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ABSTRACT

Telephone conferencing can be used to solve communication problems in correspondence education. Technical problems have largely been resolved, and programs like the Educational Telephone Network (ETN) at the University of Wisconsin Extension have effectively used telephones to deliver instruction to remote classrooms. The success of such instruction depends on visual and printed supports and high technical quality, coupled with adequate administrative organization. The Open University of Great Britain has also developed telephone conferencing technology which facilitates elaborate communication networks among correspondence students and instructors. (EMH)

Teaching by Telephone

A Two-Way Communication Mode in Distance Education

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In recent years the distinction between correspondence education and face to face teaching has become increasingly blurred. Correspondence systems are now using a mix of media, often including some contact between student and tutor, whilst conventional educational institutions are using various means to make courses available over a wide area. In the type of distance study where the correspondence and face to face approaches converge, the telephone is playing an increasing role.

An examination of telephone teaching systems in several areas of the world indicates that technical problems need not be obtrusive. However, this study also reveals that to date most such systems have been developed to extend classroom courses and that success in this venture depends on three factors, the simplicity and flexibility of the equipment used, the unattractiveness to the students of the available alternatives, and the provision of quality written materials.

These conclusions suggest that correspondence courses could use telephones most successfully as one element in the teaching and feedback system. Since a start in this direction has already been made by the Open University, the needs of this institution and the role telephones might play in meeting them are discussed in some detail.

ALL ROADS LEAD TO DISTANCE STUDY

The last five years have seen radically different instructional systems develop in a convergent manner particularly in the field of adult education. The correspondence movement has led to complex teaching systems, such as the Open University and DeVry Institute, in which written materials are only one element among several, whereas the tradition of classroom instruction has spawned a host of projects aimed at reaching people outside the classroom.

Both types of institution thus face the classic problem of distance study, which is to gauge the students' reaction to the instruction and answer the specific problems of individuals in a cost-effective manner.

Now if, as private citizens, we send a book to a friend and want to know how he enjoyed it, we ring him up. Although the distance study problem may not be quite that simple, the telephone can give significant help there too. The purpose of this article is to show how

TELEPHONES AND GROUPS

In the 101 years since Alexander Graham Bell put together the first telephone in Brantford, Ontario, his invention has undergone vast technical development and yet has hardly changed at all from a psychological point of view. The overwhelming majority of telephone calls still involve just two people communicating by sound. This is not, of course, to belittle a capital invention; indeed, it is probably because the common telephone answers communications needs so well that the wiseacres can remark, 'The video-telephone is the communications technology of the future – and always will be'.

Nearly all correspondence schools use the telephone heavily on a one to one student to tutor basis. The DeVry Institute, to cite but one example, receives some 2000 student calls a day on its toll-free telephone service. However, in this article we shall be concerned with the use of telephones by groups of people, i.e. calls involving more than two people and usually more than two locations

LOUDSPEAKERS AND CONFERENCING: TECHNICAL AND ORGANIZATIONAL CONSIDERATIONS

It will be useful to begin by distinguishing three ways in which telephone communication might be used by a group.

1) An individual at A converses with a group at B. Although no special telephone is required at A the group at B must have a telephone equipped with loudspeaker and microphone.
2) Individuals at A, B, C och D hold a discussion. This is a conference call. Each party can use a regular handset but equipment is needed somewhere to bridge th four lines together.

3) Groups at A, B, C and D hold a discussion. This is evidently a combination of (1) and (2) and requires special telephones in each location as well as bridging equipment

We shall explore this last, and most general case because it subsumes the others. Any institution intending to use the telephone with groups on a regular basis must make several technical and organizational choices some of which, as we might expect, require a compromise between the technical quality of the system and its flexibility. Such decisions concern the telephone sets, the bridging equipment, and the telephone lines.

Telephone sets

No loudspeaking telephone (LST) can escape the problem (negligible in the regular handset) of feedback between speaker and microphone To prevent feedback howl the microphone must be switched off when the speaker is in use and vice versa Since doing this manually is somewhat fastidious most LSTs incorporate a voice-switch which automatically opens the line in favour of the louder voice. Clarke and Gale [1] have described this problem admirably and figure 1, taken from their article, portrays the voice-switch schematically as a 'decibel devil' If this seems unduly anthropomorphic it is worth remark that the technical characteristics of the voice switch have a crucial influence on the naturalness of any conversation held over an LST.

