Developments in audio-visual education

some recent articles

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PREFACE

Advances in the study and application of audio-visual aids in education which have taken place in the last fifteen years have been impressive. The articles reprinted in this compendium are presented to illustrate some of the more recent changes in thinking and practice in this field. This study differs from its predecessors in being a collection of articles already published (with the two exceptions noted below).

Although Unesco has already issued a number of publications in this field (see list below) and there exists an extensive literature dealing with national practices in this field, it was felt that an international compilation of recent views would be of interest, and National Commissions of various countries were requested to assist in the selection of articles to be included. The present work is the result of this process. The two unpublished articles are those by Guelmont and Poltorak, and by Ukawa. These were, however, prepared under government auspices and may be regarded as representative of developments in the U.S.S.R. and Japan.

The interested reader is directed to *The Year Book of Education, 1960, 'Communications Media and the School'* (Evans Bros., London, 1960) and to the other recent Unesco publications listed below:
- Allison, Mary L.; Jones, Emily S.; Scholfield, Edward T. *A manual for evaluators of films and filmstrips.* Paris, Unesco, 1956. 23 p. (Reports and papers on mass communication, 18.)
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FILM, RADIO AND TELEVISION AS EDUCATIONAL FORCES
IN MODERN CIVILIZATION

Paul Heimann

FILM, RADIO AND TELEVISION AS EDUCATIONAL INSTITUTIONS

Film, radio and television are usually discussed under the heading of the customary educational and teaching aids, i.e., on the same level as abaci, wall maps, sandtrays or sets of pictures, for the reason that films and tape recordings can be used in education in a way similar to the projection of slides. However, to lump them together with the traditional aids is to mistake completely their true importance and to ignore the social and psychological value of mass media in present-day civilization. A revision of thinking about modern mass media is needed. Far from existing somewhere on the fringes of modern educational thought, they are right at the centre.

Television, for example, is not just an alternative method of demonstration, but an independent and organically complete educational institution, like the school itself. It should be regarded as such and not simply as a vehicle for entertainment, political propaganda or commercial advertising. Educational subject-matter of the most varied kind falls within its range to a far greater extent than is generally realized. It is significant that most television organizations are themselves aware of this.

In a Unesco report, C. P. Siepman pointed out that the large American broadcasting corporations, ABC, CBS and NBC, when questioned, described a large proportion of their programmes as educational. Indeed, the NBC view is that programmes should be adjusted to the possibilities of development and self-realization of individuals and should constantly serve the purposes of education.

A passage in the American Television Code in addition, stipulates that television networks, advertising agencies and, particularly significant, financial backers, must deliberately seek opportunities for the inclusion in broadcast programmes of factual material which will contribute to the enlightenment and education of the American public.

The situation in Germany is similar. An analysis of German afternoon programmes in the first half of 1960 shows that out of 203 programmes monitored, 104 were educational. Even among the 406 evening programmes viewed during the same period there were at least 155 with an educational slant. If television plays, and all theatrical and operatic performances are added, as they have some claim to be, our overall view of television almost suggests an educational bias, which may well be in conformity with the true nature of the medium.

The situation is possibly even more favourable with regard to sound broadcasting, although it is naturally completely different in the case of the film. The great majority of broadcasting stations, particularly in Germany, France and England, are public services of high standing. The cinema on the other hand is an industry guided by the profit motive; and while this does not necessarily restrict its practical educational influence, it does modify it in the sense that the educational responsibilities of the cinema are completely vague.

THE EQUIVOCAL NATURE OF THE MASS MEDIA

The assimilation of mass media by public education cannot be considered complete; in a deeper sense, it is only just beginning. Indeed, it is now being seriously overshadowed by large-scale public and expert criticism of these media, on medical and biological, psychological and sociological and aesthetic, cultural and educational grounds. Such criticism ranges from naive and ill-informed attacks to extremely subtle analyses like those of Günther Anders and Adorno.

More particularly, the opposition of teachers to the impending threat of school television has recently been increasing. However, one good result of this has been to produce specific affirmations and objections which it thus becomes possible to refute. What is particularly feared in connexion with school tele-

vision is the encouragement of passive acceptance, educational impressionism, the growth of a dangerous type of conformity, the paralysis of creative imagination through the intensification of artificial stimuli, the replacement of first-hand by second-hand experience, loss of individuality, the mechanization of the pupil/teacher relationship, and the standardization of educational activity.

These objections are by no means to be lightly dismissed, for some of them are valid expressions of educational philosophy; nor can they easily be refuted by purely educational arguments.

The following are, however, useful criteria for establishing the value of visual documentation centres: reasoning based on cultural history and educational sociology, which goes beyond purely educational arguments and sets out to demonstrate the cultural legitimacy of the media; and a critical analysis of the very remarkable educational potential of these forms of communication, from which it might be possible to deduce methods of organizing them and using them for educational purposes.

Scientific and historical research provides ample evidence that the attitude of Europeans as to their surroundings, and their consciousness of the world have changed since the Renaissance, in the sense that the archaic, mythological outlook has gradually made way for the development of empirical and realistic ideas and concepts. The rapid expansion of the natural sciences is the most impressive intellectual reflection of this development.

This gradual development culminated in a consistent, if sensational way, though at a level beyond art, with the arrival of photography. This is the aesthetic correlation of a type of consciousness that has learned to think in terms of reality.

Photography projects a picture of the world as seen 'through the camera's eye' which has undoubtedly become representative of the twentieth century. Our consciousness has a strongly realistic bias and the greater the extent to which things and situations can be made to seem real or actually experienced, the more significant they will appear to us. It is this illusion of reality that film and television photography can create for us. Considered from the aspect of cultural history, all of us are at home in front of the screen and willingly become receptive to its influence.

The auditory stage of sound broadcasting is no exception to this rule, for the photographic or electronic camera lens and the radio microphone operate on the same aesthetic and psychological levels, though on different sensory levels. Our reality-bound consciousness regards them as identical instruments and, particularly in sound films and television, they have for a long time been fused in an excellent synthesis with an outstanding power of aesthetic and intellectual suggestion.

This evolution of consciousness and its aesthetic consequences may be regretted or may even be interpreted as a sign of regression. Nevertheless, along with the help of mass media, it is now enabling us to make the world our own, both physically and spiritually, and on occasion to render it transparent. The French cinema theorist Henri Agel correctly refers in this regard to a spiritual realism for which the film is something that can also dematerialize the world. In this connexion, if we consider that educational thought from Ratke and Comenius up to the American pragmatists of the Dewey school has followed a very similar road, even the most sensitive and conscientious educators should no longer find it too difficult to assimilate these media.

