematical principles which are reinforced with the suggested follow-up materials. In two programmes of each series the story approach is abandoned and a more visual treatment is attempted with geometric topics using colour filmstrip to accompany the radio recording. Further mathematical fun over the radio can be found in"Johnny Ball's Maths Games" - two series of ten minute programmes for the transition years 10-11. Well known for his antics on children's television, Johnny Ball brings immediate excitement and interest to his listeners. Each ten minutes is packed with games, puzzles, and tricks and must be used in recorded form. With pauses and repeats, and class discussion, a half hour lesson soon goes by.

"Maths Today" was a pair of unusual series for the early years of the secondary school. The BBC prepared not just sets of programmes with accompanying notes, but a complete two-year course consisting of packages of workcards, 8 mm film loops, and as described in the next chapter, related radio and television series for teachers. The course was meant to occupy all or most of the teaching time and was produced to help teachers to bring in the 'new' mathematics to the secondary school. The programmes were not mathematics lessons as the 'A' level course was a few years earlier, but more a mathematical experience of introductory work on which the following classwork could be based.

"Maths at Work" was an interesting and useful diversion from the usual path of mathematical broadcasting. The five programmes were designed for the average CSE pupil in the fourth or fifth year of secondary school, and consisted entirely of case studies of young people applying mathematics in the course of their employment. The situations are not fictitious, details of all the people involved and their jobs, are given in the teacher booklet which help with discussion

BBC SCHOOLS MATHEMATICS SERIES - SECONDARY

Year	Series	Audience Age	No of Progs	Medium
1958	Mathematics	11-12	5	TV
1961	Mathematics and Life	11-12	10	TV
1965-70	Mathematics	11-12	8	Radio
1967-72	Maths Today Year 1	11-12	14	TV
1968-73	Maths Today Year 2	12-13	14	TV
1975-80	Mathshow	11-13	14	TV
1981-85	Maths File	11-13	10	TV
1963-67	Middle School Mathematics	13-14	28	TV
1972-78	Countdown	14-16 slow learners	28	TV
1978-82	Everyday Maths	14-16 slow learners	14	TV
1983-84	Maths Counts	14-16 slow learners	10	TV
1979-	Maths Topics	13-16	15	TV
1984-	Maths at Work	14-17	5	TV
1985-	Help Yourself to Mathematics	13-15	5	Radio
1962-65	Pure Mathematics	Sixth form	96	TV
1964-65	Modern Mathematics	Sixth form	16	TV
1978-79	Prospect	Sixth form	5	Radio
1984-	'A' Level Studies: Statistics	Sixth form	5	TV
1985-	MI10 Mathematical Investigations	11-14	10	TV

after the programme is shown. The mathematics encountered in each programme may be linked up with the work a class is currently doing and the broadcasts may be used to emphasise that what is done in school has relevance outside in the real world. A secondary aspect of the series is that it gives pupils an insight into a variety of careers, which it is difficult to find elsewhere.

The radio series "Help yourself to Mathematics" was another new venture for Schools Broadcasting. A set of five units, each 40 minutes long, on five areas of mathematics is currently being broadcast overnight, and is obviously meant to be used in recorded form. The series is intended for independent pupil study. Armed with a tape recorder or a personal tape player, and the comprehensive workbook, a pupil is expected to be able to work through the unit without teacher assistance. This is an interesting educational area, where educational broadcasting could cease to become broadcasting, as in future years instead of repeating the series, pre-recorded tapes and pupils workbooks will almost certainly be available for purchase from the BBC's Radio Shop at very reasonable prices. The complete study package could just as easily have been produced by an educational publisher, not by a highly experienced broadcasting company.

In an attempt to help teachers carry out the recommendation of the Cockroft Report, the BBC has brought out a new series for 1985/86: "MI 10: Mathematical Investigations". As its name suggests the series is made up of ten 10-minute investigations which may be carried out in the classroom. There is at least one 'pause for thought' break in each programme to allow for class discussion of the problem and they are therefore obviously designed to be used in recorded form. The teachers notes contain many suggestions as to how the class should be prepared for the investigational approach.

The last few years have seen the BBC venture into new fields of mathematical broadcasting for school pupils. The Independent Companies have obviously observed from a distance but have been slow to move in similar directions. It is hoped that future work will continue to be innovative and will expand the great potential of mathematical broadcasting to the full.

4. Other Areas of Educational Broadcasting in Britain

Local Education Authority Initiatives

During the sixties and early seventies the cost of television equipment (cameras, recorders etc.) was becoming low enough for several local authorities to consider the setting up ofan ETV network broadcasting to local schools. Programmes made by their own advisers and teachers could have the advantage of local content and easy classroom feedback. After much planning and experimentation several authorities did set up their own broadcasting network. Two of the most successful schemes, while they lasted, were Glasgow and Inner London. The Glasgow Local Education Authority Television Service was inaugurated by Her Majesty the Queen on 27th June 1966. William Beaton (1967) explained its cost and facilities: A well equiped television centre in an existing LEA building, comprising two studios cost £64,700 to build. A two channel cable distribution system used 100 miles of cable and 18 repeater kiosks to link the centre to 320 schools and FE colleges. An administration and technical staff of 10 full time personnel were assisted by several part-time or seconded teachers.

The service went on the air with an initial budget of £70,000 per annum. One of the initial two programme series was on modern mathematics for secondary schools. It is of particular interest as it is linked closely in content and character with the then new school text books "Modern Mathematics for Schools" developed and tested in Scotland by a team of nineteen teachers and lecturers known as the "Scottish Mathematics Group". This set of texts was one of the first to follow the 'modern maths' approach and the television programmes made by the LEA must have been an invaluable aid to teachers in the classroom who had, up until then, been using traditional methods and schemes.

The Inner London Education Authority (ILEA) set up a similar system a few years later using cable linked to its 880 primary, 230 secondary schools and 120 special schools and colleges. It was a more expensive and more ambitious project than that in Glasgow and in fact had a longer life, as it still exists today, albeit in a much smaller form, whereas Glasgow has ceased production altogether.

However successful these local networks may have been, the expense was enormous and their future insecure. Until video tape recorders had become widespread there was still the problem of time-tabling classes to match the broadcast times. The Glasgow experiment was considered by

J. F. Murray (1978) of the Scottish Council for Educational Technology as

"an effective local service answering local educational needs related to the Scottish curriculum".

Local teacher involvement was one of its assets as was the fact that whereas it took the BBC between two and four years to produce a programme from conception to transmission, in Glasgow this process took an average of six months. However, the end was near in 1975 at the time of local government re-organisation. Glasgow Corporation became only a small section of the large Regional Authority of Strathclyde. One year later, the service was closed down. Murray saw several reasons -

at a time of economic stringency the annual running costs of £400,000 was a nice sum to be dispensed with.

the new authority argued that it could not maintain such a service in only one of the divisions under its control, and

schools had been expanding with more restrictions being put onto the organization of the timetable, matching classes with transmission times became low priority.

"Whatever the rights and wrongs of the situation were, the decision was taken and a service that combined a high degree of technical and educational expertise, with a vast potential to fill a real gap in the Scottish Educational broadcasting scene, was disbanded, and has not been re-instituted." (Murray, 1978)

The ILEA service was radically cut back in 1979 for similar reasons. However it was seen that the increasing use of VCR's in schools at that time, meant that there was an alternative to renting at high cost, the distribution lines from the Post Office. Now, ILEA produced video material is available for purchase or hirefrom ILEA Learning Resources Branch along with other teaching material.

Local Radio

Local Radio stations started in the early 1970's and have increased in number ever since. Under the Broadcasting Acts of 1973 and 1981 they were to provide a source of information, entertainment, and education. In order to fulfil this last service, station managers realised that the BBC and IBA already made reasonable provision to the community on their national networks, and that it was the challenge of Local Radio to find new approaches and new audiences. This they have done, and the educational service they now provide can generally be described under three categories:

1) Programmes which do not conform to a subject syllabus and in many cases, do not have a set place in the school timetable, such as advice on careers and local job opportunities, personal relationships, revision techniques, and local leisure pursuits.
2) Programmes which make use of the local aspects with discussion of local issues, competitions and quizzes, using phone-ins and interviews.
3) Programmes which help to build up a relationship between the radio station and local schools, such as publicising and promoting school events, encouraging visits by pupils to the studios, and inviting classes to make shows for transmission over the radio.

In the field of mathematics little has been done by local radio, however there have been some initiatives in some areas which are of interest:

During the Spring term of 1984 Capital Radio invited classes of pupils to take part in a 'Plan Your Own Radio Programme' competition. Interested schools were given timing details of various advertisements, news items, a phone-in competition, traffic and weather reports, and other items, together with a list of records and their duration. Pupils were asked to work with these lists of times in minutes and seconds and plan a $2\frac{1}{2}$ hour morning radio programme! Quite a difficult task, especially os new items and commercial breaks had to be at certain times during the show. It was good public relations exercise which also made pupils aware of how mathematics is used in the most unlikely of places. The competition attracted over 2000 entries which is a good measure of its success.

In Liverpool, a successful mathematics competition has been run since 1978, organized jointly by Mathematical Education on Merseyside, (a group of educationalists at Liverpool University) and the local independent radio station, Radio City. The competition is in the form of a mathematical quiz between teams of three pupils, under $14\frac{1}{2}$ years of age, from secondary schools in and around Merseyside. Originally eight schools were invited to enter a team. Each half hour contest was recorded and broadcast during one evening each week. Questions were either of the quick mental arithmetic type or of the larger problem solving type in which case teams had several minutes to answer while a recordwas being played. The fact that the competition, 'Radio Challenge', is now in its eigth year and has been expanded to include 'Senior Challenge' for older pupils obviously shows the success of the venture. In recent years schools have been given an open invitation to compete,and one organized into seven areas. Local teachers run competitions within their locality until a winning team is found. The seven winning area teams then,

together with the previous years 'Challenge' winners compete in the knockout contest, each round of which is recorded and broadcast.

A competition of a similar nature is organized for Sheffield schools by members of Sheffield University and broadcast by Radio Sheffield. Sometimes the winning team plays its counterpart from Liverpool in a friendly contest.

Teacher Education

The use of broadcasts to help the in-service education of teachers has been going on for many years in a variety of ways. Not just with the education courses of the Open University but with the continuing education programmes of the BBC and with the use of video cameras and recorders to examine classroom practice in ILEA and at major universities.

The BBC emphasised its commitment to this role in "Broadcasts and Teacher Education" (1981).

"Programmes on radio and television designed for teachers and members of the general public concerned with education, together with accompanying books and booklets, have been an integral part of BBC Education's output for over 20 years".

They also feel, quite rightly so, that any series of programmes for schools, whether produced by themselves or by the independent companies, not only educate the pupils but give ideas of content and styles of teacher to the teachers themselves:

"It is our belief that it is not sufficiently widely recognised that one of the most potent resources for covert teacher education is school broadcasting. In our radio and television programmes aimed at children in classrooms, but mediated by teachers, will be found new curriculum ideas, new teaching techniques and righ resources for in-service work".

A good example of this could be found in the series "Maths Today" first broadcast in 1967. It was a two-year course in modern mathematics directed as much towards the teacher as to the 11-13 year olds in the classroom. The teachers noted for the series amounted to 500 pages on the philosophy of the new approach as well as information about programme content and follow up material. The BBC made a radio series "Developing Maths Today", a television series "Teaching Maths Today", and published a book, all to help the classroom teacher to make full use of the school programmes.