A second constraint appears in conference calls. Most telephones, including LSTs, are not designed specifically for use in multi-party conference calls. In such calls the total background noise is the sum of the noise from all the lines and receivers involved For this reason the sound quality of a conference call depends critically on the quality of the lines and sets used.

Now it is quite possible to design a telephone conference room with impeccable technical characteristics by both paying attention to the acoustics and fitting high quality microphones and speakers at strategic points in the walls and ceiling. However, whilst the construction of a series of such rooms might be appropriate for a large commercial firm with regional offices, it usually represents too great a loss of flexibility in an educational context. We shall see that the most successful and durable telephone-teaching systems are based on the use of a portable LST or conference set that can be plugged in wherever a jack is available.

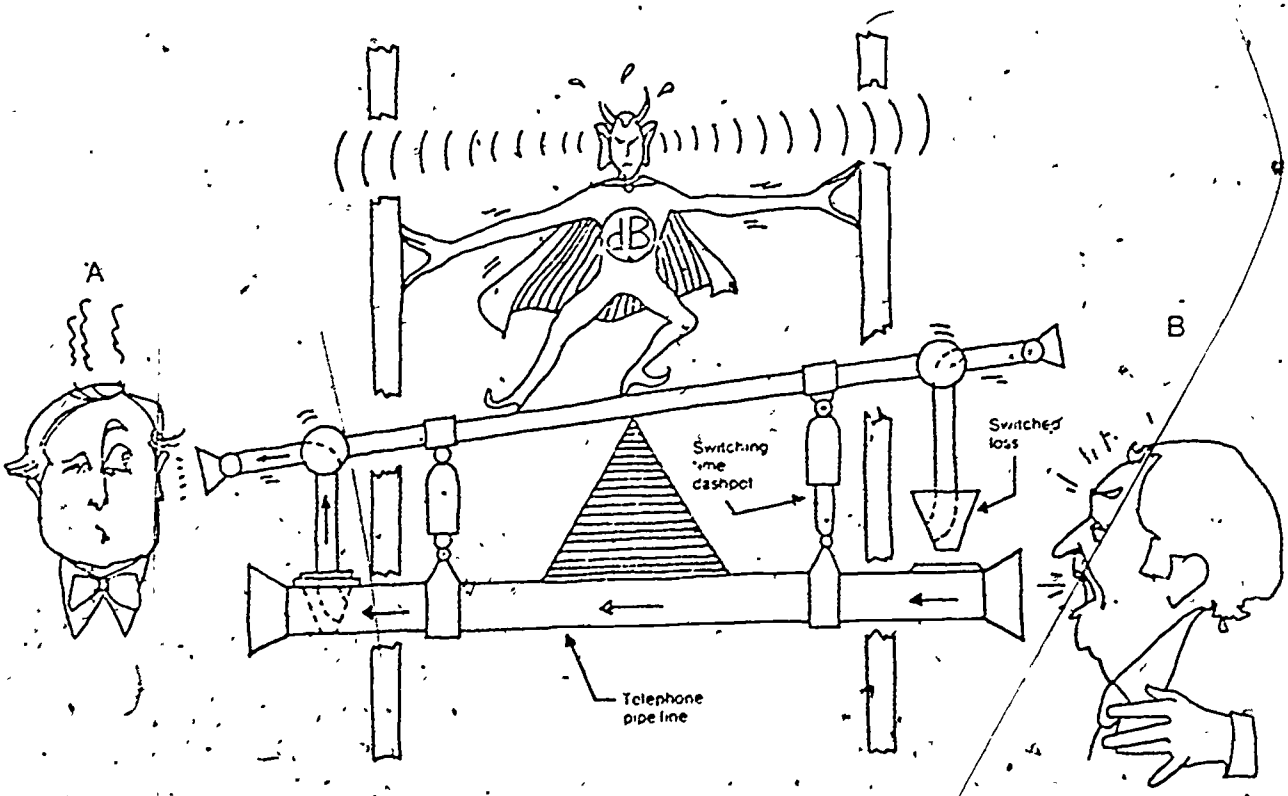

Figure 1

The voice switch, the vital element in a loudspeaking telephone, allows the voice of one talker at a time to be transmitted over telephone line Here the action of the switch is illustrated by a mechanical analogy. The hypothetical dB devil samples the sounds produced at each end of the line and opens or closes the transmission channel to allow the voice of the louder talker to be transmitted. It also inserts 'switched loss' into the return path to prevent the feedback which causes 'howling'.