THE ARGUMENTS OF THE EDUCATIONAL SOCIOLOGISTS

The evolution of Western consciousness, as described above, has been paralleled by a far-reaching social and cultural transformation of our lives, which in recent years has been proceeding at a staggering pace, owing to the all-pervading influence of technology. Sociologists are fond of describing this as a process of cultural change no longer conceived of as a normal periodic change in style but as a step through the gateway into a completely new cultural era.

Whether this is true or not, we are now being subjected to the pressure of a vast process of cultural disintegration. However, this is accompanied by a no less intensive building-up process, something which that is often forgotten. This latter process has already resulted in far-reaching changes in our work and consumption habits and in our social, ethical and cultural attitudes.

In the wake of these new living and world conditions, there are people who up until now have existed merely as pawns in a game of historical power and whose intellectual and political maturity has been gained at the rather dangerous moment when their own world is threatened with the collapse of its scale of values. Since becoming active on the historical scene, these masses (for it is with them that we are concerned here) have become shouldered with responsibilities and are conscious of educational needs which hitherto arose only in the training of an elite. This process, which Karl Mannheim has described as the 'fundamental democratization' of our society, can bear fruit only if the masses are provided with educational and teaching aids of a completely new type. In this connexion, the mass media are already playing a tremendous part. For the masses, they really constitute signposts to a real and yet boundless world. They have become so because they make use of an audio-visual language that is understood internationally.

Mass media are, in fact, the catalysing agents in a vast process of cultural change, which they reflect and constantly further and modify. It is precisely this which makes them so outstandingly important for education, regardless of the direction in which
their influence may radiate. They have contributed to the development of a revolutionary situation in education, which makes demands on the general educational perception of modern teachers—demands which cannot be ignored.

Cinema, broadcasting and television appeared in that order at almost exact quarter-century intervals, beginning at the close of the nineteenth century. At the same time, their educational and aesthetic potentials became gradually enriched by increasing technical progress. For example, as camera work and cutting-room techniques progressed, various standard types of film were created—narrative feature films, informational short subjects, educational films and documentaries. The film thus developed into a classical medium of concentrated narrative conveyed in visual and acoustic images.

The novelty of sound radio lay not so much in the fact that it created its own appropriate forms of presentation, as that it possessed practically unlimited possibilities for the diffusion of its message due to communication through electronic radiation. Its primary feature is—reduced to a formula—its ubiquity, i.e., the omnipresence of its broadcasts, whether in the form of original radio programmes or of concert relays. What matters is its reception at the greatest possible number of places simultaneously.

Television may be regarded as a kind of synthesis of these two stages of historical development. It has taken over both the ubiquity of electronic radiation and camera and cutting techniques and has therefore developed into a fully equipped universal stage for an era which in practice can draw upon the whole store of forms known to present and past civilizations. The television screen possesses an adaptability which is unlimited. This is why television is the richest and most versatile of the mass media when it comes to presenting a photographic and auditory picture and interpretation of the universe.

This quality of differentiation naturally has educational consequences which are easy to recognize in connexion with the use of these media in teaching. Every audiovisual expert and every teacher discovers this as soon as he makes a serious study of either films or television.

THE EDUCATIONAL POTENTIAL OF THE MASS MEDIA

In spite of this differentiation in working with the mass media, the audio-visual expert and the teacher will time and again be referred back to an identical system of communication which is equally valid in all of its three variants—film, radio and television—and which covers material as widely divergent as plays, sports reports, dance programmes, political reviews, interviews, quiz programmes and even religious services.

Adorno and Horkheimer, in their 'Dialektik der Aufklärung', show ironically that the complaints made by many art and culture historians about the disintegration of the power of stylistic invention in Europe are completely unfounded, as the stereotyped reduction of all the material communication into a form suitable for mechanical reproduction is something more rigorous than the demands of any genuine style. So far as our subject of discussion is concerned this means that things, faces, situations and events are so filtered for purposes of translation into audio-visual language of the mass media that they positively enforce a specific type of experience. The special effectiveness of these media is therefore to be sought in what has become a technical audio-visual language.

One of the basic qualities of this language is its practically unlimited capacity for expressing and rendering virtually every aspect of the world. We all know that anything in this world that is designed to achieve significance and to arouse public consciousness—whether in politics, art, beauty contests, sports records, ideas or even historical events—is compelled to employ this language. The universal appeal of these mass media has become so great that it can be accepted as an uncontested, basic feature of all mechanized communication.

In addition to this unlimited capacity, analysis of the phenomena involved brings to light other exceedingly important characteristics, at least four of which should be mentioned here. For it is chiefly the combination of these that produce what may be called the educational potential of the mass media; and it is with this that we are really concerned.

Reduced to four concepts, we have the following: the power of attraction of the audio-visual language, the almost unlimited extent to which it can be manipulated; its tendency towards the accumulation of stimuli which can be called in short the accumulation phenomenon and finally the topicality principle. These features are common to all mass media.

The four phenomena thus roughly defined are the essential structural principles of mass media. They are active at all levels, in programming, in production and presentation, in the action of the media on the public and, not least of all, in our own educational work. Indeed, they are the universal principles of modern communication and therefore deserve closer study and interpretation.

THE POWER OF ATTRACTION OF THE AUDIO-VISUAL LANGUAGE

The remarkable power of film fascination is probably the first thing we notice in considering mass media. This fascination is not merely a kind of diffuse moment of interest, but a very specific effect arising from the technological depiction of the world. In addition, we must remember not only the visual aspect but also the auditory components, which possess their own
brand of fascination, principally of an emotional type.

This relationship of photography to our reality-bound consciousness acts most powerfully through the fully-developed dynamism of film photography and television, in which it raises fascination to its ultimate level. In his research, Herbert Wölker proved empirically that the film multiplies the intensity of experience many times over, and thus facilitates identification with the matter shown. The influence of identification on the social process of learning has been made clear to us by Karl Heinrich’s latest work on the effect produced by films.

The intensification of experience depends essentially on the visual and acoustic impact of photography. For that reason, in an age of increasing abstraction, increasing intellectualization and declining sensibility, as Gehlen calls it, film and television, through their power of making things concrete, have a compensatory function. By attracting audiences to the images and the stark graphic descriptions of commercial cinema and television, this function sometimes has a very negative effect; but it nevertheless retains an authentic and indispensable therapeutic quality. Moreover, the relationship of photography to the world is not confined to this power of making things concrete. The subjects photographed have their own authenticity and documentary value. Photography always relates to facts, to something that has actually happened or really existed. This enhances its fascination, but weakens its power of symbolism. According to Cassirer’s theory of symbols, photographs are never symbols used to express an intrinsically spiritual concept. They are signals pointing to some concrete fact. Therefore, the weak point of photography as a means of conferring reality and exercising fascination lies in its dubious relationship to abstraction.