Other broadcasts for practising educationists are made by the BBC's

Continuing Education Department. Special attention was given to this area during the three years 1972-1974 with the BBC Inservice Education Project for Teachers (ISEPT). It consisted of programmes on three themes, one for each year: the raising of the school leaving age, primary education, and middle schools. This project consisted of a three-media package: television, radio and print. Since then the BBC has contributed with a variety of programmes about a variety of issues. Over the last few years much emphasis has been placed on computer literacy. Several series have been made to help teachers in this new curriculum area and copyright restrictions have been relaxed to allow the recording of programmes for using in the classroom. 'The Computer Programme', 'Making the Most of the Micro', 'The Electronic Office', 'Computers in Control', and 'The Learning Machine', are all in this category. Currently the BBC offer one series of five programmes for mathematics teachers, 'Mathematical Thinking' which looks at ways of taking the Cockcroft Report into the classroom.

Adult Education

An important need which has to be fulfilled by a broadcasting service in a developing country is to educate the adult population. Many would argue that this should also be one aim of a radio or television service in any country. For many years there has been a wide spread view within broadcasting establishments that general broadcasting is educational broadcasting. A British Government enquiry into adult education (DES, 1973) (the 'Russell Report') commented that:

"the principal adult education force in Britain today may well be the general television output of the BBC and Independent Television".

Anthony Bates (1984, p 119) believes that a similar view is held by controllers of the Public Broadcasting Service in the USA:

"'quality' general programming - including many programmes bought from the BBC and ITV companies - constitute a large part of the putput of this national educational network".

Bates suggests (1984, Ch 6) that present adult educational broadcasts in this country, generally referred to as Continuing Education, can be divided into three categories: programmes for the dis-advantaged, general interest programmes, and what he refers to as 'up-market' programmes.

The first are those aimed at minority audiences such as the deaf,

or the illiterate. The second, general interest programmes, are for larger audiences, and are concerned with the non-academic, non-vocational, everyday interests of the adult population. The last category are programmes for people who are committed to improving their knowledge or skills in certain areas, either academically or career-wise; for example 'Trade Union Studies' or 'The Effective Manager'. According to Bates during 1981 there were a total of twenty nine series on all three categories of adult education offered by the ITV companies and thirty four broadcast by the BBC.

Adult education programmes specifically designed for that purpose, as distinct from programmes that happen to have an educational element, arrived on the scene in about 1927 when a series of early evening radio talks on social history were broadcast by the BBC, and supported by a published pamphlet. The year before J. C. Stobart, a former Board of Education inspector on the BBC's staff wrote to his old employer Lord Reith outlining a plan for a 'Wireless University' providing courses for all members of society. From little acorns large oaks grow! Was this the beginning of the Open University?

Greater strides were taken in adult education after television had arrived. Experience gained by producing programmes for schools was put to good use in preparing programmes for wider audiences. In 1960 Rediffusion brought viewers back to the classroom by repeating its successful schools French series in the evening to adult audiences. It is a testimonial to the quality of Schools Television that this repeating of series to adults at home often happens today. In 1962 Scottish Television started a series of medical programmes for practising doctors and in the same year Ulster Television successfully brought the words of distinguished academics into our homes in a series of forty-two half-hour lectures by the staff of Queen's University, Belfast. Areas of discussion include law, literature, music, physics, history and economics. With contributions such as those made by both the BBC and the Independent companies, the Government granted in 1963 extra broadcasting time for this purpose, and from then on the adult education or continuing education service expanded rapidly to what it is today. The appearance of BBC 2, the second public television channel in 1964, and the second independent one, Channel 4 in 1982, added to the amount of time that could be made available for broadcasting in this area. Channel Four in particular has an unparalleled commitment to education with 15 per cent of total output, and it has an educational management team made up of senior staff from the Open University.

Adult Numeracy

During the middle of the 1970's there was a growing awareness of the lack of basic education among a large section of the adult population. Abroad there had been a rapid expansion of the use of broadcasting for adult literacy and in the mid 70's this movement spread to Britain. The BBC helped to initiate the Adult Literacy Campaign in 1975 which was a complicated, but successful, venture involving joint action by several organizations. The broadcasting company spent £800,000 on the production of two television and four radio series, and the Gvoernment put £3 million into the Adult Literacy Resource Agency which was distributed to local authorities and voluntary agencies to set up courses and discussion groups at the local level. A further £3 million was contributed by the local authorities themselves, and other financial assistance was provided by charitable sources for a telephone referral service. The total budget for the three year campaign was well over £7 million. (see Bates, 1984). It was with this work going on around them that broadcasters began to think about the need for numeracy tuition. Several surveys produced estimates of one in ten adults not being able to add up the cost of a few items and one in four adults could not calculate the change from a five pound note. (Yorkshire Television publicity brochure, 19). The BBC had produced mathematics programmes for their Continuing Education broadcasts for many years, but the nearest they had got to basic arithmetic was a series of programmes in 1977 aimed at college students "Focus-on Numeracy". They were designed to be used in General Studies groups of further education and no attempt was made to direct them towards the general public.

The first real venture in Britain into open numeracy education came from the combined forces of Yorkshire Television and the National Extension College (NEC). It started off in a fairly moderate way but in fact was to turn out as the start of a major numeracy campaign continued in later years by the new Channel 4. Yorkshire Television produced a series of thirteen half hour programmes called "Make it Count" which were first broadcast on the independent network early in 1978. Home study materials were available from NEC. There were two aims of the project: firstly to improve the audiences' skill at elementary arithmetic, and secondly to encourage them to enter tuition in the local community. It was seen that an important component in the success of the Adult Literacy Campaign over the previous three years had been the work viewers had been encouraged to do at their local adult

education classes. The programmes used large amounts of film and graphic material, in which the presenter, Fred Harris a graduate in mathematics and a former teacher - took viewers through the simplest exercises. Animated film showed, slowly with frequent repetition, how to set out the figures and how to "carry" from one column to the next. Topics covered included number recognition, the four rules, percentages, fractions, decimals, practical maths, and aids to quick calculation.

The IBA considered "Make it Count" to be such an important contribution to educational broadcasting that it funded a fellowship to carry out research into the success of the series. David Stringer (1979) reported that audience ratings estimated that $\frac{1}{2}$ million people watched the Sunday morning broadcast and 2-2$\frac{1}{2}$ million watched at Thursday lunchtime. Further study was made of the more serious viewers who bought the study packs from NEC. Of these, about 30% were school children, the rest being almost equally distributed throughout the age range up to the age of fifty. Of the adult participants, there were about twice as many women as men, 40% had left school at the minimum age with no qualifications, and of the rest although many were well-qualified in other areas, hardly any of them had made any attempt before to improve their bad arithmetic.

There is no doubt that the programmes were well received. In the first few weeks, Yorkshire Television received over 1,200 letters from viewers, most expressing gratitude that at last someone was doing something to help them. During the series, NEC sold 8,000 student workbooks. However, from the two original aims of the project, Stringer reported one was a great success, but one was a failure - very few viewers made the effort to contact local education authorities to find out about joining tuition groups. In fact had they done so many would have been disappointed. Local Authorities were still involved in the literacy project and at a time of cutbacks there was no extra money available for numeracy courses. But the fact remains that few home learners attempted to look for help elsewhere. The reason that the Adult Literacy Campaign succeeded in this respect while "Make it Count" failed was that the literacy campaign brought in the link between television and the local tutor right from the beginning. Cross referenced were made from one to the other, both programmes and courses were well advertised, and much planning was done to bring the two sides together. But all this takes money and the Adult Literacy Campaign had the financial backup while 'Make it Count' had not.

The BBC, not wishing to compete with the independent network on education, delayed its efforts in this area until "Make it Count" had emerged. Then it made plans for a series aimed at those who had the necessary arithmetic skills but who had difficulty using them in every-day situations. Ten programmes, accompanied by a book, began in April 1979 under the title "It Figures". Dramatised sketches and documentary film were used to illustrate real-life problems. A telephone referral service was also available to put viewers in touch with additional help - a successful part of the Adult Literacy Campaign. Over the last five years the BBC has tended to produce programmes for adults above the level of what can be called basic numeracy. For example a current series which has been broadcast for some years is "Maths Help" - a series of twenty short programmes, covering the topics of a typical 'O' level syllabus for adults studying this course at evening classes. It may also have some benefit to pupils in schools and copyright restrictions have been relaxed to allow for recorded use in the classroom.

Yorkshire Television in 1979, encouraged by the audience reaction to "Make it Count" decided to make a second numeracy series. "Numbers at Work" followed the pattern of the earlier series with an accompanying publication from NEC and a similar style of presentation from Fred Harris. The content continued on from basic number work to look at examples of how these skills are used in various places of employment. The importance of estimation is emphasized. There are many examples shown of measurement, reading dials and scales and completing charts and graphs. The programmes were shown during 1980 and preceded by a repeat of the "Make it Count" series. Little evaluation of this second series was carried out until the advent of Channel 4.

In 1983, the first year of Channel Four, Yorkshire's two numeracy series were purchased and repeated while the new company's policy on Adult Education took shape. Recent evidence, including a survey by Gallup Poll financed by the Advisory Council for Adult and Continuing Education, showed there was still very much a need for numeracy tuition among the adult population: 30% had difficulty in reading a railway time-table, 20% could not work out a 10% tip on a bill, and 50% did not know what was happening to prices when the rate of inflation was dropping! This evidence, combined with that from the earlier IBA fellowship report, caused Channel 4 to decide to make a major commitment to numeracy over a continuing time period. The two existing YTV series were up-dated and reduced to ten programmes each, and a new third series was commissioned.

This was similarly produced by Yorkshire Television and comprised of ten half-hour programmes. Later programmes of "Numbers at Work" asked for viewers suggestions for topics to be included in the new series. Thus "Counting On" consisted of some themes from the first two series taken further and some new topics introduced such as the calculator and home computer. Fred Harris was again the presenter, but this time in a magazine format with each programme having a distinct theme, which was announced by Fred at the beginning. The National Extension College again published a book for serious viewers, and also offered a free, computer-marked, quiz in which the audience was invited to participate.

During the first showing of "Make it Count" and "Numbers at Work" on Channel Four audience ratings were collected by BARB, the Broadcaster's Audience Research Board. These showed that the two series stood up well in relation to other educational offerings broadcast by the company on other evenings, with the second series being not quite as popular as the first. The population profile for "Make it Count" indicated that the series reached proportionately more older and less well educated women. (Sargant, 1983) The start of the new series "Counting On" in 1983 was timed to coincide with the first 'Numeracy Week', September 12th to 19th, organized by the government sponsored Adult Literacy and Basic Skills Unit (ALBSU). The week was intended to raise awareness of the problems many people encounter with numbers. It was promoted through a number of activities: the Post Office franked letters with a special 'Numeracy Week' message, posters were distributed to post offices, job centres, libraries, and other public places, and numeracy tuition courses were started both on a national and a local level. In fact in the years between the first YTV showing of "Make it Count" and the 'Numeracy Week', local education authorities had begun to see the need for local provision in this area, and many adult education numeracy courses were already in existence. This was a much more determined campaign, backed by government finance, than the YTV project three years earlier, and as such had a much greater impact on the population.

Evaluation of "Counting On" was carried out by the British Market Research Bureau. Over five thousand people, aged 15 and over, were interviewed in November and December 1983 and their answers analysed in detail. 3% stated that they had seen at least one programme (about $1\frac{1}{2}$ million estimated viewers) whereas 70% did not know it was on; 19% deliberately avoided the programmes, stating they were not interested. From the 3% who had seen at least one programme, some could remember

little about it, having seen only one. The rest, about 2% of adults, or an estimation of 850,000 people were then considered by the research bureau to be the audience. Many of these watched with children, and in general the audience was a good cross-section of the usual viewers to Channel Four, but with a small bias towards women rather than men. The desire to see further programmes of the same kind was quite low, but the series was overwhelmingly seen to be both helpful and useful to people with number problems. The main reason given for people not watching the series was that they were not aware of it. (The British Market Research Bureau Limited, 1984 for Channel Four Television).