Bridging equipment

To be useful bridging equipment must provide amplification in all directions, but its design presents no technical difficulties. The availability of bridging equipment is in fact governed mostly by political considerations, and it is to be hoped that other countries will follow the example of the United States in requiring telephone companies to publish specifications so as to allow any equipment which meets these specifications to be joined into the network. Already several different US manufacturers are advertising conference bridging consoles.

This is important because the constraints on conference bridging are organizational rather than technical. Once an institution holds telephone conferences on a regular basis it becomes essential that the bridging equipment be located in the institution rather than at the telephone exchange.

Telephone lines

For conferencing use, even more than for person to person calls, telephone lines must combine high quality with low cost. This is best achieved by using dedicated tie-trunks where possible. Any institution considering telephone teaching will probably already have some dedicated lines to its regional centres, and one of the reasons for locating the bridging equipment in the institution is that it permits the use of these lines for conference calls.

Telephone teaching in action

Now that the main features of telephone conferencing have been presented in an abstract manner, it is worth while examining some real telephone teaching systems. Although the survey of telephone teaching around the world which the authors are conducting is as yet incomplete, it is possible to trace a broad outline of activity in this field.

A retrospective search on ERIC reveals that some fifty reports touching on telephone teaching were published in the US in the last decade. Plotting the number of reports against the year of publication gives a slightly skewed bell-shaped curve rising from no reports in 1967 to fifteen in 1970 and then falling off to six in 1973. One has the clear impression of yet another passing fashion in the use of technology in education.

However, this flurry of activity in the late sixties was accompanied by a process of natural selection. The fittest telephone teaching projects survived whereas those which could not adapt to changing conditions, in particular the disappearance of the Hawthorne effect which had been present at their birth, gradually fell into disuse. We shall describe some successful and durable projects first.

The Wisconsin Educational Telephone Network[2, 3]

Appropriately, for it has always been a world leader in continuing education, the University Extension of the University of Wisconsin must receive or gold medal for telephone teaching for its Educational Telephone Network (ETN). In fact the ETN is only one of three ongoing telecommunications projects at the University of Wisconsin extension, the others being the Subsidiary Communications Authorization (SCA) which allows educational communications to ride piggy-back on the state FM radio signal, and the Statewide Extension Education Network (SEEN) which combines voice communication over the ETN with Electrowriters. SEEN was added to the system to meet the needs of Engineering Extention in 1970 but ETN itself, which we shall now describe, originated in 1965.

ETN is a huge telephone conferencing system which can link up to 210 specific meeting places in 100 Wisconsin communities. These meeting places are courthouses, clinics, libraries offices, etc each specially equipped. Until this year the equipment simply consisted of a loudspeaker and telephone handset. To talk back from a particular location a student simply lifted the receiver and spoke into it. In the last year, this arrangement has been replaced at all 210 stations, by a specially developed portable unit, the Darome Edu-Com, consisting of a loudspeaker and four microphones. This unit plugs into a coupler provided by the telephone company and is very simple to use. Here again, the student who wishes to speak presses a lever on one of the microphones and talks into it. In view of the technical problems of automatic voice switching mentioned earlier it is interesting to note that one of the most experienced educational telephone networks finds manual switching perfectly satisfactory.

Obviously not all ETN stations are involved in every call. At the present time the network is in use 55 hours a week carrying some 34 courses which involve 50 instructors and over 600 students. The average conference lasts about 90 minutes and takes the form of a question and answer session between an instructor and some 100 students in around 45 locations. The students receive fuller written and visual documentation for these courses than would be the case for regular on-campus instruction.