Here we come to an argument applicable to all mass media and one which recurs in a variety of shapes. Photography makes possible a maximum of what English theorists call involvement, an entering into contact with the outside world; but it holds the mind captive in concrete situations. By drawing on real situations, it promotes what might be called emotional commitment, but at the same time weakens thought by making an assault on our senses. This sometimes appears in a crude form in popular science broadcasts, where lavish visual display, an abundance and complexity of pictorial matter, very easily gives the illusion of understanding, though in reality it merely builds up visual dummies in our consciousness. The intellect is frequently quite untouched by such visual exploits.

Educational responsibility and imagination must not capitulate in face of this dilemma. Indeed, they must use it consciously and even orient their educational activities on that basis, e.g., by using films and broadcasts in teaching. Through their power of fascination, these are particularly suitable in the initial stages of a learning process, where the great thing is to give a powerful motivation and awaken interest from the start. The mass media are ‘magnificent gateways’, as the English publicist Hoggard once called them. However, they may prove to be a hindrance where abstractions and generalizations are concerned. In such cases, they may almost act as barriers. On the other hand, visual barriers of this kind can be set up deliberately, to goad pupils into using their brains.

Where an accurate observation of detail is the prerequisite for the correct training of perception, as in geology and geography, the use of films can be exceedingly profitable. It is also must valuable in the ‘deepening stage’, in the sense in which the term is used in Herbart’s theory of phases. On other grounds, it is also valid for the teaching of politics and civics which, because of their abstract nature, are difficult to present in visual form. Here the mass media are absolutely essential.

The effect of the visual attraction of photography, as a means of realistic presentation and information, upon the film consumption of young people is best known to those who use films in teaching. A profit-hungry industry exploits photography’s power of attraction and conviction mainly to lend the unreal world of mediocre authors a semblance of reality and to draw the imagination of the audience into a dream world clothed in the garb of reality. We realize that there is at present no way of overcoming this evil except by preventive educational methods designed to immunize pupils against this form of mental poison. The ability to illustrate is transformed into the power to seduce. The basic meaning of the Latin word *fascinare* is ‘to bewitch’. This conveys an echo of the assault on our senses and, let us be honest, is not this power of enchantment present to some extent in every film and in every radio or television programme?

**FACILITY OF MANIPULATION**

The adaptability of mass media is a property which makes of them well-forged and efficient tools in the hands of experts. It gives them their wealth of expression and ensures their suitability for all purposes. However, its values are neutral and it may serve either truth or falsehood.

The concept itself is used here in a very broad sense, which makes it possible for us to penetrate to the reality underlying every phase of film and radio production. Facility of manipulation is a universal phenomenon in the mass media and is displayed in a great variety of ways.

Perhaps the clearest way of demonstrating it is by reference to the work of the film cutter, whose sole function is to cut and re-join single sections of film into intelligible sequences. The purpose in this case is to create sense. Cutting and mixing images in film and television are primitive forms of manipulation.
They may be used to tell the truth, to lie, to camouflage, to excuse or anything else.

The early Russians were well aware of the power that lay in cutting and had good reasons for regarding it as the fundamental principle of film art. But manipulation begins as early as the shooting stage, in focusing, in lighting, in camera angles. No photography is possible without perspective. Even a snapshot is a form of interpretation.

Nowadays, the problem of manipulation also appears on an entirely different level in television, in the person of the interpreting speaker. Speech within the framework of a visual medium has in this way become a manipulatory power of the first rank. The oral description given in a visual broadcast establishes a very pronounced emotional accent. This is a very effective form of primitive manipulation.

It must however be granted that, on a higher level, television is nowadays campaigning for a new word-picture relationship. This takes the form of an extremely interesting process where idea and observation are fused in a single simultaneous act. Words become concrete in picture sequences and images are intellectualized by the medium of the interpreting word. This cultural phenomenon is of great importance and novelty and is rendered possible only through the medium of television. This experience gives an indication of educational resources which are still untapped but which will one day radically alter the educational style of television.

On the highest level, again, the manipulation process is relentlessly carried through in radio programming and in the planning centres of the film industry. Here, decisions about spheres of influence are made, and whole populations are exposed to the magical influence of planned films. In this regard, everything depends on the personality of those who occupy these posts of command. At this point, the phenomenological method of examination ought to make way for a true sociological analysis of the balance of power in the 'brains trusts' which control the broadcasting organizations and the film industry. In any event, a study of this power of manipulation at every stage of film and radio production might well provide a most valuable contribution to our knowledge of the inner educational structure of these systems.

Manipulation is also important at a much humbler level, e.g., in the preparation of our educational films. Here the problem is one which causes us great concern. Should we take as our model the perfect educational film, which traditionally constitutes a system of knowledge so compact and so completely adaptable as almost to render superfluous both the teacher and any further work on the material? Or should we produce open fragments of film, where the subject matter is accompanied by questions, so that pupils are placed in a working situation which in terms of modern teaching theory is educationally ideal?

Here we come up against the same ambivalence and qualitative difficulties as were encountered in considering the problem of fascination. In this case too, the search for truth or falsehood, the encouragement of sense or nonsense, the offer of an opiate or a challenge, are effected by the same method—the power of manipulation—and by that alone.

What educational maxim can we derive from this? Manipulation must always be uncovered. This must happen in two directions. In the first place, the manipulation of sense in the cinema must be discerned, i.e., we must learn how to understand films. In the second place, it must be exposed. Whether we are concerned with exposing a dream structure or with seeing through the visual perfection and manipulation of the newsreels of the Third Reich and laying bare its ideology, we should be constantly engaged in an effort to uncover the serious consequences of manipulation.

THE CUMULATIVE EFFECT

The cumulative tendency, i.e., the tendency to pile up stimuli, is something mass media share with the other constituents of modern civilization, which suffer in general from a plethora of facts, stimuli, material and opinions. Owing to their unlimited capacity, however, these media are predestined to a boundless accumulation of stimuli, precisely because the technique of providing them is so easily mastered.

In this regard, the thematic, visual and sound overloading of television broadcasts and films is typical of the production style of all the mass media. It is claimed that this ultimately induces a permanent blockade of the audience's capacity to take in what it sees and hears. It has been said that television broadcasts are nowadays only looked at, but no longer seen. The onlooker develops a layer of undigested secondary experiences, a hydrid form of consciousness, which believes that it knows everything but in actual fact merely contains masses of experience which can lead to absolutely nothing.

However, those who tend to frown upon the endless piling on of stimuli are overlooking the fact that it originates in a genuine spiritual need which is only awaiting satisfaction. This is the need for an expansion of consciousness and a widening of the horizon, without which it is becoming increasingly difficult to find our way and to act constructively in our complex world. In the recent development of Europe, our consciousness has altered not only qualitatively but quantitatively. Educational theory seems at the moment to have no proposals for satisfying its demands. Even the schools are running aground at this point. If we consider seriously, even for a moment, what Henry Cassirer, head of the Unesco television section, put forward at the London Television Conference in 1957, namely that a revival of the universal mystic thought
of the Renaissance, as represented by Leonardo, Michelangelo and Machiavelli, was required on sociological grounds, not merely on the level of genius but among the broad masses, we cannot casually dismiss television’s possibilities in that direction. If there is any way out of the educational bottleneck that now exists all over the world, it must be by means of the mass media, which possess not only the technical capacity for the task, but also the methodical facilities for implementing it.