The three numeracy series were shown again during 1984 in the same time periods, Spring, Summer, and Autumn to try to coincide with the terms of adult education classes to try to encourage tutors to refer to them. There is no doubt that Channel Four and Yorkshire Television have made a major contribution in attempting to combat adult innumeracy. It is hoped that further work will be done by all broadcasting agencies in this field in the future whenever there is seen to be a need.

5. The Future of Educational Broadcasting

Changes in Distribution

Although over the last sixty years we have seen a continual development of the education service provided by the broadcasters in this country, its future, in the same form, is by no means certain. A few years ago, (Murray, 1981, p 11), it was hoped that some expansion of the service may have been likely by providing an educational radio channel on the VHF band in place of the frequencies currently used by the emergency services; or that the part of the VHF band previously used for the old 405 line television transmissions could be used for a television channel devoted to education. However there has been no sign yet of any serious plans to move in either of these directions. Perhaps what is more likely, is that there will be more room for educational services on future cable or satellite systems. Cable has the capacity for a large number of channels and has greater potential as far as educational broadcasting is concerned. There could be local programming by local educational institutions, increased interaction between the broadcaster and the student, and generally a more specifically targeted service. Of course the transmission of television signals by cable is nothing new; an earlier chapter describes the experiments in LEA television in Glasgow and London; but modern technology, the microchip revolution and the lowering costs of cameras and other video equipment means that cable television today is a much better financial proposition and can offer much more to the consumer than the local education services offered to schools twenty years ago.

In America, the cable industry is more of a reality than here in Britain and is expanding rapidly. One of the most successful and technological advanced systems is called Qube and operates in Columbus, Ohio. Described by Rowley (1981) the interactive network allows for audience participation by allowing them to 'vote' with a keypad when invited to do so during a programme. Results are displayed almost instantaneously and it provides an invaluable opportunity to sample opinions or reactions, providing statistics on all aspects of life traditionally gathered by opinion poll organisations using questionnaires.

A satellite system is another way forward. They have been used successfully to relay television signals internationally for many years, but their use in transmitting to households across the nation is still very much in experimental form. Britain plans to send a satellite into

space for our own domestic use within the next few years. Compared to cable, it has the advantage of the signal more easily reaching remote areas, and would benefit viewers in the highlands of Scotland for example, which at present suffers badly from poor reception. On the other hand satellite transmissions cannot contain the large number of channels of cable television.

Some interesting experiments in using satellites for education purposes were carried out in the seventies. In 1974 the satellite ATS-6 was positioned over the Appalachian Mountains in the USA and was used to transmit four in-service courses to teachers. It covered a large mountaineous area having poor ground communications and extreme weather conditions. It was difficult for teachers in the small isolated communities to receive normal in-service training, but with dish aerials set up at fifteen sites some one thousand teachers were able to receive programmes transmitted from the University of Kentucky, at Lexington. At some of the sites there was also a radio link back to the University via a second satellite, ATS-3.

A year later NASA repositioned ATS-6 over India where it was used in the Satellite Instructional Television Experiment (SITE) organised by the Indian Space Research Organisation during 1975 and 1976. Two thousand four hundred villages in less accessible parts of India were equiped with a television set and a dish aerial placed in their community centres. Programmes of an educational nature were broadcast, with one great advantage of the system being that there were several audio channels, and listeners could choose the appropriate one according to the predominant language of the village. One series, on the natural sciences was broadcast for teachers to try to improve the teaching of the subject in the community schools. Evaluation of SITE showed up several problems: the hardware was not properly maintained and receivers were often out of use; there was a shortage of experienced writers and producers to make good programmes; and there were difficulties in communicating to villagers who were unused to the medium of television.

What makes developments in this country in the field of cable and satellite education systems uncertain is the financial aspect. If such systems are set up for entertainment broadcasting the consumer must be prepared to pay for the rental of a cable to his house or for the cost of a dish aerial in the roof. These charges are likely to be more than the current price of a television licence. If the educational broadcasting service is expanded to occupy a separate channel either on cable or satellite transmission, who will pay? Is it likely that the present

duopoly of the BBC and IBA would put more financial resources into their educational service - I think the answer is no! The present schools programming and continuing education service are financed from the total revenue of the companies whether from the licence fee or from the advertisers. There is always pressure to keep costs down and there is great competition for funds between the different departments of the companies. Murray (1981 p 26) showed concern that the evidence of under-use of broadcast material in schools could cause a cutback in the educational service currently provided:

"The future of educational broadcasting must depend to some extent on evidence that the resource provided by the broadcasters is valued by the teaching profession, and those in education must be very cautious in the demands they make of broadcasters while there are indications that the resources provided are both undervalued and underused."

This concern is justified by the evidence that in 1980 the BBC proposed to cutback schools broadcasting by axing the whole of the Scottish output, and suggested that it could be replaced by a service jointly funded by the BBC and various sectors of the Scottish educational system. Fortunately the proposal was not ratified.

Any expansion of the present educational service into a separate educational channel is likely to come from commercial enterprise. Organisations such as the National Extension College could well be interested in providing a service similar to that of the Open University but on a less academic basis. Such a service would be paid for using metered television sets or rented cables. Schools programming, if desired would be financed by local education authorities. One could argue, however, that once education becomes separated entirely from general output programmes, and especially if it becomes a charged service, then the educational value of broadcasting rapidly diminishes. The service would only be used by committed students at home or by pupils in schools. Other viewers at home may well be 'frightened off' by the television 'lessons'. Developing countries are especially aware of the importance of integrating educational material with the other component parts of broadcasting in order to raise the standard of education of the adult population.

Broadcasting for recorded use

The increasing popularity of the video cassette recorder (VCR) both in the home and in our schools is make the broadcasting organisations rethink the style of their programmes and their method of distribution.

In the last few years it has been clear that all secondary schools and the majority of primary schools use educational broadcasts in recorded form. Using a VCR it is not necessary to match the timetable with transmission times and programmes can be previewed by the teacher and repeated several times to different classes. The BBC and IBA have recognised that this change in usages has several implications:

The transmission times do not have to be during school hours but can be more economically moved to off peak times, being replaced by more popular programmes for adults at home.

the programmes may be made in small segments to allow for other work or discussion by the teacher in between.

and individual sections of teaching within the programme need not be bridged together with a continuous flow of ideas, as in the classroom they be used as separate illustrations at different times.

The BBC has been the first to make changes along these lines. In 1983 it switched some secondary schools radio from afternoon to night-time transmission and in this year (1985/86) it has begun to do the same with schools television. With advertising revenue uppermost in their minds, it seems certain that the independent companies will soon follow suit. For several years all parties have been transmitting programmes which allow teachers to pick out individual sections for use with a class.

It is possible that in the future the distribution medium itself may be changed. In 1983 the Open University cut back its radio transmissions to less than 13 hours per week, finding it more economical to send pre-recorded radio cassettes to its students. Blank cassettes can be purchased and recorded on very cheaply and depending on the number of students on a course, may be very much cheaper than transmitting the programme over the air. Will the same soon apply to video-cassettes? They are much more expensive than the smaller audio variety, but of course so is television transmission time more valuable than radio. Evidence that broadcasting companies may be moving in this direction could be taken from the fact that last year the BBC set up its 'Radio Shop' which deals in the selling of radiovision filmstrip and schools radio recordings on cassette. Whether there is any plan to extend this to the selling of television programmes on tape is speculation. Educational programmes made by other organisations are at present available on VCR cassettes for purchase from the Inner London Education Authority and by the Educational Video Index.

Any change to put educational programmes on a strictly commercial

basis such as the selling of pre-recorded tapes would do serious damage to educational broadcasting in this country. Firstly it would eliminate programmes for minority audiences as they would not be profitable, secondly it would cease to be a free service and would therefore increase the educational differences within society. It would compare, admittedly on a smaller scale, to the closing down of all state schools and the expansion of private education. Not everyone would be able to afford to buy the video cassette recorder and the cassettes, or to rent a cable connection to their house, or to put a dish aerial in their roof to receive satellite transmissions. It would not be education for all, but education for those who could afford it.

Computer and Microcomputer Developments

Over the last few years more and more consumers have been buying television sets with the extra circuitry required to receive the teletext transmissions of Ceefax (BBC) and Oracle (ITV). This is a one-way communication of information from a central computer to our TV screens, and at present is rather limited in the amount of information it can display. So much so, that most of the data is of a general nature, geared to maximum audiences, for example sports results and weather forecasts. A more important development as far as educational broadcasting is concerned is its use in transmitting computer programmes over the air straight into micro-computers. The BBC has successfully carried out experiments using Ceefax to send programmes to schools or homes which have the BBC/Acorn computer. The technology is there for future development in linking a television signal with a micro-computer program which has obvious potential in the field of mathematics.

Other areas of the curriculum may find that the much larger database of Prestel has more value in schools. This is the British Telecom viewdata system which is transmitted along the telephone lines. It has the major advantage over teletext of being a two-way communication. By asking certain questions of the computer, the user may delve deeper and deeper into a particular subject. Although it has no sound, and limited graphics potential at present, its future development may produce a product which has a high educational value.

The micro-computer first arrived in our schools about six years ago. Since then the quality has improved in terms of colour and greater storage capacity, while the price has come down. Today we are more likely to see networks of machines in our secondary schools rather than the odd one or two. Their purpose is not just to teach young people the

computer skills required for their future lives in this technological age, but also to provide an important teaching aid and a resource for individualized learning. Computer Assisted Learning (CAL) has been with us for many years. First experiments in the USA involved costly mainframe computers and enough terminals in the classroom for pupils to use individually or in pairs. CAL programmes have been expensive, take up large areas of computer memory, and rely heavily on textual, graphical and animated presentation. Its main advantage is that every pupil has his own patient teacher to communicate with and to work with at the pupils own pace. CAL is becoming more important now that the microcomputer is cheap and is becoming increasingly larger in terms of memory. CAL packages can be used without too much extra cost; but at present it lacks two important qualities: the human voice and high quality moving pictures. The video recorder can produce both of these, as can the recently developed video disc which has the advantage of faster access time. Work is going on to try and connect the video recorder and video disc to the microcomputer to try to produce a more sophisticated Computer Aided Learning package.

A prototype microcomputer based audio-visual teaching system called CYCLOPS has been developed and tried at the Open University. In this experiment the video signal from computer graphics is digitised and converted into a sound signal. This is then transmitted along telephone lines to other users. The work at the O.U. was funded by British Telecom (see McConnell and Sharples, 1983) and the system has also been tried in schools in a project funded by the Microelectronics in Education Programme (M.E.P.) It is clear that developments of this kind, combining the strengths of different media together in one multi-media system will certainly pose a threat to the service offered by the broadcasting companies. Will they join in with this development and survive? Or will they stand alone, trying to exploit the unique strengths of broadcasting to the full in the hope that the educational value of the service will continue to be recognised?

6. USING MATHEMATICAL BROADCASTS IN THE CLASSROOM

Some general comments:

G. Moir (1967):

"If a class is to derive maximum benefit from a series, the teacher must give as much thought and care to its selection as he would do to the choice of a new set of textbooks or to hiring a film for a specific educational purpose. It is essential that the level of the series should be right for the class in question, and that the subject should have relevance to the body of learning into which it is to be placed. This means that the teacher must ensure that he has access to all the ancillary literature which is published, to enable him to choose the right series for the right class and to use the programmes well."