Although we have concentrated here on ETN it is important to realise that ETN and SCA (the point to point FM radio system) are used together. The students already mentioned are linked on a telephone conference using the university's 400 station capacity bridging equipment and dedicated lines whereas another group of students receive the same course over SCA. If the SCA students have questions they phone into the studio and the question is carried live on both ETN and SCA.

The number of students involved in ETN-SCA courses in Wisconsin has grown steadily and a further large increase at the beginning of this year brought enrolments to over 30,000. The system is estimated to cost $0.14 per student hour in network production and operation costs (i.e. not including the costs of additional instructional materials).

Other systems

Another successful system on somewhat similar lines is the Statewide Continuing Education Network in Kansas which has been operating since 1970. This network now links 23 localities in Kansas, the equipment used at each station being the Western Electric 50A conference telephone. Twenty courses are on offer at present and enrolments number in hundreds. Similar systems exist in Missouri and in the city of Los Angeles and a 20 station network has been proposed in Iowa.

THE LESSONS OF FAILURE

Information on telephone teaching projects that have been abandoned is harder to come by. Perhaps the failure of technological innovation in education is so commonplace as to be unremarkable. If so it is a pity, for failure can be more instructive than success. In fact two systems which have been abandoned in the last year contain some lessons. For the sake of delicacy we shall call them projects A and B.

Telephone teaching project A was set up in 1966 to teach graduate courses to groups totalling about twenty students spread about three remote classrooms with about 300 miles between the farthest points. The classrooms were specially designed with built-in microphones and speakers and electrowriters were available. The commonest use of the system was the lecture with interruptions for questions and it was intended to reduce travelling by instructors. (Now that it has been abandoned, the instructors are again travelling every week sometimes in chartered aircraft.) Telephone teaching was dropped because it was not considered cost effective and one observer of project A has remarked that instructors were not prepared to make the changes in teaching methods that the system required.

Project B involves a multi-campus institution which has used a telephone conferencing system very successfully for administrative purposes for several years. In 1973, the smallest campus, which has to serve a sparsely populated area using peripatetic instructors, decided to try telephone teaching in two undergraduate arts courses. In this project classes totalling around 30 students in 2 or 3 centres were linked on 50A conference sets. Ordinary public lines were used and in the early days the conferences were set up by the telephone company operator although later on bridging equipment was installed on campus. The teaching format was that of a lecture with interruptions for questions. After 18 months use of the system stopped and the instructors started travelling again. The students said they preferred the instructor to be present in person and the instructors found that the university was not equipped for the production and distribution of the additional written materials which telephone teaching required.

These brief descriptions of both ongoing and unsuccessful telephone teaching projects enable us to identify some of the factors which favour success.

Size and institutional commitment

There is obviously a vast difference in size between the Wisconsin ETN and projects A and B. This is not to say that a small scale project is doomed to failure, but that a project which is marginal to the main activities of an institution and receives little support from it is severely handicapped. This of course touches on a classic problem in the implementation of new systems of various types. The cautious approach of a series of small projects to prove the worth of the system to the organization has probably condemned to failure many projects which would have been perfectly viable on if implemented on a sufficient scale.

The type of teaching carried out

Here we reach the crux of the matter. The telephone conference has proved unsuccessful when used as a direct substitute for a classroom lecture. Not only is the telephone more suited to a question and answer format, it also requires that students have access to fuller written and visual materials than is the case in classroom instruction. It is no accident the University of Wisconsin, with its long tradition of preparing materials for extension students, should have made a success of its ETN system. This also suggests that a correspondence institution, since it already provides quality written materials, could use telephone conferences successfully as a two way communication mode.

Technical quality

Since, of the projects described, project A probably attained the highest sound quality, we may conclude that once sound quality is adequate, as for instance in the ETN system, it is not worth incorporating further refinements if they lead to loss of flexibility. Resources can be applied more effectively elsewhere in the system (e.g. in producing written materials).

The availability of alternatives

It is also worth remarking that telephone teaching prospers where there are no obvious alternatives. In projects A and B the instructors could give the courses by travelling and the students were accustomed to this. In the case of the Wisconsin ETN this alternative is simply not available given the number of localities involved.