THE PROBLEM OF TOPICALITY

This problem is of the same magnitude as that posed by the power of fascination of the mass media. Topicality and the trend towards it have come to set the pattern for television. Live broadcasts are among the high points of television programmes. Arnold Hauser, in his Sozialgeschichte der Kunst und Literatur (Social History of Art and Literature) tries to account for the power of attraction exerted on the minds of spectators by the impression of spontaneity resulting from the coincidence of perception and event, and attempts to explain why the modern mind has this peculiar sensitivity towards actual events.

We may agree with Hauser that this is not so much a fashionable contemporary whim as a profound metamorphosis of our attitude to life, which experiences the world primarily as a process in which we can genuinely participate only through grasping significant moments—a truly Heraclitean view of the universe!

It seems that the television set has already become a concrete symbol of this process of simultaneous experience, for it provides a synchronized record of life as it flows by. Television enables millions of people to participate in all kinds of topical events, even if most of them are not ‘Heraclitean’ moments.

This is not the place for an assessment of the value of this form of modern topicality. However, even if we regard it as no more than a potentially important anthropological phenomenon, we are faced with the introduction of completely new elements into our already complex world. Naturally, our educational thinking as a whole cannot remain unaffected. Try to imagine contemporary events becoming a legitimate, even an integral feature of modern general education. The schools would then be faced with a task for which their organization and present attitude towards teaching does not yet equip them.

Only the mass media, and television in particular, are already prepared to cultivate a relationship with the outside world that could conform to this topical pattern.

RIVAL EDUCATIONAL PATTERNS

Film, radio and television are cultural institutions which obviously cannot be considered as educationally neutral. On the contrary, they exert a lasting formative influence on character, though this is often involuntary on the part of their organizers. Within the framework of their influence a completely novel educational situation has developed, because they use for their own purposes a technical audio-visual language that has created an entirely new educational atmosphere. Their boundless capacity for manipulation, their fascination for the senses, their tendency to intensify stimuli and their accent on topicality reveal the mass media as means of communication in which a hitherto unknown educational ideal has been given an institutional structure which seems clearly opposed to the traditional conception of the school.

We should be wise to accustom ourselves to the idea that we are now dealing with two rival forms of education, which not only follow different ideas of teaching but have become embodied in different social structures.

On the one hand we have the state school system from kindergarten to university and on the other the large, more or less government-controlled broadcasting stations.

We need not hesitate to regard television stations as setting the pattern for the new type of teaching, as they not only embody a new educational trend but also display certain cultural, social and aesthetic developments in a representative combination. It is perhaps too soon to attempt an accurate definition of the differences between the two educational patterns, for the whole development is still in a state of flux. However, some of the differences are already beginning to emerge.

Television clearly supports an extensive concept of teaching, in which broad surveys, a wealth of facts, the piling up of stimuli, a receptive attitude towards information, topical value and the establishment of a pattern of learning with particular orientation are the decisive factors.

Schools, on the other hand, embody the ideal of an intensive, selective education, based on the independent activity of pupils, in which exemplary teaching conditions and methodical thoroughness are the valid objectives. They want to and must develop exemplary learning methods.

Both types of education are based on the genuine needs of modern civilization. For a long time, our society has been subjected to spiritual and psychological stresses which find their concrete expression in this educational duality. As a result, these two types in conjunction form the first integrated educational system of modern times. The natural relationship between school and television might therefore be described as a sort of competitive co-operation, as in the long run schools will be unable to avoid making use of current educational material from outside.
However, the screen requires spectators who have been subjected to school educational methods and are equipped with faculties of comprehension without which the fluctuating world depicted in the daily flood of images cannot be intellectually revealed. This demands the cultivation of new educational qualities which until now have perhaps appeared suspect. Television requires promptness in orienting ourselves to a large mass of stimuli, alertness in our observance of rapid sequences of pictures, preparedness for the interpretation of quickly-changing superficial appearances and the ability to hold aloof from the assault on our senses. It cannot be denied that such factors should be included in the spiritual and intellectual equipment of contemporary human beings even if only a few of us are prepared to admit that we already possess a training ground for these qualities in the form of the television screen.

It is therefore strange that, at any event in Germany, these two educational institutions still profess to ignore each other officially—though, paradoxically enough, they are already surreptitiously linked by the fact that schoolchildren participate in both. This temporarily illicit relationship need only be legalized at the level of educational policy to bring about a situation which could well be decisive for the future of education in our country.

School television broadcasts might possibly be one way of bringing about a temporary link, as is already the case in many countries. However, there are other possibilities, some of which are quite revolutionary. Developments in the United States are to some extent a model for the future everywhere. There, television stations have simply incorporated the school system, with its methods and curriculum content. The early-morning broadcast ‘continental classroom’ is an example of this, as is the Italian ‘telescuola’.

Moreover, some schools have begun to set up regional television systems of their own, with the help of which they are arranging a rich variety of educational programmes and are thus entering into competition with the television stations, partly through the adoption of radio methods.

The head of an audio-visual centre should be responsible for an organ serving both types of education and both educational institutions. He represents the school and its classical teaching traditions and at the same time the novel requirements of the mass media. He leads an amphibian existence, which in this situation may be a valuable stimulus for a far-seeing government educational policy, as authorities cannot remain unaffected by these developments. We must wait and see if they will know how to make best use of them. At any rate, the audio-visual centres are the appropriate clearing houses for these problems, the specialized agencies in a process which is only just beginning but which will become of national importance.
INTRODUCTION

In generalizing research findings, or, for that matter, in dealing with them on an individual basis, it is necessary to make criteria of confidence explicit. Otherwise, acceptance or rejection of research findings is likely to be based on what Whorf [28] calls ‘natural logic’, i.e., a series of implicit concepts or propositions which admit of no alternatives, explanation, or explication.

Furthermore, a working definition of scientific method is also essential since a philosophy of science, frequently that of logical positivism, underlies the great emphasis on empiricism as such in film research. Respectability in film research is equated with the controlled experiment, and thereby restricted. The controlled experiment is equated with science. The product is an implicit concept of scientific research that needs to be made more explicit. This can be done by defining scientific method.