Although Moir's comment is an excellent piece of advice to today's teachers, it was written before video cassette recorders (V.C.R.'s) appeared, to make our lives easier. Bearing this in mind a few more sentences need to be added:
It is also imperative that the teacher confirms the description given in the broadcaster's literature by previewing each programme a day or so ahead. He should then consider whether it should be used as a whole or in separate parts, and what additional explanations or supplementary work by the pupils is necessary to reinforce the learning process.

C. G. Hayter (1974) emphasises this reinforcement and points out also the problems with class movement in the report of his study into the use of broadcast material:

"In the simplest terms, the use of a broadcast programme involves what happens before it is taken and what happens afterwards - preparation and follow-up. There is ample reference to these stages in all sections of this report and to the disadvantages of separating them from the programme owing to the length of a lesson or to the necessity to move to and from a viewing room immediately before and after a programme is taken."

The pupils themselves value this supplementary work: The Jordanhill College of Education study described by Aileen Macintyre (1981) involved collecting information on pupils attitudes to broadcasts in school. They found that both primary and secondary children enjoyed using television and radio in lessons and the majority strongly prefered the teacher to prepare them for, and to follow up, the broadcasts; in fact many added that they felt they ought to do more of this work.

In a general sense, these comments from both pupils and educators are worth noting, however there are some mathematical programmes (and perhaps some in other subject areas too) which stand by themselves with little or no supplementary work required as a twenty minute slot of valuable educational relaxation . . ."Now for something completely different . . ."! One such example is the BBC TV series "Maths at Work" which shows how different teenagers use the mathematics they learn in school, in the work environment. Ideally the subject area described could match that being currently taught but this is not essential. Used occasionally programmes like this add to the mathematical experience of the pupil without hindering the progress of the subject.

In the survey of the mathematics departments of secondary schools in Northamptonshire described in the next chapter, it was found that in practice there was no standard pattern of broadcast use in the classroom in mathematics. Most departmental heads recognised at least some importance in general in matching the subject matter of a programme with the work currently being taught; although a similar number stated that programmes were sometimes used in isolation to the other work in the classroom. It was generally accepted that supplementary exercises had a part to play in the use of broadcast material.

Making full use of the resources available - A practical situation.

Bishop Stopford C of E Secondary School is a 11-18 Comprehensive with 925 pupils on roll of all ability levels. It is one of six similarly sized schools within the town of Kettering.

Within the mathematics department of B.S.S. it was decided to make a concerted effort to make more use of broadcast material during the 1985/86 academic year. Up until then some maths television series were used by some teachers i.e."Maths at Work", and "A Level Statistics", but by no means was full use being made of the available facilities. Certainly radio had never been tried in recent years. It should be noted that Computer Studies 'O' and CSE level courses were run within the department and regular use was made of the BBC TV series "The Computer Programme".

The facilities available were good: the department had for its own use, a colour television and a VCR on a trolley which was moved between rooms on the same floor and a second television which was generally stationery. The mobility of the VCR was a disadvantage when regular timer recordings had to be made as each time it was unplugged from the mains the clock had to be reset. What was needed was a timer which ran from

a separate battery supply - if such a machine is ever made! However it was only necessary to record series which were newly broadcast - copies of those which had been broadcast during previous years had been made available from Northamptonshire's mathematical resource centre. A radio cassette player was also available for departmental use but it was fairly small and had been untried in the classroom environment.

In mathematics, the careful selection of a work package, which may or may not include a television or radio presentation, for a particular group of children is of paramount importance. Mathematics is a collection of skills; for a particular age group, the level of proficiency at these skills may vary considerably from the weakest pupil to the strongest. Cockroft (1982) reported a seven year difference in the mathematical ability of 11 year olds. It is therefore impossible for a rigid scheme of work to be used successfully for all pupils within the comprehensive school year group. A well written and presented twenty minute television programme may well live up to the broadcasters aims: 'suitable for the whole ability range' but pupils of differing abilities will learn different things from it! Follow up material would have to be far more flexible; there should be options available for the class teacher to choose according to his pupils.

At Bishop Stopford School the pupils are set in mathematics from year one onwards. In this first year there are two equal bands of three sets in each, whereas in other years there are six or more sets across the whole year group. The scheme of work followed, as in most other schools, is a list of topics for each year group or set which needs to be covered each term, designed around a set of text books and external examination syllabuses. A rigid list such as this, helps pupils who may move between sets, and aids continuity when classes change teachers. But as mentioned above, there must be flexibility; the individual class teacher decides to what depth a topic is taken and what exercises are chosen. It seemed important that whatever broadcast material was chosen to be used it should be included in the written scheme of work leaving the class teacher to decide how best to fit this resource into his own particular style of teaching.

There seemed to be three ways in which a department may plan to use broadcast material in the classroom:

1) Find suitable programmes to help pupils understand particular topics from the set scheme of work. In which case the individual teacher may vary the order in which the topics are taught or may use different practice material than was used before in order to fit in with the methodology of the broadcast.

2) Programmes may be found which are useful in teaching general mathematical ideas, and together with suitable introductory and follow up work if necessary, would be short enough not to interfere with the written maths scheme. Their value should not be underestimated as they contribute to the general mathematical experience of the pupils.

3) A broadcast series may be found which is considered so valuable that it is worth re-writing the set scheme of work to fit in with the topics covered in the series. This may well involve changes to the curriculum in other years and only a long trial period would decide whether the upheaval was worthwhile.

It was decided that if the department were to make more use of broadcast material, it had to be along the lines of (1) and (2) - at least initially. The type of major change described in (3) could not be justified until it was sure that using TV and radio in the classroom suited both teachers and pupils and that the facilities in the department could adequately cope with the number of users.

While searching through the BBC and IBA publications, it was noticed that some current mathematics series overlapped the primary/secondary age division. "Mindstretchers" (10-12 years), "Maths Score Two" (10-11 years) and "Johnny Ball's Maths Games" (Upper Primary/Middle) were all stated in the BBC leaflets as being suitable for the upper end of the primary school and for the lower end of the secondary school. It was clear that before we considered using any of these series with our first year we had to find out from our feeder schools whether any pupils had used the programmes before. At Bishop Stopford School this was a far more difficult task than might be imagined; being a Church School, it could take children not just from the Kettering area but from the whole of Northamptonshire. Even some pupils from over the Leicestershire boundary 12 miles away applied to be enrolled and were accepted. In theory the number of feeder schools were too numerous to mention but in practise there were about forty which regularly contributed pupils, even though it may be only one or two each year. When a general questionnaire asking for details of the mathematical education of their pupils was sent out by the department to the forty or so main feeder schools, a small section was included which asked for the broadcast series used by the schools to be listed. The questionnaire, and relevant results are given in Appendix I.

It was decided for several reasons to use the first year as a starting point for introducing broadcasting to the mathematics curriculum: The range of ability was lowest in this year and it was possible to use a series across the whole year well before any differentiation took place between C.S.E. and 'O' level courses. There was also more mathematics series to choose from at the lower end of the secondary school. Four seemed to be particularly interesting: "Johnny Ball's Maths Games", "Maths File", "Mindstretcher" and "Mathematical Investigations", and in the event the first two were chosen to be used in the first year. "Maths Games" was listened to and it was considered a very valuable series if Johnny Ball's enthusiasm could be transferred to his audience. It also had the advantage of requiring a radio recorder rather than a VCR and therefore being easier to organize. "Maths File" was appealing for its humour and also for the fact that the mathematical content of many of the programmes matched the work done with the first year. "Mindstretcher" was thought to be very interesting but not always of a mathematical nature and it was felt that it would be better placed within a "life skills" course rather than in the mathematics lessons. "Mathematical Investigation" was a new series for 1985/86 and the broadcasting of the programmes did not match up with the order of topics covered with year one and consequently could not be used during 1985/86 without major syllabus changes. However it was decided to record the series and possibly use them with the lower school in later years. The results of the primary school survey showed that "Johnny Ball's Maths Games" was used by five of the thirty three feeder schools which sent in returns, however on considering the number of pupils Bishop Stopford School received from these five feeders it was felt that no more than 10% of pupils would have heard the programmes before and consequently this did not affect the decision. It was noted that "Maths File" was used in one of the schools that replied. Brief descriptions of how the two series were used are given below and details of programme content are given in Appendix II.

Johnny Ball's Maths Games

The first series of these radio broadcasts consist of ten programmes, each of ten minutes duration. Pre-recorded cassettes were purchased from the BBC Radio Shop, and after listening to each programme it was decided that all ten should be written into the first year scheme of work to encourage teachers to use them. Two programmes in particular tied up well with two topics taught during the year and these had to be used at the relevant time. The other eight were of a more general nature and

could be used at any time in isolation to the current work being done.

Maths File

This television series contained ten twenty minute programmes, but only six seemed relevant to year one pupils. Five of these matched up well in content with the syllabus and their use was written in to the scheme of work at specific places. Teachers were asked to use the other programme at any time during the year.

Some explanation of the first year classes is necessary. Time-tabling restrictions have necessitated the 160 or more first year pupils to be divided into two equal ability bands. Pupils in each band are then placed into three sets according to their mathematics ability. During the 1985/86 year the six sets were taught by five different teachers, one of which was the author. It was made clear to all first year teachers that it was important that all programmes be listened to, or viewed, in advance. Some thought could then be given to how each could best be used with their particular set of pupils. It was expected that all teachers should use the "Johnny Ball" published worksheets, whereas with "Maths File" supplementary exercises should be chosen from the first year text book. No direction was given as to what exercises should be used.

While this extra burden was placed on teaching time in the first year, nothing was removed from the scheme of work. One important consideration to be taken into account when judging the value of the broadcasts at any particular time during the year, was whether the use of a series or of an individual programme was worth the time spent on it.

Although the experiment had only been running for a third of the complete school year, the completion date for this dissertation meant that it was necessary to ask the teachers involved for their comments on using the series at the end of the Autumn term. The four teachers (not the writer) were asked to complete a form (shown in Appendix III) on which six rather general questions were asked on the use of the broadcasts:

1) Do pupils learn from them?
2) Are they relevant to the first year course?
3) Are they worth the time spent using them?
4) Have you had the time to watch/listen to them in advance?
5) Are they better used with supplementary exercises, or better used in isolation?
6) Have you had any problems with organising the TV and VCR?

The answers given to these questions are summarized below:

1) Three teachers gave the answer 'Yes', two of them adding that they provided a stimulus for work in a particular area or for mathematics in general. The fourth teacher who in fact taught both a set 1 and a set 3 group was critical: "The top sets tend to be rather condescending about them and the bottom sets forget again immediately after the programme." The teacher of the other set 3 also added that the programmes were not suitable for some low ability pupils in the group.
2) All four teachers thought that the programmes used so far were relevant to the first year course.
3) Three teachers felt it was worth spending the time on them, one of these added that repetition of a broadcast would be useful to set 3 pupils. The fourth teacher (who was critical in reply to question 1) was concerned that using the broadcasts meant that topics were taking longer to complete. One of this teachers classes in particular was getting rather behind in the scheme of work.
4) The above teacher was one of the most dilligent in studying the broadcasts in advance. One other stated that he felt this was essential. A third admitted that he had not been able to look at all those he had used, but agreed that he should have done. The last teacher answered no, he had had no time to watch or listen to the broadcasts in advance.
5) All four teachers answered that they are better used when integrated into the course. One added "I didn't feel the need to do extra work outside the lesson". (i.e. outside the television lesson).
6) All four felt that in general there were no major problems in organising the equipment, however two of them mentioned that the location of their teaching room sometimes made things difficult. For some periods in the week these teachers taught on a different floor of the building to the mathematics floor, so the lessons in which they could use the television and VCR were more limited than for the other teachers.