TELEPHONES AT THE OPEN UNIVERSITY

Having described the technical features of telephone conferecing and examined some existing systems, we shall now consider the role that telephones could play in a major correspondence teaching institution. We shall take as an example the Open University, which has already taken some steps towards a greater use of telecommunications in its

activities. The Open University teaching system is sufficiently well-known to require no long description here. Its major component is the correspondence element to which is added television and radio broadcasts, summer-schools and face to face tuition at study centres. At present (1975) the university offers 85 courses which make up a total of some 40 full credit equivalents.

Many courses have an enrolment of several thousand, but some have only several hundred. Even though the number of students accepted by the university is in a few years time likely to increase even more to a projected total of 72 000, it is likely that, as the number of courses and half courses increases too, the number of students on some courses will fall to a rather small total. The university is nevertheless committed to providing a wide range of courses, especially at higher levels, so that students may concentrate on majoring areas if they so wish.

As it has developed the Open University has encountered both administrative and tuition problems which could be partially solved by telephone conferencing.

Administrative problems

The university is administered from a central complex at Walton Hall and from 13 regional offices around the country. The central academic and administrative staff at Walton Hall are complemented by a substantial number of regional academic and administrative staff in the regions. The university is run on democratic lines with each academic being a member of Senate and of his appropriate Faculty Board. These have a vast number of sub-committees, and in an institution still innovating rapidly, a large number of working groups. Regional staff are fully integrated into these activities and the travel demands are therefore often onerous. Telephone conferencing seems to be a partial solution to the expenditure of funds, time, effort and paper, at least on those meetings which require formal decisions or where there is unlikely to be extended discussion. It is recognized, however, that telephone conferencing will not and probably ought not replace all face to face meetings even for subgroups.

While some record keeping functions and administrative decision making procedures are carried out at Walton Hall, for instance marking of computer-marked assignments, summer school allocations, fee records and so on, the regions also carry out certain administrative functions such as arranging for examinations, keeping in touch with students individually and monitoring their progress.

All these activities need to be co-ordinated and result in a vast volume of documents and records being exchanged between the centre and regions as well as heavy usage of telex and telephone. The need to convey information to so many regions, often simultaneously, and to receive replies from each, suggests that a telephone conference facility may be useful for this purpose as well.

Tuition problems

Two problems have emerged in the provision of face to face tuition. The first is that of a widely scattered student population on the smaller courses; the second the difficulty experienced by many students of attending the study centres where tutorials are held. The university has 260 study centres dotted around the country, but they are obviously more concentrated in the urban areas, and students who live in the remoter countryside may have to travel long distances and this may be exacerbated by poor transport services. But even in the urban areas such as London it is not uncommon for students to take well over an hour to get to a study centre and at a cost that is not negligible.

There are also many other reasons for inability to get to a study centre, such as night shift work, physical disability, difficulties in finding someone to care for children; and often just sheer fatigue after a hard days work. About half the student population do not attend the tutorials, which are optional, regularly. Some students can cope without them, but there are disabled and housebound students who miss the support they provide. It was to assist these students that the university initiated its teaching by telephone project. This project experimented both the conferencing and the loud-speaking uses of the telephone.

The conferencing project has been carried out in London for almost two years involving about a hundred students. The students were enrolled on a variety of courses in all faculties and were recruited for telephone teaching because they were unable to attend study centres for some reason. Some were disabled, others found the travel irksome or difficult, others were on courses where the low student population made face to face tutorials prohibitive.

Audio-conferencing has also been used for briefing part time staff and for self-help groups, that is, groups of students on a course who wish to keep in regular contact but who find the extra travel onerous. Some self-help groups have continued throughout the year with discussions on the course units, the TV and radio programmes, the assignments, and perhaps to benefit from some particular expertise that one or other of the participants has to offer in relation to the course. On a technology course for instance, it is often found that a least one of the students works in the particular field, and his experience can be valuable to the others.