Under the circumstances, it is appropriate to look to a living philosopher for a definition of scientific method. Nagel [20] supplies one which, at first glance, seems to pronounce a benediction on the narrow empiricism of data-gathering researchers: ‘...what is distinctive in all science, not merely of natural science such as physics, and what assures the general reliability of scientific findings, is the use of a common intellectual method for assessing the weight of the available evidence for a proposed solution of a problem, and for accepting or rejecting a tentative conclusion of an inquiry. Scientific method, in my use of the phrase, is a procedure of applying logical canons for testing claims to knowledge.’

This broad definition provides both a contrasting background and a source of some support for the criteria used in this summary of educational film research findings. It is to be understood that this summary is an attempt to state current policies of knowledge in the field. Policies of knowledge are propositions suggested by systematic observations of behaviour, subject to revision suggested by additional observations, or by alternative imaginative constructions suggested by the same or additional observations.

The policies-of-knowledge concept is used so as to avoid intellectual booby-traps intrinsic in the use of such words as facts, truth and science, and in the imputation of invariance and absoluteness by such words as laws, principles, etc., superimposed on summaries of research findings.

In educational film research, we are dealing with a finite body of material produced during a finite period of recent time during which theory, research technology, and the art of film-making have changed and expanded. It is, thus, necessary to formulate criteria of confidence that are realistic in terms of research material at hand. Furthermore, the criteria employed must be formulated so as to be useful in terms of decisions that must be made within the limits of risk tolerable in an ongoing process of education under bureaucratic control (a) in directing and controlling future research activities, (b) in educational television and other media or teaching devices as well as educational film research.

Those among us active in educational programmes are acutely aware of some facts of life that we, as research-oriented individuals, might prefer to sweep under the rug. One of these facts of life is that formal educational programmes frequently do not rest on firm theory, supported by immaculate research data. Consequently, a policy of knowledge based upon reasonable theory with even tenuous research support is likely to be a basis of decision as good as the current one, if not better than it.

It may be argued that consideration of the decision-structure of formal educational programmes is totally irrelevant to, if not a deliberate subversion of, the ad hoc task of this seminar. If we were operating in a field of pure science, such an objection might have

2. The figures in brackets refer to the bibliography on page 25.
considerable validity. But educational research, by virtue of its qualification, is not a pure science field. It is, quite patently, a field of operationally-oriented or applied scientific research.

**CRITERIA OF CONFIDENCE**

Four criteria of confidence are used in generalizing the substantive findings of educational film research. They are not limited to the application of 'logical canons', yet they do not deny the validity of what Nagel proposes. While these criteria are my own, I believe they are or resemble the de facto criteria by which certainty is assigned to educational research findings in the present 'state of the art'.

1. **Reasonable intuition.** Essentially, this criterion specifies that if 'facts' (meaning numbers and statements about numbers upon which statistical operations have been performed) conflict with what is intuitively reasonable, the 'facts' are suspect. It is immediately granted that, by this and other specified criteria, confidence is subjective. I can't imagine what else confidence can be, although I recognize that, among other things, specified 'confidence limits' indicated by mathematical probability influence confidence.

2. **Demonstrated competence of the investigator as an imaginative observer** in the field of psychology, sociology, education, communication, or a related discipline. Nagel supports this criterion. He asserts that scientific concepts 'have not been obtained by a process of simple abstraction from empirical data, but that they are intellectual creations, often suggested by the data, and are the products of constructive imagination.' Hence, subjective confidence in research findings is related to the demonstrated competence of the researcher as a constructively imaginative observer, not blinded by his hypothesises.

Some of the 'best' leads to policies of knowledge in the field of films in education come from imaginative explanations of phenomena which competent researchers carefully warn us are observed in 'exploratory' experiments involving 'crude' concepts, techniques, and appurtenances. Yet, as Merton [18] points out, 'in observing particulars we inevitably imply universals'.

Constructively imaginative insights applied to 'crude' data, that may in themselves fail to satisfy the rigorous test of Nagel's 'logical canons', are at least a source of advancement of policies of knowledge.

3. **Relatability to a consensus of theoretical formulation.** Lonesome data, random points on a grid, and empirical research findings are of little use unless and until they are related to a systematic formulation which, by consensus, is accepted as a theory. Confidence in the generality of research findings is enhanced when research findings are or can be related and integrated into an accepted formulation of higher order abstraction. Conversely, confidence in the generality of research findings is weakened when they are not explicitly related, or relatable, to such a systematic formulation, i.e., to theory. Film research has notably avoided theory-orientation.

4. **Replication of the investigation of the problem** adds to the confidence in results, provided that the results of replications are consistent or extensive. In replication, neither the stimulus (or input) ensemble nor the techniques of investigation nor the population characteristics need to be identical. There is really no point to complete identity in replication of a study, except to satisfy the human need for redundant information. Nor, for that matter, is complete identity in replication likely to be achievable with human subjects. Replication involving a relative rather than an absolute constancy of the experiment is essential to increase the generality of the findings beyond the unique conditions of any experiment. This criterion of replication leaves open the questions of how many replications there are and how varied the conditions are. The answers to these questions are functions, in part, of the individual's tolerance and criteria of risk, and these probably are related to his personality characteristics'. Subjectivity appears to be inescapable.

**CASE ILLUSTRATION OF CRITERIA APPLICATION**

The application of the criteria of confidence can be illustrated by research findings on the effects of colour v. black and white films in factual learning.

Intuitively, the expectation of a difference between educational effects of colour and of black and white films is reasonable. Colour is a visual dimension. A dimension can be equated with information so that a one to one relationship can be said to exist between the addiction of a visual dimension and the addition of information. Under conditions as yet unspecified, it is intuitively reasonable to expect that the addition of the dimension of colour to a visual presentation will increase learning, including factual learning, since, in information theory, information is valued in terms of its reduction of the range of alternative sequential events. Learning involves such a reduction, and, if one chooses, can be defined in such terms.

Imaginative researchers have investigated, with replication in variety, the problem of factual learning from colour v. black and white films. In general, the results indicate either no significant difference, or internally contradictory results such as that with some films colour is significantly superior and with others there is either no difference or a difference in favour of black and white.

We are thus confronted with a situation in which the 'facts' do not coincide with reasonable intuition. Without being able to relate research findings, i.e., the 'facts', to a theoretical formulation, we have only two alternatives: (a) to accept the policy of knowledge
that colour films (v. black and white) add no significant increment to factual learning, or (b) to continue researching the problem by increasing the number of combinations of colour with 'subjects' of films, population samples, test items, etc. Neither alternative is acceptable. Thus, we are forced to look elsewhere for resolution of facts and intuition.

In 1957, Neal E. Miller [19] set forth a series of 'scientific principles for maximum learning from motion pictures' in which he related film research problems and findings to his drive-cue-response-reward theory of learning. Miller's treatment constitutes one of the major advances in a field notable for its rule of abstinence from major advances, its dreary plateaux of conceptual confusion, and its preoccupation with ad hoc problem formulations.