In general, at this stage in the course, it seemed that three out of the four teachers were using the broadcasts enthusiastically. The other had serious doubts as to their value, but was more than willing to continue to give it a try. It would have been interesting and relevant to any future decision about broadcast use, to obtain the pupils views about learning from the radio and television programmes. However it was felt that this would have been best done at the end of the school year, Christmas being too early for them to have formed a valued opinion.

7. A SURVEY OF THE USE OF MATHEMATICS BROADCASTS IN NORTHAMPTONSHIRE SECONDARY SCHOOLS

Introduction

A small survey was carried out into the use of broadcast material in order to find answers to several broad questions:

What mathematics programmes are used in secondary schools?

How are they used?

What influences their use apart from the programme itself? and

Does copyright restrictions limit their use in any way?

It was considered important also, to ascertain whether an education authority could influence the use of broadcasts, for example by providing more or less television equipment, or by providing teachers with ancillary help to organise the recordings. The number of programmes used could be compared with the results of the annual surveys carried out by the Educational Broadcasting Services (EBS) department of the BBC to see whether the usage in this county was above or below the usage in the country as a whole.

As mentioned in the last chapter, most educationalists consider the work done by a class before or after a broadcast to greatly affect its educational success. According to Womack (1980-83, p 38) there is general scepticism among education officers of the broadcast companies, of the quality and quantity of "follow-up" work organised by the classroom teacher. Do practising teachers have a different view of the importance of this supplementary work? David Womack reported on the usage of mathematics series in primary schools and carried out an experiment into the effect of classwork before a programme as against classwork after. It would be interesting to see how Northamptonshire secondary schools make best use of mathematical broadcasts.

The Survey Sample

There is no general pattern of educational provision for children across the whole country. In most areas, the 4+ to 11 age range is catered for either by one primary school or separate infant and junior schools, which, with one exception feed into a 11 to 18 comprehensive secondary. There is one secondary school with no post 16 provision. In the East Northamptonshire Area and the city of Northampton, the primary schools feed to larger middle schools which cover the range 9-13 years of age. Secondary schools in this area therefore, take pupils from age 13 to 18 years.

The sample then consisted of the mathematics departments of all

forty three state secondary schools in Northamptonshire. One being of 11-16 age range, ten 13-18 and the rest 11-18 years. Questions asked about uses of programmes for the lower secondary groups had therefore a more limited possible audience; but it was considered that to include the twenty-four middle schools into the sample would have too greatly increased the cost of postage and stationary.

The Questionnaire

It was felt that from the sample of forty-three schools, it was necessary to get a good return in order to produce meaningful information - a minimum of thirty was aimed at. It was recognised that at the time of distribution, there was an industrial dispute between teachers nationally and their employers which involved the withdrawal by many teachers of activities outside of school hours, including management directed initiatives involving extra work. It was possible that asking colleagues to spend time completing a questionnaire could have been taken as an imposition on their goodwill, with the result that there would be a lower return that in normal circumstances. It was even more necessary therefore, to design the questionnaire so that it was interesting, attractive, and easy to complete. Each question asked, required an answer limited to two or three choices, usually the two extreme views with perhaps one centre position.

The head of mathematics at each secondary school, was asked to tick in one of two or three boxes for each question. The questionnaire was divided into five sections, and bearing in mind that ideally it should start and finish with straightforward questions and with those of a more searching nature in the middle, they were included in the following order:

The Availability of Resources
How Broadcasts are Used
What Series are Used by the Department
The Influences on the Use of Broadcasts
The Question of Copyright.

A draft copy of the questionnaire was prepared and shown to several colleagues for their comments. Some changes were made and the final form typed and photocopied. It is shown in appendix IV and although it is pointless to discuss every question here, some comments are necessary:

In order to be able to compare the results of the third section with the surveys of the EBS, the same definition of usage is used. That is a school 'uses' a series if it uses two or more programmes. Consequently one answer for the teachers to choose was "Two or more". Another option was "all the series". Again, in order to compare the

average number of classes with the EBS figures, teachers were asked to state how many classes viewed or listened to each series. Although distributed to schools during the Autumn term 1985, the questionnaires stated that answers should refer to the 1984/85 school year. This was included, as the list of mathematical series were those broadcast during the past academic year, not the present one.

The fourth section included the most thought provoking questions. A major influence on programme use, is of course, the availability of resources. This was the main reason for asking about resources in section one. Other influences are obviously at work as well. The head of department will have certain views on the use of broadcasts and may well exercise his (or her) authority in this direction by insisting on certain series being used. They may be written into the scheme of work for certain classes. If the classroom teacher has the choice and chooses not to use broadcast material, what are the reasons behind his decision? In section four, question four, four possible reasons are given and heads of departments are asked to tick one or more. Following this, questions are asked to find out if teachers recently trained are more aware of the potential of television and radio, and also to seek views on whether in-service training of teachers in using broadcasts is desirable.

The last section asked questions on copyright regulations. The latest EBS survey asked schools whether they used Open University broadcasts. The answers were surprising - over one third said they did (but not just in mathematics). The EBS did not ask whether they were used live or in recorded form, the latter being against copyright law unless schools held a licence, details of which are given in appendix VI. Although the EBS were not interested in whether the law was broken or not, due to the hours of transmission of OU broadcasts, it must be most likely that they are used in schools in recorded form. The Northamptonshire survey similarly did not ask whether teachers followed the copyright regulations as the replies might not have been truthful. Instead questions were asked about whether teachers would like to use restricted programmes if they were allowed to do so.

The questionnaire was typed and photocopied onto four sides of A4 paper and with a covering letter, posted to the Heads of Mathematics of all forty-three secondary schools. A stamped addressed envelope was also included for its return. The Mathematics Advisor for Northamptonshire was contacted with the possibility of him mentioning the forthcoming questionnaire at his meetings with secondary heads of department. However, the matter was discussed and it was felt that due to the current

industrial action, any linking of the questionnaire with the local authority may do more harm than good. Consequently, it was left to the covering letter to encourage participation.

In the event, the initial number of replies was very encouraging. After three weeks of sending out the questionnaire, thirty-three had been returned. It was expected that a second copy together with a reminder would have to be sent in order to obtain this number of replies. As only ten replies were missing it was decided to telephone the schools to remind the heads of mathematics. In most cases a phone message was left asking for the questionnaire to be returned and leaving a phone number which could be used to obtain a second copy if the original one was lost. Within another two weeks no requests for another questionnaire had been received, but two more had been returned completed. This gave a total return of thirty-five out of forty-three or 81%.

The Results Analysed

The collective results are shown in Appendix V and are analysed below.

Section One

The EBC survey for 1984/85 showed that 99% of secondary schools in the country have at least one colour television, and a similar figure was obtained for video cassette recorders. (Appendix VII) The average number of VCR's per school was found to be three. The results of the Northamptonshire survey do not give figures for the amount of equipment in schools as a whole, but they do show that in some mathematics departments the level of available equipment is not sufficient. For example, in answer to question 1, five heads of department stated that a colour television was not available, and seven that a VCR could not easily be borrowed. Both of these figures show that it would seem to be extremely difficult for a member of the department to use broadcast material if he or she so wished. However, in answer to question two, although 12 departments said there would be some difficulty in organising the recording and playing back of a programme, none said that it would be hard. One head of department stated in a separate comment that their difficulties lay in carrying the equipment up and down stairs.

At the other extreme, several mathematics departments have a TV and VCR all to themselves. Whether this availability of equipment is influenced by the importance the head of department places on broadcast material is discussed in section four. The radio/cassette recorder is slightly more available than a colour television.

In most schools, it seems from question three, teachers have the use of an ancillary for recording broadcasts at least some of the time.

Only in 3 schools do teachers have no help in this. Comparing this with the findings of the Spring 1984 EBS survey (Appendix VII), Northamptonshire schools seem to be rather better off. Nationally, 65% of schools had either a technician or a teacher responsible for recording broadcasts.

Section Two

Eight departments which returned the questionnaire were not users of mathematics programmes; they did not complete any part of section three. Some of these, however attempted to answer parts of section two, which tended to confuse the issues of how broadcasts are used. In terms of this analysis therefore, it was decided to consider where relevant, only the answers given to section two questions by the twenty-seven user schools. Figures for these are given at the end of Appendix V.

Educationalists, and producers of broadcast material, as mentioned earlier, tend to believe strongly that the work done by a class 'around' a programme is essential to the success of the resource. Possibly mathematics is an exception to this, because the answers given to questions one and two in this section form the general opinion that teachers consider it to be important, but not essential. 59% of 'user' departments felt that there was 'some importance' in the subject matter of a programme matching the work currently being taught, with 37% saying it was 'very important' and 4% (1 school) saying it was 'not important'. However all 'user' departments sometimes used programmes in isolation to the work being done!

If the answers given to question three are representative of the country as a whole (and there is no reason to believe they might not be) the broadcast companies must be rather disappointed by the use of the supplementary worksheets they produce. Only 4 departments generally use the BBC/ITV worksheets if they are produced. This figure can be compared with the research done by David Womack into the usage of maths broadcasts in primary schools: only 14% of teachers stated they carried out follow-up activities used in the Teacher's Notes of a series. (Womack, p 39).

Answers to questions four and five show similar opinions to those given to questions one and two, in that relating a programme to work done before or after it is used, is not essential. 5 schools answered "not usually" to all three questions on the use of supplementary material. There seems to be some preference to using follow-up rather than preparatory material. Teachers may well gain from reading the conclusions of Womack's experiment in primary schools where he found that the "doing followed by viewing" format is a more effective teaching strategy in terms of present knowledge of the learning process than the more conventional

'viewing-doing' format", Womack (p 89).

Question six showed a ballanced response to whether programmes are shown as a whole, or divided into sections. Question seven showed that there is a problem in some departments in matching a series with the mathematics curriculum. This would have some influence on what series, or what programmes within a series, are used.

Many teachers, it is feared, cannot see the value of radio broadcasts in mathematics. The results of section three will confirm this. Perhaps if they tried a programme with a class they may be pleasantly surprised, but question eight showed that the majority of departments (80% of total) had never attempted to use mathematics radio programmes.

Many heads of department are satisfied with the number of broadcasts available in mathematics, but 13 thought there was a need for more. This is 34% of the total replies, but almost half of those who use broadcasts. Of these 13, 12 felt that if more were produced, they should contain different content to that of current programmes.

Section 3

The nine questions in this section relate to the usage of nine broadcast series in mathematics. Not all are relevant to all the secondary schools because some schools have a limited age range, as mentioned earlier. "Johnny Ball's Maths Games" and "Mathscore 2" was considered relevant only to schools having 11 and 12 year olds. This was twenty-eight schools out of the thirty-five replies. "A level statistics" was not relevant to one of the schools which replied, as it had no sixth form.

The figures for user schools were obtained by adding the number of departments who replied "at least two programmes in the series" with those who responded "all the series". In this way the figures could be compared with those from the EBS (Appendix VII).

In seven series out of the nine the proportion of user schools was higher than the proportion stated in the findings of the EBS survey. One of the two remaining series had no users in Northamptonshire, whereas the EBS gives a usage of $1\frac{1}{2}$% of schools. This proportion is so low that the difference is insignificant. The other series "Maths at Work" had no comparison as EBS figures for this series was not made available. The most difference in the figures between the two surveys could be seen with both "Maths Help" and "Maths Counts" which seem to be used about $3\frac{1}{2}$ times more in secondary schools in Northamptonshire than in the country as a whole. Statistical analysis (Appendix VIII) show there are significant differences, as are those for many of the other series.