Students say that these calls help them to keep pace with the course deadlines and the course units. Participants have to be disciplined into not speaking all at once. The subject under discussion should not be too far-ranging and should be well prepared. Most sessions take an hour, which is long enough to cover much ground without leading to excessive fatigue. Experience gained thus far shows that participants, both students and tutors, have to be introduced into the technique if they are to make the most of it. Even then, there is an improvement in the teaching situation with each experience until everyone is at ease and accepts psychologically the limitations of

non-visual communication A tutor has written, "Telephone teaching is immensely taxing One requires intense concentration and one must not lose the thread of what one is saying while making sure that the students participate fully It is often helpful to use ordinary single telephone calls with students, especially the blind, for a preliminary discussion of the topic Telephone tutorials are highly condensed I do not make students feel that they are obliged to ask questions, they can merely listen I have no discipline problem since I tend to go round the ring allowing each person to contribute at whatever length they wish, which means that some students who have some special expertise hold forth for some time On the other hand a certain amount of cross talk is quite feasible Strangely enough a social unit emerges fairly soon and the last five minutes is usually set aside for informal chat "

Another tutor working in the group situation, stresses the need for a chairman whose role would be to dethreaten group silences, to indicate to the distant tutor that students feel a question is unreasonable when their expressions show this and to identify individuals by name to create better rapport The tutor needs to use signals like "do you agree?" "anyone not understand that point?"

The use of loudspeaking devices has been more problematical The British Post Office Loudspeaking Telephone, the LST4, was designed for a businessman s desk and not for group work, so its range of reception is small, and the normal volume often inadequate for a seminar room An even greater problem is presented by the clipped speech which results from the lag in voice switching at the beginning and end of sentences A solution has been found in the use of extension roving microphones and speakers, though even these have not been completely successful in a large acoustically hard room The problem becomes even more acute in the case of a faint trunk call, or when the unit is linked into a conference call circuit where there may be volume problems

In the London region, these devices have been installed in four study centres They have been used for trunk call tutorials with writers of the correspondence material at Walton Hall, and with academics living in the London area speaking from their homes This is obviously very convenient for the tutors since it saves travel. But teaching by telephone is very taxing in the degree of preparation required and the concentration needed to keep the discussion moving. There is no scope for any of the tension releasing actions normally resorted to by lecturers, nor can there be long pregnant pauses, and the lack of visual cues means that the tutor must keep up the flow of talk endeavouring to obtain responses from the students by direct questions if necessary. In most cases, the member of the part-time staff normally attached to the group has been present with the students to set up the apparatus and encourage participation.

One useful application has been in the science foundation course, where the tutors are often not equally conversant with the four separate disciplines in the course. On the other hand all the expertise needed is invariably available among the staff within the cluster of four study centres A tutor at one centre can therefore take care of his own group first, and then phone through to another centre and tutor the group there, and so on, In this way a cluster of four centres can spread expertise without breaking continuity of contact between the tutors and their own groups, and without additional travel In the coming months efforts will be made to link housebound students to tutorial sessions at the study centres by means of the loudspeaking equipment. The students listening at home can either use the conventional handset or various kinds of headsets can be substituted for greater comfort This ought to break down what may be an overwhelming feeling of isolation

Loudspeaking devices of one kind or another have been installed in a number of remote study centres in other regions. There is the island of Jersey, for instance, and mid-Wales, where access is often difficult and student population is low in number An obvious future extension is to the remote islands around Scotland and some of the far-flung districts in the north. Normally when students from these areas wish to attend a tutorial, they have to travel to a main study centre, a considerable distance away and involving an overnight stay The total costs of fares and hotel can be considerable, and although this is the students personal responsibility, the university must take it into account, and it is the overall cost that must be balanced against the costs of loudspeaking teaching Distance teaching by telephone will become increasingly necessary on small population courses where specialist tutors are not available locally in the more far-flung areas of Britain.

It is hoped that when the system has been perfected, broadcasters on television and radio will stand by their telephones to hear live feedback from students at study centres. Since all the broadcasts are 'canned' the broadcaster can take the call in the comfort of his home. Furthermore many of the programmes are cassetted and can be played at the study centres for revision purposes. The students could then phone the broadcaster with their queries and seek further information from him.

It has been frequently suggested that people cannot learn effectively as long as the medium used obtrudes too obviously between tutor and student. This happens to a certain extent in teaching by telephone where the student is sometimes excessively aware of the presence of the device which then interferes with concentration on the teaching. But half the Open University students are either home based or remote, and they are often willing to put up with the crackles and squeals of the telephone if it saves them time and money.