In his discussion of cues, Miller points out that 'Colour should be an advantage if it is one of the most relevant cues or can be used to emphasize relevant cues; it should be a disadvantage if it distracts or complicates'. This deduction from Miller's theory of learning (by no means completely reported in this particular discussion) provides a handle by which we can begin to deal perceptively and usefully with the problem of colour v. black and white films (and of ETV of the foreseeable future).

Since the 'facts' revealed by research are not consistent with reasonable intuition, and since little if any attempt was made in most of the research studies either to define the problem or to analyse the data, making it relatable to theory on which a consensus exists, our confidence in the research 'findings' diminishes. In justice, if not in charity, it is clear that we are more likely to find 'right answers' by asking 'right questions'. Adequate initial conceptualization of the problem, or later insight into it, is a necessary condition for asking the 'right question'. This is so, even in what may be designated as ad hoc or applied research.

AVAILABLE SUMMARIES AND UNWELCOME REIFICATIONS

AVAILABLE RESEARCH SUMMARIES

The existence of several summaries of film research 'findings' eliminates the need for an encyclopaedic approach to my task and for a bibliography of film research reaching or exceeding 400 items.

Hoban and van Ormer [9] summarized instructional film research up to 1950. In the nine years since then, research on educational films has added to the scope and the conceptualization of film research and to the constructions attached by Hoban and van Ormer to research findings up to 1950.

The 'progress report' of Hovland, Janis, and Kelley [10] on psychological studies of opinion change is important more for its conceptual than for its definitive research contributions. The idea of a summary and interpretation of existing research as a 'progress report' is so self-evident that one wonders why this idea was not prominently articulated and accepted long ago.

The report-of-progress idea is echoed in the May and Lumsdaine [16] report on Yale studies of educational films issued last year. The May and Lumsdaine report deals exclusively with films. The Hovland, Janis, and Kelley report deals primarily with communication and persuasion. Within this conceptual context, Hovland, Janis, and Kelley apply constructive imagination to data and lack of data on 'credibility of the communicator', 'fear-arousing appeals', 'group membership and resistance to influence', etc. In the opinion of your present 'progress reporter', this sort of conceptualization is an intellectual benchmark whose existence and importance has, to a large extent, been overlooked in research in both films and TV in education.

Fearing [6] uses even a broader orientation in his discussion of the 'Social Impact of the Mass Media of Communication'. While Fearing's chapter is largely concerned with research relating to the impact of films, radio, etc., in out-of-school exposure situations, many of his observations and conclusions are relevant, or appear relevant, to the use of films (and other modern media) in the formal curriculum of school and college.

Miller's [19] summary in terms of learning principles has already been cited. Because of its orientation, this summary is highly selective within the range of film research studies and includes non-media studies on the psychological mechanisms or phenomena discussed.

The 1960 edition of this Encyclopedia of Educational Research will contain such a summary, up to 1958, by William H. Allen. This forthcoming article, supplemented by a limited-circulation mimeographed version carrying the research up to 1958 [1], reflects the trend toward an increase in the evaluative treatment of educational film research.

The research summaries by Allen; Miller; Fearing, Hovland, Janis, and Kelley; and Hoban and van Ormer by no means exhaust the list of such summaries. They merely indicate that many summaries of research have been made and are available.

CLASSIFICATION AND REIFICATION OF MEDIA

It might logically be expected that 'devices' such as motion pictures, television, etc., would act as integrators of the conceptual and research approaches of the several disciplines related to (a) device development, (b) the input or output of the device, and (c) the responses of the audience. In practice, however, this expectation has failed to materialize. Instead,
prohibitum.

Since this is not feasible, the alternative border lines between zones are not sharp, nor is there of the criteria of confidence or research findings to certainty corresponds to an achievable consensus.

No deliberate attempt is made to indicate the gradation between limits of this zone, or the other two zones to be summarized, gradations are implicit.

THE LOW-CERTAINTY ZONE

Within the zone of low certainty, as within the other two zones to be summarized, gradations are implicit. No deliberate attempt is made to indicate the gradation between limits of this zone, or the other two zones of certainty.

The network of communication of research findings

A serious vacuum in educational film research (as in most of educational research) is in the investigation of the network of communication of research findings from investigator to implementer. Film research, like any research, is a production enterprise. The product is information. This information is distributed, partly through the channels and procedures of technical reporting, and partly through the interpersonal grapevine. There is little evidence that film research findings have reached and influenced the producers or users of films for and in schools and colleges.

One suspects that the researchers have tended to avoid contact with the retail market—easily understandable behaviour on the part of highly trained specialists who have narrowed their activities in communication to specialized study in preference to the more exacting role of distributing the results of their study to user groups other than their professional reference group. Marketing film research findings to implementers is a tough and time-consuming job for which researchers may have little aptitude or training and less time [8]. However, refusal to study the marketing problem, particularly the network problem, is a research neglect, for which a heavy penalty is paid in social efficiency.

It is interesting that the network problem involves the integration of so many elements (or components) of communication. A point of departure in network research is Christie's [4] definition of a network as the ‘rules of permission and prohibition on the routing of messages’. Presumably, this definition is not intended by Christie to be sufficient or comprehensive. He uses it in his study of the structuring of information processing in task-oriented small groups. However, the concept of a network as a set of rules of permission and prohibition on the routing of messages is quite generally useful. From this point of departure, the problem expands to include sources and receivers, channels and media, the character of the information and the transformations it undergoes, the movement of messages between people in time and space, and the responses to the routed messages. Essentially, this is the macrocosm of communication.

The vacuum in research on the network of distribution of audio-visual research information constitutes one of those sealed-off areas that perpetuate in the intellectual community what Bateson [2] terms schismogenesis, i.e., self-perpetuating esoteric groups whose members talk only to each other, and accept as novices only those who conform to group norms in values, motivation, temperament, and ability [17]. Schismogenesis is a built-in mechanism for increasing what most of us blandly call ‘cultural lag’ and tend to accept as an inevitable social evil.

The rhetoric of pictorialization

The rhetoric of pictorialization is old-fashioned rhetoric applied to the medium of pictures. Old-fashioned notions of narration, exposition, description, and argumentation specify the forms of rhetoric. The analytic study of these forms has been neglected although study of films involving one or a combination of these forms has been made since Lashley and Watson [14] conducted the first comprehensive
The evaluation of communicative study of a film. In this study, published in 1922, the evaluated film was dramatically structured, characterized by exaggerated naïveté of plot and conflict resolution.

The Lashley-Watson study is a classic in the sense that its analysis of the problem, its indices of results, and its basic findings antedate conceptualizations rediscovered or reformulated in the late 1930’s in studies of social impact of the mass media, and increasingly used since then.