However, in studying these figures it was noticed that the EBS

definition of series usage being "at least two programmes" was a little different than the Northamptonshire surveys implication of the same phrase. Many series consist of ten programmes which are broadcast over two terms. The EBS termly questionnaire would show schools who use at least two out of five programmes, whereas the county questionnaire showed schools who use two or more out of the complete ten programmes. This is likely to make some difference in comparing the two sets of figures, but not a great deal. The complete series of "Maths Counts", for example is used in Northamptonshire by 12 schools (34%); this is still well above the national figure of 12% for using at least two programmes per term. The average proportion of schools using eight of the series (excluding "Maths at Work") was 9.6% for the EBS survey, and 26% for the county survey considering the 'at least two' figures. The average proportion of county schools who use 'all the series' was 11% which is still above the national figure.

If the mean number of classes per user school from the two surveys is compared, there is no clear difference on the whole. Some series are used with more classes per school in Northamptonshire while some other series are used with less. The average of the eight means are 3.25 classes in Northamptonshire and 3.05 classes nationally.

If more teachers in Northamptonshire use maths broadcasts than their colleagues throughout the rest of the country, as these figures seem to show they do, it is difficult to see why! There is no in-service training for mathematics teachers in the county on the use of broadcasts, and section one does not show that county secondary schools are any better-off for recording equipment. Possibly the amount of ancillary help available is greater in this county in which case this may have some effect on programme usage. It is quite possible that the figures from the EBS are an under-estimation of programme usage in the country; perhaps the local survey gives a better picture of the true national usage. This suggestion is drawn from the way the EBS obtain their data: schools are asked to state which broadcasts are used during a particular term either live, or recorded for future use. A series such as "Maths File" which has been running for several years, may have been recorded by a department two years ago and used in recorded form ever since. This use would not show up on the annual EBS survey other than during that first year. Only for new series may the EBS survey accurately reflect usage figures.

Section 4

The use of TV and radio in a department depend on many things.

USUAGE OF MATHS SERIES IN SECONDARY SCHOOLS

	Northamptonshire Survey			EBS Survey (National)	
	User Schools (two or more progs in a series)	User Schools (% of returns)	Average no. of classes per user school	User Schools (% of returns) (two or more progs per term)	Average no. of classes per user school
Johnny Ball's Maths Games	3	8.5%	4.5	2.5%	2.0
Help yourself to Mathematics	0	0%	0	1.5%	2.7
Mathscore Two	6	17%	1.8	6.5%	3.5
Maths Help	12	34%	2.9	9%	3.8
Maths at Work	17	48%	3.3	———	———
Maths Counts	23	65%	3.9	20%	3.2
Maths Topics	11	31%	4.3	12%	3.7
Maths File	6	17%	6.8	13%	3.7
A level Statistics	13	37%	1.8	12%	1.8

Average of eight series (not "Maths at Work)	EBS	9.6% of schools
	Northamptonshire 'at least two'	26%
	Northamptonshire 'all the series'	11%
Average of eight mean no. of classes	EBS	3.05 classes
	Northamptonshire	3.25 classes

The first considered, is the attitude of the head of department. This attitude would affect the availability of resources if a particular request was made to the head teacher for a VCR to be positioned within the department. Teachers may well be encouraged to use broadcasts if certain series are written into the scheme of work. Question one asks the head of department for a personal opinion. By far the majority thought broadcasts made some contribution to the mathematical experience of the pupil. In reply to question two, only 9 (26%) felt broadcast material was important enough to include their use into a written curriculum, or perhaps they simply did not wish to impose their views onto other members of their department, as 4 out of the 6 head of departments who answered "a lot" to question one answered "No" to question two! Relating the answers to question one back to the availability of resources questions in section one, although in general the head of departments who felt there was at least some use for broadcast material in the classroom found colour television and recording equipment easily available, there were two cases where the value was recognised but the equipment difficult to obtain.

The mean of all the fractions given in question three was 0.53. The mean fraction given by those 9 departments where broadcasts were written into the curriculum was not surprisingly, higher, at 0.78.

In question four, reasons why, in the opinion of the departmental heads, members of staff do not use broadcast material, are, in order of importance:

No time to pre-view and organise the work	71%
Effort involved in organising the equipment	51%
The equipment not always available	34%
Do not accept the value of the programmes	27%

Most heads of department ticked more than one of the four options. No one offered any other reasons.

Womack (1980-83 pp 41-43) discovered that two-thirds of his sample of primary school teachers did not use a mathematics television series with their class. Reason given by the teachers themselves were many and varied, and for comparison purposes it is difficult to fit them into the four choices above. Very few answers involved any suggestion of lack of equipment, perhaps because a VCR is not as necessary in a primary classroom, it being easier to use a programme "live" than it is a secondary school. Also very few mentioned that finding time to organise the viewing was a problem, again perhaps because no time is needed to record and preview a series.

The 18 heads of departments (51%) who felt one reason was the effort involved in organising the equipment must have hinted at a lack of willingness on the part of his teachers as in answer to section one, question two, 10 of these 18 stated that it was easy for staff to organise the recording and playing back of a programme. The remaining 8 stated "some difficulty" in doing this. No-one said it was hard! 11 out of the 18 also answered "yes" to the question of whether the department had the use of an ancillary! Of the 12 schools (34%) who gave lack of equipment as a reason for staff not using broadcasts, six stated in section one that some pieces of equipment were not easily available and six stated that it could be easily borrowed.

In answer to question five, over half the replies stated "no difference" to whether less experienced teachers are more or less aware of the potential of TV and radio than older members of staff. Considering the rest, 26% felt that younger teachers are more aware, and 9% felt they were less aware. Not very conclusive! Question six, however was clear cut. 71% said there was a need for in-service courses for maths teachers in using broadcasts in the classroom.

Section Five

The copyright regulation of school broadcasts do not seem to be very clear to most teachers. Only 29% of heads of department seem to be fully aware of them; one would expect the figure for other mathematics teachers to be even lower. In question two, by far the majority of replies showed a feeling that copyright regulations were at least to some extent restrictive to the use of broadcasts in the classroom. In practice this might not necessarily be so as there is a general feeling in many schools that these restrictions are to be ignored! In the case of the regulations on Open University programmes, the answers to questions three and four support this view. The EBS in their annual survey for 1984 asked for the first time whether schools used O.U. broadcasts. No mention was made of how they were used, but unless schools have a licence (appendix VI) the use of O.U. broadcasts in recorded form is illegal. The EBS survey found that they were used by over one-third of secondary schools. Because of the time of broadcasting these programmes, it is most likely that they are being pre-recorded for later use, and as schools would find the licence fee rather prohibitive (appendix VI) it is most likely that most of these schools are ignoring the regulations. Question four showed that 51% of mathematics departments would like to be able to use O.U. programmes. In answer to whether the schools had a licence to record them, 6 out of the 35 said "yes" they did. It was decided to find out how many recordings

the schools had paid for, and a telephone call was made to either the headmaster, bursar, or head of resources. In five of these six schools it was found that they did not have a licence and that the head of mathematics had been mistaken if he had said they did! In the one remaining school, it was assumed that they did have a licence, but at the time, no one could say how many hours they had paid for.

In answer to the final question, 63% of heads of department said they would like to use non-schools broadcasts if they were allowed to do so.

CONCLUSIONS

1) Northamptonshire secondary schools have a level of broadcasting equipment which is adequate in the majority of cases, and this seems to compare with the level found in the rest of the country. Lack of equipment is not a major reason for mathematics teachers not using broadcasts in the classroom.

2) The employment of an ancillary to help with the recording of programmes is common practice, and probably more common than in the country as a whole.

3) In mathematics, secondary teachers do not consider it essential that a programme matches the work currently being taught. Where supplementary material is used, it is more likely to be used after the programme than before. The worksheets published by the broadcasting companies are not very often used.

4) Almost one half of mathematics departments who use broadcasts would like to see more available, containing different topics to those found in current series.

5) Television programmes are more popular in secondary schools than radio programmes. The value of radio in the mathematics classroom is not recognised.

6) The use of mathematics series in Northamptonshire secondary schools is significantly higher than that estimated by the Educational Broadcasting Services of the BBC, for the country as a whole. Although some reasons for this may be suggested, no evidence exists to show that any of them are valid.

7) Most Heads of Mathematics recognise the value of using broadcasts for teaching mathematics. One in four encourage the use of programmes in their department by including them into the written scheme of work.

8) A lack of time and effort, is the most popular reason, given by Heads of Mathematics, for teachers not using broadcasts. Only one in four thought that some did not accept the value of the programmes.

9) There is a majority feeling that in-service courses in the use of broadcast material should be held.

10) In the opinion of most Heads of Mathematics, copyright regulations restrict the use of broadcasts in the classroom. Over one half could see a value for Open University and general output programmes being shown in the mathematics classroom. Only one school held a licence to record O.U. material which suggests that the majority of those who use this resource (EBS figure of one-third of schools) do so against copyright regulations.

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APPENDICES

APPENDIX I THE FEEDER SCHOOL SURVEY

The following page shows a simple questionnaire which was sent to forty-one primary schools in Northamptonshire, being the main feeders for Bishop Stopford School, Kettering. It was sent to obtain some idea of the resources which pupils had had experience with in mathematics lessons before reaching the secondary level. Only a part of the survey has relevance to this dissertation - that is part four, which asked for details of the television and radio series used in the primary school. The results of this section were used to help the mathematics department of Bishop Stopford School decide which programmes could be offered to pupils in the first few years without fear of repetition.

Thirty-four replies were received (83%) and the information gathered from section four is shown below. The answers given in the column: "Year Group (Age)" were difficult to analyse as an individual school's description of a year group did not seem to be uniform, i.e. the top year may have been given as "fourth year" or "10/11" or "10+" or "10" or "11". Or did "10" refer to the third year? For this reason, the results below indicate only whether a school used a series or not, and no notice was taken of the age of the audience. It should be pointed out that some primary schools were "junior" only, i.e. 7 - 11 year olds while others were "infant" and "junior" i.e. 5 - 11 year olds.

USE OF MATHEMATICAL BROADCASTS

Name of Programme	Number of Schools using the series
Let's Go Maths. ITV	7
Junior Maths. ITV	8
The Micro at Work. ITV	0
Maths - with a story. Radio	1
Johnny Ball's Maths Games. Radio	5
Computers at Work. Radio	0
Maths Score One. BBC TV	9
Maths Score Two. BBC TV	7
Mindstretchers BBC TV	4
Others: Maths File. BBC TV	1

SCHOOL

IF IN DOUBT, ANSWERS SHOULD REFER TO THIS ACADEMIC YEAR (1984/85)

1. MATHEMATICAL TEXTS

What mathematical texts or published schemes of work do you use with your older pupils?

follow closely

other

2. STANDARDISED TESTS

Do you use any standardised tests? (e.g. Richmond, Nelson Profile)

Please state name of test and the age given

3. USE OF THE MICROCOMPUTER

What make of machine if any is available for use by pupils or teachers?

For how much time during the last year of the primary school can each pupil get 'hand on experience' of a micro? hours

Is the micro used by the teacher to demonstrate to a whole class? (YES/NO)

If so in what subject areas?

Is the micro used by the pupils individually or in small groups as an aid to learning in particular subject areas? (YES/NO)

Is so please list the names of published software and the subject area covered

Do pupils get a chance to learn or practise a programming language in school? (YES/NO)

If so please state the language used (e.g. Basic, Logo etc.)