A POSSIBLE COMMUNICATIONS NETWORK

During the teaching by telephone project, conference calls have been set up by the telephone company (Post Office) operator using, where necessary, ordinary public long distance lines. The project is judged sufficiently successful to merit the setting up of a university telephone network in a systematic matter. This network would run from the centre at Walton Hall, to the regions, to the part-time tutors, to the students. Although this net is short-circuited at various points, this is the main linkage system for the three elements of the total system for academic work, decision-taking and administration. (We should point out that both part-time staff and students have access to the main decision-taking bodies by direct representation.)

With perfect telephone equipment we could visualize a system of communications as in figure 2. Such a system would involve

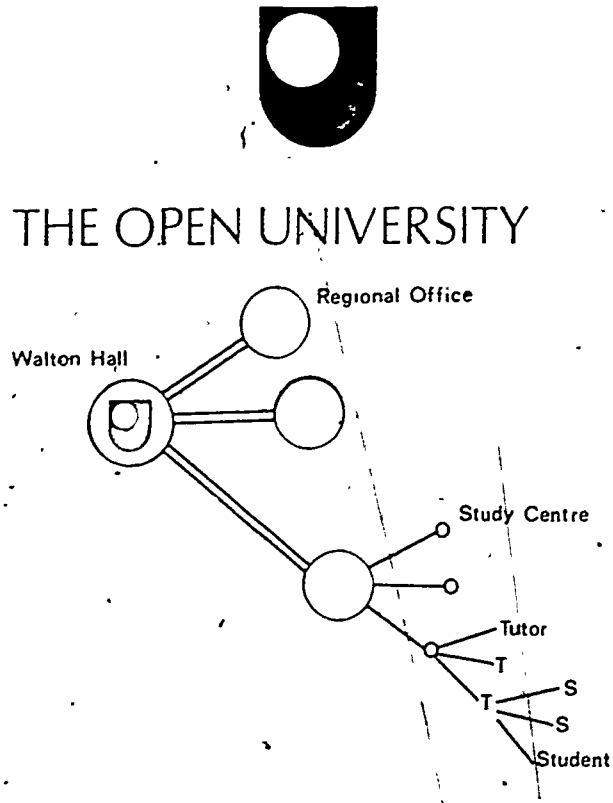

Figure 2

A possible communications network for the Open University

1) A bridging console at the central campus at Walton Hall on which administrative teleconferences involving the thirteen regional offices could be set up. Conference telephone sets would be required in each regional office and, for convenience in several rooms at Walton Hall. The cost of a dedicated line to each region should be evaluated where such lines do not already exist. This part of the system would closely resemble the very successful administrative conferencing system at the University of Quebec, Canada [4]

2) Bridging consoles at each regional office. This would be used for
   a) Conference calls involving tutors at home (or at work) using regular sets
   b) Conference calls involving students at home using regular sets.
   c) Conference calls involving study centres using loudspeaking or conference telephones.

Although none of the conferences organised from Walton Hall or from the regional offices is likely to involve more than 15 stations, the capacity of the bridging consoles should take into account likelihood that different groups will wish to hold conferences simultaneously. The experience of the University of Quebec is that the conferencing habit spreads rapidly once conferences are easy to set up. [4]

Advantages of network

A feature of all successful educational telephone networks is that the institution can set up calls directly without being obliged to go through the telephone company for every conference. The institution's responsibility for operating the system facilitates the identification of problems and, since such systems generate significant new traffic for the company, produces a good working relationship between company and institution. Experience elsewhere indicates that such a network at the Open University is likely to be highly cost effective

CONCLUSIONS

Our study of the educational use of telephones has indicated that telephone conferencing can solve some important two-way communication problems in correspondence education. The problems posed by the implementation of telephone teaching are political, organizational and psychological rather than technical. Good equipment for telephone conferencing exists, although national rivalries have prevented the development of an international market. It is to be hoped that the impetus to telecommunications development provided by the energy crisis will allow the best equipment to cross national boundaries, and this conference might wish to make a recommendation along these lines.

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