The rhetorical problem is an extremely complex one. Were it not for the fact that application of old and new techniques of scientific inquiry is yielding data in areas hitherto thought unresearchable, one would be prone to conclude that the complexity of the rhetoric of film treatment is such that this problem area can only be nibbled at, not systematically investigated. Furthermore, various investigations of 'appeals' in communication have yielded results that generate optimism toward appeal-analysis as one of several ways of coping with the problems of film rhetoric in research. Rhetoric may then be defined in terms of efficiency of display of an appeal.

A rather long quotation from the report of Lashley and Watson on the appeal problem, and on the responses of audiences to these appeals, seems justified for more than its historical interest.

'Dramatic story treatment has little, if any, advantage over less theatrically ambitious rhetorical forms in instruction in factual learning or in changing attitudes or overt behaviour. However, the technical difficulties of inter-treatment study alone are so formidable that the problem has not been adequately researched.

As indicated above, reasonable intuition (illumi-
that, by chance alone, some pregnant insights are predictable.

Harris and Buenger investigated the magnitude and significance of correlation between tests of learning from films and tests of learning from lectures (and related verbal materials). They found a low-magnitude, non-significant correlation between the raw scores, and a low-magnitude significant correlation between souped-up 'adjusted' scores. It is, of course, possible that the obtained correlations are, at least partly, a function of the tests, or that they may be a function of rhetorical differences of presentational treatment between the films and the lectures.

It is, perhaps, grasping at straws to attempt to relate the findings of the Harris and Buenger pilot study to theoretical (philosophical) formulations of media characteristics. Nevertheless, the data obtained in their study suggest (as all data only suggest) that media differences may exist and may be empirically verified.

In connexion with the problem of role of picture and language, it serves little purpose to enumerate the various studies of effects obtained by applying readability constructs to film commentary, by using an obtained optimal rate of words per minute of sound track narration, etc., other than to acknowledge publicly the diligence of researchers in dealing with the language component of audio-visual messages. Differential roles remain to be identified and explicated in or by research. Since only two criteria of confidence (reasonable intuition and some consensus of theoretical formulation) have been satisfied, confidence in policies of knowledge in this area is extremely low.

Films and the higher mental processes

Film research to date has been a feast of investigation in factual learning, in attitude change, and in perceptual-motor learning, and a famine of investigation in what has long been referred to in educational psychology as 'the higher mental processes'. By 'higher mental processes' are meant those rational activities unique to man—conceptualization, critical thinking, generalization, etc.

For reasons not difficult to imagine, this area has escaped major attention in research on educational films. The influence of Judd, Tyler, Brownell and others nurtured in the Judd and Charters tradition seems to have by-passed the concern of most film researchers.

Two research studies, one by Rulon [22] and the other by P. E. Vernon [26] take higher mental processes into account. In Rulon's study, 'rote' items were distinguished from 'eductive' items. 'Eductive' items are those which require that a concept be applied to a 'new' situation, or that one 'fact' be inferred from another. Rulon found that when films and textbooks were combined in the instructional programme, significant differences obtained in favour of the 'eductive' over the 'rote' items. The differences held for immediate and delayed (three and a half months) tests.

Vernon studied film and filmstrips in teaching British seamen in the Second World War to take soundings. It is a sheer delight to read his report after wading through the ponderously objective ones of American researchers. He found that greater gain from film and filmstrips obtained in 'comprehension' scores than in 'memory for detail' scores.

This ends the research tale of films and higher mental processes. It is noted that a synergistic effect is found in both the Rulon and the Vernon studies.

Intuition, combined with theories of the meaning of meaning, strongly indicates that higher mental processes are influenced by films, and research data weakly suggest that a synergistic mechanism of some sort may operate to increase this effect. However, according to the research data at hand, the relation of films to responses involving the higher mental processes remains in the zone of low certainty in policy of knowledge.

ZONE OF HIGH CERTAINTY

In dealing with those film findings that satisfy the four criteria of confidence and thus fall in the zone of high certainty as policies of knowledge, it is necessary to make a distinction between policy statements and the successful use of stated policies in specific teaching programmes. The former is a product of scientific inquiry. The latter is a product of the 'art of teaching'.

Like all arts, the 'art of teaching' is highly creative in many respects. So are the arts of film-making, television, production, and other activities having to do with the production of a product. The creative nature of film-making increases the difficulty of film research, since (a) independent variables are embedded in an art-from, and (b) the art of film-making itself is a variable. In the creative process, the artist, knowingly or unknowingly, may introduce additional variables which have not yet been identified as variables in theory or research. Consequently, there is a consensus rather than an invariance in film research findings supporting the relatively certain policies of knowledge, in that 'pure' research in educational films is practically impossible.

The following formulation of policies of knowledge in the zone of high certainty may seem to be unduly conservative. To be sure, it is frequently much easier to specify areas of ignorance or near-ignorance than areas of certainty. However, in dealing with high-certainty policies of knowledge, only two alternatives appeared to be open: (a) to specify an unwieldy number of specifics on which all four criteria of cer-
tainty have been satisfied, or (b) to generalize broadly enough to include the large number of specifics in a few general statements. The latter alternative was chosen as the more manageable, though the less detailed.

An integrating structure has been lacking in film research. Education has no rigorous theoretical basis or useful vocabulary (in contrast to jargon) into which film research can be integrated. Psychology is still in the process of continuing proliferation, and its technical vocabulary is still cult-oriented. Sociology has contributed the concepts of role, prestige, status, and group identification, but these do not satisfy the full spectrum of requirements for adequate research. An available source to which we can turn for integration is the theory of structure and dynamics of communication [24].

In the following discussion, some of the concepts and tools of communication theory have been selected and applied so as to bring some kind of order into the statement of policies of knowledge consistent with film research findings. This attempt is severely limited by both the research material and the assigned scope of this paper.

_People learn from films_

This policy is axiomatic, and it may appear fatuous or obvious, or both. It need not be explained here why so much film research has been devoted to producing empirical data in support of the self-evident, and larger absolute quantities of educational television research are being spent to the same end. Nor need it be explained that media research in education frequently deals with comparative learning, i.e., with the problem of whether the learning increment from newer media and methods is equal to, less than, or greater than that from older media and/or more conventional methods. Fundamentally, concentration on these research problems is a function of the process of innovation in education—a process to be discussed briefly in a later section of this paper.

A tremendous amount of film research has been in the field of learning. As a result, the evidence that factual, attitudinal, opinional, and perceptual-motor learning occurs when people are exposed to films is overwhelming. On the basis of satisfaction of all four criteria of confidence, it can safely be said that people learn from films.

Instead of disposing of the problem, this statement of a policy of knowledge opens up the question of the determinants. It is in the nature of man to learn. The central problem of education is not learning, but the control of learning. Once we have satisfied ourselves that people can and do learn from films, the problem becomes that of (a) controlling what is learned, and (b) increasing the efficiency of learning.