4. USE OF MATHEMATICAL BROADCASTS

Please list any TV or radio programme in Mathematics regularly followed by classes:

Name of Programme	Station	Year Group(Age)	Fraction of year group following the series
Lets go Maths	ITV		
Junior Maths	ITV		
The Micro at work	ITV		
Maths - with a story	Radio		
Johnny Ealls'Maths Games	Radio		
Computers at Work	Radio		
Maths core One	BBC TV		
Maths core Two	BBC TV		
Mindstretcher	BBC TV		
Others:			

APPENDIX II PROGRAMME DETAILS OF "MATHS FILE" AND "JOHNNY BALL'S MATHS GAMES"

These two programmes were used with all the first year pupils at Bishop Stopford School during the academic year 1985/86. Not every programme of "Maths File" was relevant to the existing scheme of work. Those marked "*" below were not used.

MATHS FILE

Ten twenty-minute television programmes. The mathematical ideas are dealt with in an artificial dramatic framework, centred on a comical character Inspector Newton in charge of an equally unlikely Number Squad. Animation is an important part of each programme.

1. Number Lines
2. Sequences
3. Fractions
4. Number Relationships
5. Co-ordinates
6. Angles
* 7. Pattern
* 8. Enlargement
* 9. Area
* 10. Three Dimensions

Programme 4 could be used at any time during the year but the other five were directly related to certain parts of the syllabus and consequently had to be used at specific places in the first year course.

Johnny Ball's Maths Games (Series A)

This series consist of ten ten-minute radio programmes enthusiastically 'performed' by Johnny Ball. Each one consists of mathematical puzzles, tricks and investigations. Almost a dialogue between Johnny Ball and the pupils; they are expected to verbally answer as a group, the questions he asks.

1) First, Fingers First.
2) Good numbers - good buddies.
3) The Road to Big Numbers.
4) Fibonnacci and the Golden Rule.
5) Geometry, Plane and Simple.
6) Tetrahedrons, Cubes and Nets.
7) Just by Chance.
8) Time.
9) Doodling with dates.
10) Follow the band.

Number 5 and 6 tied up well with certain sections of the syllabus and had to be used in conjunction with this work. The other eight programmes could be used at any time during the year.

APPENDIX III THE BISHOP STOPFORD SCHOOL TEACHER QUESTIONNAIRE

After having used mathematical broadcasts for one term with their first year classes, teachers were asked to complete as much as they could of the form shown. This gave some idea of how successful the year's experiment was likely to be.

TEACHER QUESTIONNAIRE DECEMBER 1985

To teachers of first year mathematics classes,

By the end of this term you will have shown the following broadcasts to your first year group:

Johnny Ball's Maths Games	Programmes 1,5 and 6
Maths File	Programmes 1 and 4

I would appreciate any comments you have about the use of the broadcasts under some or all of the following headings.

J.Toller

DO PUPILS LEARN FROM THEM ?

ARE THEY RELEVANT TO THE FIRST YEAR COURSE ?

ARE THEY WORTH THE TIME SPENT USING THEM ?

HAVE YOU HAD THE TIME TO WATCH/LISTEN TO THEM IN ADVANCE ?

ARE THEY BETTER USED WITH SUPPLEMENTARY EXERCISES, OR BETTER USED IN ISOLATION ?

HAVE YOU HAD ANY PROBLEMS WITH ORGANISING THE TV AND VCR ?

APPENDIX IV THE SECONDARY SCHOOL QUESTIONNAIRE

The following questionnaire was sent to the head of mathematics of the forty-three state secondary schools in Northamptonshire. It was accompanied by an explanatory letter.

49, Church View Road,
Desborough,
Kettering,
Northants

20/9/85

The Head of Mathematics

.....

Dear Colleague,

I teach at Bishop Stopford School, Kettering, but am at present taking a part-time M.Sc course at Loughborough University of Technology.

I am writing to ask if you would participate in a small research project I am carrying out in connection with my dissertation. It is entitled ' Mathematics through Broadcasting ' and I am interested in what mathematics television and radio programmes are used in the secondary schools of this county.

I am also trying to find out what influences the use of broadcast material in our mathematics lessons. Have we enough recorders and television sets ? Do teachers need more training in using broadcasts in the classroom ? Are the copyright laws restrictive ?

I would be grateful if you would help me to find answers to questions such as these by completing the enclosed questionnaire, and returning it to me as soon as possible using the stamped addressed envelope.

Answers given to questions will be kept entirely confidential and only collective results will be included in the dissertation. No individual schools will be mentioned. I hope to be able to distribute a small abstract of the findings to you after Christmas.

Thank you,
Yours faithfully,

John Toller.

SURVEY OF THE USE OF MATHEMATICAL BROADCASTS IN NORTHAMPTONSHIRE SECONDARY SCHOOLS

To all Heads of Mathematics

Please answer the following questions with regards to your department over the past academic year. (1984/85)

Your answers will be kept entirely confidential.

Feel free to make any additional comment you wish.

SECTION ONE THE AVAILABILITY OF RESOURCES

PLEASE PLACE A TICK IN THE RELEVANT BOX

1) How available are these pieces of equipment ?	NOT EASILY AVAILABLE	CAN BE EASILY BORROWED	MATHS DEPT HAS ITS OWN
a) black and white television	☐	☐	☐
b) colour television	☐	☐	☐
c) video cassette recorder	☐	☐	☐
d) radio/cassette recorder	☐	☐	☐

	EASY	SOME DIFFICULTY	HARD
2) How easy is it for staff to organise the recording and playing back of a programme ?	☐	☐	☐

	NO	SOMETIMES	YES
3) Do you have the use of an ancillary for recording broadcasts ?	☐	☐	☐

SECTION TWO HOW BROADCASTS ARE USED

PLEASE PLACE A TICK IN THE RELEVANT BOX

1) In <u>general</u>, how important is it that the subject matter of a programme matches the work currently being taught ?	NOT IMPORTANT	SOME IMPORTANCE	VERY IMPORTANT
	☐	☐	☐

	NEVER	SOMETIMES	MANY
2) Are there occasions when a programme is used in isolation to the work being done ?	☐	☐	☐

P.T.O

	NOT USUALLY	SOMETIMES	GENERALLY
3) Does the department use the BBC/ITV worksheets if they are produced for particular series ?	☐	☐	☐
4) Does the department use preparatory exercises or worksheets before a broadcast ?	☐	☐	☐
5) Does the department use follow-up material after a broadcast ?	☐	☐	☐

	NO	SOMETIMES	YES
6) Do you show programmes in small sections, with other work or discussion in between?	☐	☐	☐
7) Is there a problem in matching the content of a series with your maths curriculum ?	☐	☐	☐

	YES	NO
8) Have you <u>ever</u> attempted to use any maths radio broadcasts in recent years ?	☐	☐
9) a) Do you think there is a need for more broadcasts in mathematics ?	☐	☐

	DIFFERENT CONTENT	SAME CONTENT
b) If YES, should it contain different mathematical content to what is currently produced, or the same content presented in a different form?	☐	☐

SECTION THREE — WHAT SERIES ARE USED BY YOUR DEPARTMENT ?

PLEASE TICK ONE OF THE FIRST TWO BOXES, AND FILL IN THE THIRD BOX ONLY IF THE PARTICULAR SERIES IS USED. OTHERWISE IGNORE THAT LINE.
(some may not suit your age range)

	AT LEAST TWO PROGS IN THE SERIES	ALL THE SERIES	STATE THE NUMBER OF CLASSES IT IS USED WITH
1) Johnny Ball's Maths Games BBC Radio.	☐	☐	☐
2) Help yourself to Mathematics BBC Radio.	☐	☐	☐
3) Mathscore 2 BBC TV	☐	☐	☐
4) Maths Help BBC TV	☐	☐	☐
5) Maths at Work BBC TV	☐	☐	☐

P.T.O

	AT LEAST TWO PROGS IN THE SERIES	ALL THE SERIES	STATE THE NUMBER OF CLASSES IT IS USED WITH
6) Maths Counts BBC TV	☐	☐	☐
7) Maths Topics BBC TV	☐	☐	☐
8) Maths File BBC TV	☐	☐	☐
9) A level Statistics BBC TV	☐	☐	☐

SECTION FOUR THE INFLUENCES ON THE USE OF BROADCASTS

UNLESS OTHERWISE STATED PLEASE TICK THE RELEVANT BOX

1) As H.O.D. how much do you think can broadcasts contribute to the mathematical experience of the pupil?
LITTLE ☐ SOME ☐ A LOT ☐

2) Is the use of any TV or radio programme laid down in writing as part of the mathematics curriculum ?
YES ☐ NO ☐

3) What fraction of your dept (including yourself) try to use broadcast material in the classroom if it is relevant ?
FRACTION : ☐

4) For which of the following reasons do you think , do other members of your department NOT use broadcast material :

TICK ANY BOX

Recording and playing-back equipment not always available. ☐

The effort involved in organising the equipment and tape. ☐

They do not accept the value of programmes in the classroom. ☐

They feel they do not have the time to preview a programme and to organise the work around it. ☐

5) Do you find that probationers or younger teachers are more aware, or less aware of the potential of TV and Radio in the classroom, than older members of staff ?
MORE AWARE ☐ NO DIFFERENCE ☐ LESS AWARE ☐

6) As H.O.D. is there a need for in service courses for mathematics teachers in using broadcasts in the classroom ?
YES ☐ NO ☐

P.T.O

SECTION FIVE THE QUESTION OF COPYRIGHT

	NO	PARTLY	YES
1) Are you aware of the copyright regulations with regard to recording schools broadcasts ?	☐	☐	☐
2) If a school stayed rigidly within the copyright regulations do you think it would restrict the use of schools broadcasts in the classroom ?	☐	☐	☐

	YES	NO
3) Does your school have a licence to record Open University programmes ?	☐	☐
4) Would you find it useful to be able to use OU programmes in the classroom if you were allowed to do so without a licence ?	☐	☐
5) Would you find it useful to be able to use other TV or radio programmes in the classroom if you were allowed to do so (e.g Horizon etc) ?	☐	☐

Thank you very much for your participation.

Please return the questionnaire to me as soon as possible in the stamped addressed envelope provided.

APPENDIX V THE RESULTS OF THE SECONDARY SCHOOL QUESTIONNAIRE

The Results

SECTION ONE — THE AVAILABILITY OF RESOURCES

1) How available are these pieces of equipment ?	NOT EASILY AVAILABLE		CAN BE EASILY BORROWED		MATHS DEPT HAS ITS OWN		NOT ANSWERED	
a) black and white television	10	29%	17	49%	4	11%	4	11%
b) colour television	5	14%	24	69%	5	14%	1	3%
c) video cassette recorder	7	20%	23	66%	4	11%	1	3%
d) radio/cassette recorder	3	9%	24	69%	7	20%	1	3%

	EASY		SOME DIFFICULTY		HARD			
2) How easy is it for staff to organise the recording and playing back of a programme ?	23	66%	12	34%	0	0%	0	0%

	NO		SOMETIMES		YES			
3) Do you have the use of an ancillary for recording broadcasts ?	3	9%	6	17%	26	74%	0	0%

SECTION TWO — HOW BROADCASTS ARE USED

	NOT IMPORTANT		SOME IMPORTANCE		VERY IMPORTANT			
1) In general, how important is it that the subject matter of a programme match the work currently being taught ?	1	3%	20	57%	10	29%	4	9%

	NEVER		SOMETIMES		MANY			
2) Are there occasions when a programme is used in isolation to the work being done ?	1	3%	29	83%	0	0%	5	11%

	NOT USUALLY		SOMETIMES		GENERALLY			
3) Does the department use the BBC/ITV worksheets if they are are produced for particular series ?	16	46%	10	29%	4	11%	5	14%
4) Does the department use preparatory exercises or worksheets before a broadcast ?	14	40%	11	31%	4	11%	6	17%
5) Does the department use follow -up material after a broadcast ?	8	23%	14	40%	7	20%	6	17%

	NO		SOMETIMES		YES			
6) Do you show programmes in small sections, with other work or discussion in between ?	11	31%	10	29%	8	23%	6	17%

	NO		SOMETIMES		YES		NOT ANSWERED	
7) Is there a problem in matching the content of a series with your maths curriculum ?	8	23%	13	37%	7	20%	7	20%

	YES		NO		
8) Have you ever attempted to use any maths radio broadcasts in recent years ?	3	9%	28	80%	4	11%
9) Do you think there is a need for more broadcasts in mathematics ?	12	34%	15	43%	8	23%

	DIFFERENT CONTENT		SAME CONTENT		
If YES, should it contain different mathematical content to what is currently produced, or the same content presented in a different form ?	11	31%	2	6%	22	63%

SECTION THREE WHAT SERIES ARE USED BY YOUR DEPARTMENT ?

	AT LEAST TWO PROGS	ALL THE SERIES	MEAN NUMBER OF CLASSES PER USER SCHOOL *
1) Johnny Ball's Maths Games BBC Radio (28 schools)	3	0	9/2 = 4.5
2) Help yourself to Mathematics BBC Radio	0	0	0
3) Mathscore 2 BBC TV (28 schools)	5	1	11/6 = 1.8
4) Maths Help BBC TV	8	4	32/11= 2.9
5) Maths at Work BBC TV	12	5	49/15= 3.3
6) Maths Counts BBC TV	11	12	65½/17= 3.9
7) Maths Topics BBC TV	9	2	34/8 = 4.3
8) Maths File BBC TV	4	2	27/4 = 6.8
9) A level Statistics BBC TV (34 schools)	8	5	20/11= 1.8

(One school added "Everyday Maths" which was the forerunner of "Maths Counts". All the series was used by 4½ classes.)

* A 'user school' is one which uses at least two programmes of a series. i.e the sum of the first two columns. However, some HoD's ticked one of the first two boxes, but did not state the number of classes. These were not counted as 'user schools' for the purpose of calculating the mean.

SECTION FOUR THE INFLUENCES ON THE USE OF BROADCASTS

1) As HoD how much do you think can broadcasts contribute to the mathematical experience of the pupil ?

LITTLE		SOME		A LOT		NOT ANSWERED	
2	6%	24	69%	6	17%	3	9%

2) Is the use of any TV or radio programme laid down in writing as part of the mathematics curriculum ?

YES		NO		NOT ANSWERED	
9	26%	23	66%	3	9%

3) What fraction of your department (including yourself) try to use broadcast material in the classroom if it is relevant ?

MEAN FRACTION = 0.53
(out of the 27 that answered)
OR = 0.41
(out of the 35 replies)

4) For which of the following reasons do you think, do other members of your department NOT use broadcast material:

Recording and playing-back equipment not always available.	12	34%
The effort involved in organising the equipment and tape.	18	51%
They do not accept the value of programmes in the classroom.	9	26%
They feel they do not have the time to preview a programme and to organise the work around it.	25	71%

(6 schools did not tick any box, 2 of which because the fraction given in question three was 1)

5) Do you find that probationers or younger teachers are more aware, or less aware of the potential of TV and Radio in the classroom, than older members of staff ?

MORE AWARE		NO DIFFERENCE		LESS AWARE		NOT ANSWERED	
9	26%	19	54%	3	9%	4	11%

6) As HoD , is there a need for in service courses for maths teachers in using broadcasts in the classroom ?

YES		NO		NOT ANSWERED	
25	71%	4	11%	6	17%

1 'perhaps'

SECTION FIVE THE QUESTION OF COPYRIGHT

1) Are you aware of the copyright regulations with regard to recording school broadcasts ?

NO		PARTLY		YES		NOT ANSWERED	
3	9%	19	54%	10	29%	3	9%

2) If a school stayed rigidly within the copyright regulations do you think it would restrict the use of schools broadcasts in the classroom ?

3	9%	9	26%	15	43%	8	23%

3) Does your school have a licence to record Open University programmes ?

YES		NO		NOT ANSWERED	
6	17%	21	60%	8	23%

(phone calls reduced this 6 to 1 school)

	YES	NO	NOT ANSWERED
4) Would you find it useful to be able to use OU programmes in the classroom if you were allowed to do so without a licence ?	18 51% (2 possibly)	6 17%	9 26%
5) Would you find it useful to be able to use other TV or radio programmes in the classroom if you were allowed to do so (e.g Horizon etc) ?	22 63% (3 sometimes)	4 11%	6 17%

Eight departments did not tick any box in section 3, showing that non of the current series were used.One half of these departments made some attempt to answer section 2 , but perhaps a better picture of broadcast usage is obtained if these answers are ignored. Below is shown the results of section 2 from the 27 'user'schools.

SECTION TWO HOW BROADCASTS ARE USED

	NOT IMPORTANT	SOME IMPORTANCE	VERY IMPORTANT	
1) In general, how important is it that the subject matter of a programme match the work currently being taught ?	1 4%	16 59%	10 37%	0 0%
2) Are there occasions when a programme is used in isolation to the work being done ?	NEVER 0 0%	SOMETIMES 27 100%	MANY 0 0%	0 0%
3) Does the department use the BBC/ITV worksheets if they are are produced for particular series ?	NOT USUALLY 13 48%	SOMETIMES 10 37%	GENERALLY 4 15%	0 0%
4) Does the department use preparatory exercises or worksheets before a broadcast ?	12 44%	10 37%	4 15%	1 4%
5) Does the department use follow -up material after a broadcast ?	6 22%	13 48%	7 26%	1 4%
6) Do you show programmes in small sections, with other work or discussion in between ?	NO 9 33%	SOMETIMES 9 33%	YES 8 30%	1 4%
7) Is there a problem in matching the content of a series with your maths curriculum ?	7 26%	13 48%	6 22%	1 4%
8) Have you ever attempted to use any maths radio broadcasts in recent years ?	YES 3 11%	NO 24 89%		0 0%
9) Do you think there is a need for more broadcasts in mathematics ?	13 48%	11 41%		3 11%
If YES, should it contain different mathematical content to what is currently produced, or the same content presented in a different form ?	DIFFERENT CONTENT 11 41%	SAME CONTENT 2 7%		14 52%

APPENDIX VI RECORDING EDUCATIONAL PROGRAMMES

BBC Programmes (extracts from BBC leaflets)

The following concessions relate only to those BBC programmes listed in the Annual Programmes for Schools and Colleges booklet. All other BBC programmes may not be recorded without the prior consent of the BBC and the holders of copyright and performing rights in the component parts of the programmes concerned.

BBC school broadcasts in radio, radiovision, and television may be recorded by individual institutions, provided that the recordings are:

(1) Made on the premises by a teacher or other similarly qualified person.
(2) Used for instructional purposes only on the same premises.
(3) Not themselves copied again.
(4) Destroyed within three years of their being made.

Recordings may be made by LEA Resource Centres for distribution to schools under similar conditions to the above.

Teacher Training Colleges and Departments and Institutions of Further, Higher, and Adult Education may also record BBC Continuing Education Broadcasts, but the recordings must be destroyed after one year. Some Continuing Education Broadcasts, which are particularly relevant to school courses (e.g. microcomputer series) may also be recorded and used in schools for up to three years.

ITV Programmes (extracts from ITV leaflets)

Education programmes (but not other broadcasts) may be recorded off air by a teacher or pupil in the course of instruction, provided that there is compliance with the terms of a licence granted by the Independent Television Companies to local authorities and other appropriate bodies such as universities. It is of the essence of the licence that the recordings are used for instructional purposes in class in schools and other educational institutions and that they are destroyed within three years of being made.

Open University Licences

A licence which allows education and training institutions to record Open University programmes 'off-air' and to use them for teaching and training is available from:

Guild Sound and Vision Ltd,
6 Royce Road,
Peterborough,
PEI 5YB.

Licences ran for one year from 1st February to 31st January.
Some examples of charges are shown below:

No. of recordings	£
5	40
10	65
15	90
25	135
50	250

Recordings of programmes must be erased when copyright has expired (usually five years after its last transmission) or if the annual licence is not renewed.

APPENDIX VII EXTRACTS FROM THE EBC'S ANNUAL SURVEYS OF LISTENING AND VIEWING IN U.K. SCHOOLS

The most recent completed survey for which results are available is that for the school year 1983/84. This consisted of three termly postal surveys of primary and secondary schools. The secondary sample is as shown:

	Autumn '83	Spring '84	Summer '84	Total
Sample Size	903	437	449	1789
Schools Responding	700	306	279	1285

1) Virtually all secondary schools (99%) have at least one colour television and a video recorder. The average number of the latter per school is three (Spring '84 questionnaire).
2) Over one third of secondary schools use Open University Broadcasts.
3) The estimated percentage of secondary schools using particular mathematics series is shown below. Most of these have been available from the EBC for the single term of Spring 1985. Being more up to date, these figures have been included rather than those for the complete year 1983/84. It should be noted that the figures refer to that term's broadcasts only. Schools may well hold recordings from previous years and therefore do not bother to record again. On the other hand recordings made during that term may not be used until a later term. The EBC hope that one effect balances the other and that the figures for schools using that terms broadcasts give a reasonable guide to the use of the particular series in the classroom.

Series	Term	% of Schools Using Series	Average No. of Classes per User School
Johnny Ball's Maths Games (Pri/Mid)	Sp 85	2½%	2.0
Help Yourself to Mathematics (Upper Sec)	Sp 85	1½%	2.7
Mathscore Two (10-11)	Au 84	6½%	3.5
Maths Help (CE)	Sp 85	9%	3.8
Maths Counts (14-16)	Sp 85	20%	3.2
Maths Topics (13-16)	Sp 85	12%	3.7
Maths File (11-13)	Sp 85	13%	3.7
'A' Level Statistics (16-19)	Sp 85	12%	1.8

Mean percentage for the above eight series = 9.6% of schools.

Average of the above eight mean no. of classes = 3.05 classes.

4) In Spring 1984 secondary schools were asked to indicate who was responsible for recording television programmes. In 35% of cases the questionnaire was completed by an audio-visual technician who was responsible for recordings with possible help from teachers or other staff. In 65% of cases the questionnaire was completed by a teacher (sometimes Head or Deputy) but 35% of these had no responsibility for television recordings.

APPENDIX VIII

Assuming the EBC's sample of secondary schools to be the population, and the Northamptonshire secondary schools to be a possible sample of this population, we need to assess how far the same mean may vary from the population mean, i.e. to find out whether a certain difference between these two means could have occurred by chance or whether the difference shows that the sample chosen is not typical of the population.

Assuming the distribution to be a normal approximation to the binomial.

95% confidence intervals are given by p_1

where $\pm 1.96 = \dfrac{np_1 - np_2}{\sqrt{np_2q}}$

and n = size of the sample = 35

p_2 = mean proportion of population

$q = 1 - p_2$

E.g For "Maths Counts" $p_2 = .2$

$q = .8$

$$\pm 1.96 = \frac{35 \times p_1 - 35 \times .2}{\sqrt{35 \times .8 \times .2}}$$

$p = 0.33$ or 0.07

∴ For 95% confidence the sample mean may lie between 7% and 33%. A figure outside this range shows that it is almost certain the sample is not typical of the population.