**Learning from films varies in amount with audience characteristics**

Despite the observation by Lashley and Watson reported in 1922 [14], the importance of audience characteristics as a determinant of learning from films has only recently come to be appreciated and forcefully articulated.

Since we are discussing audience characteristics _per se_ in the zone of certainty, we need not explore the range of audience characteristics that have been investigated in film research or suggested by film research findings. These have been spelled out in detail in the Hoban and van Ormer summary and have been only slightly extended in research studies published since 1950.

Two significant parameters of audience composition on which there is little room for disagreement are age and amount of formal education, even though there are upper and lower limits beyond which little or no research evidence exists and few noticeable differences may intuitively be anticipated. In general, a difference in amount of learning from films can be detected between elementary and high school students, and within as few as three grades in the elementary school.

From his study of film research findings, Fearing [6] has concluded that ambiguity is a function of the audience. This is a remarkable insight. It transfers (in the sense of sharing) to the audience a characteristic of information hitherto assumed to be uniquely or predominantly a function of presentation and thus assumed to be controlled or controllable at the source rather than at the receiver end of the communication transaction.

The amount of learning from films can be increased by the use of mechanisms and methods, either built into films or applied in their use

**Redundancy.** This is one of the fundamental means of communicating information for which the sense organs of the body, particularly the eye, seem to be constructed. Furthermore, redundancy seems to be a requirement for human certainty of information. In research-supported theory, it is a most generally effective determinant of learning.

Essentially, redundant information is repeated information. Applied to learning, redundancy means the same as repetition.

The relationship between redundancy and learning has been shared in human insight and acceptance for centuries. At least as early as the time that Pompey stormed Jerusalem and entered the Holy of Holies, sword in hand, to emerge in bitter frustration at his failure to find a tangible Image of God, the Hebrew word for learning was also the word for repetition.

Ironically, the communications engineer and the
information theorist take a dim view of redundancy, and try to minimize it in order to increase transmission efficiency. Similarly, the English teacher in high school and college frowns on redundancy, identified as tautology, and expends considerable effort to teach students to avoid it in formal writing assignments. All in all, the use of redundancy in communication is an uphill fight.

For one reason or another the history of film research is the history of intense research activity on the effects of redundancy in learning from films. Repetition of whole films, repetition of scenes and sequences, repetition of illustrative examples, repetition in films and filmstrips, repetition in review and discussion of film content—all these have been investigated, and, in general, all have resulted in increments in learning.

**Participation.** This term is used because it has been extensively employed in film research. In this usage, it means student activity during a film showing—answering questions inserted in a film, or some variant of this overt exercise within the timed context of a film showing.

A preferred term is practice. It is broader, and hence includes a greater variety of student activity related to learning what the film is intended to teach. The practice concept is both a particularization and an extension of the Corey-Dale [5] axiom that ‘children learn what they do’.

Mental practice, tying a knot during a film on how-to-tie-a-knot, answering questions asked in the film—all these and more forms of practice have been investigated in film research. With the exception, for instance, of the finding that practising knot-tying is not helpful during the showing of a film in which the rate of presentation is more rapid than the rate at which students can observe and practise knot-tying, the research results are consistent with intuitive expectation and a consensus of theoretical formulation. They indicate that participation, i.e., practice, increases the learning of what is practised.

For some time, there was conceptual confusion in film research as to whether participation involved motivation or practice, i.e., whether it increased the student’s motivation to learn, or whether it provided practice exercise of relevant responses. Recent research indicates that the practice effect is dominant.

The participation techniques studied in film research are closely related to feedback information on performance. Educational research has long since established the effects of knowledge of results in learning. When knowledge of results is added to participation, or otherwise incorporated in the methodology of film use, an increment in learning is generally observable.

Due to its emphasis in communication theory, Wiener’s ‘cybernetics’, and other relatively recent intellectual developments, the term feedback seems to be preferable to the term, knowledge-of-results. By definition, ‘cybernetics’ is the science of control (government). If, as has been asserted, the central problem of education is the control of learning, then a concept freighted with a control meaning is a preferred concept.

**Attention-directing devices and methods.** The problem of directing audience attention assumes importance when film research is considered in the larger context of the flow and processing of information. In a motion picture, sound film strips, or a television presentation, the rate, amount, sequence, and nature of the information to be transmitted are fixed at the source. Production techniques are such that this information is presented smoothly and continuously. This can, and frequently does, present a problem of audience selection and discrimination within the entire range of information stored in the film, mechanically or electronically transmitted, and presented on the screen and over the sound system. Research findings in the intermediate zone of certainty, briefly discussed below, suggest that educational films are frequently overloaded with information. More information is transmitted than is received within the ‘channel capacity’ of the audience. As the density of information increases, the amount of ‘received’ or ‘accepted’ information tends to increase, but the proportion tends to decrease.

Research findings on devices which direct attention to the relevant or critical information, such as ‘pop in’ arrows, and on teaching methods which point out the relevant and/or critical information to be ‘searched out’ in a film, indicate that such devices and such teaching methods produce an increment in learning.

**ZONE OF INTERMEDIATE CERTAINTY**

This is an all-else and all-other zone that will be given short shrift because (a) the scope of the research that falls within it is so extensive, and (b) there are so many tacky problems involved in assigning research finds to this zone, rather than to the zone of high certainty.

Interestingly enough, variables and problems included in this area are important, both theoretically and practically. Rate of development, subjective camera angle, reading activities following film showings, the use of anxiety to increase learning from film showings, rate of verbalization, identification with models in films, films v. filmstrips, ‘slickness’ of production techniques, the nature of discussions following films and the number of participants, characteristics of teachers using and not using films, perceived usefulness of the information presented in a film, the open-ended technique and its effects in subsequent activities—these and other problems lie in the intermediate zone of certainty in policies.
of knowledge. The hard-pressed Ph.D. candidate can find pay-dirt among the array of researchable topics included in this area.

THE PROBLEM OF EXTRAPOLATION

In view of the number and excellence of available summaries of film research, it is quite pointless to go over the same ground in this symposium unless some new or different purpose is to be served. The discussion of the findings of film research in terms of the extremes of certainty can serve two purposes: (a) to guide the ambitious but unsophisticated researcher in educational media, and (b) to provide a basis for the extrapolation of educational film research findings to the medium (or, more properly, channel) of television in education. This summary is an attempt to establish some kind of a base from which extrapolation can be made.

However, extrapolation is not a simple operation. While there are areas of commonality between films and television, there are also areas where differences may be critical and do not admit of extrapolation.

One of these areas of noticeable difference is between what is represented in educational films and what is represented in educational television. A dominant trend in educational television is toward the lecture—illustrated or otherwise. This trend is a reflection of the manpower concept of the master teacher, whose talents may be shared over television among thousands of eager students rather than limited to the hundreds, dozens, or handful of students otherwise exposed to the manifestation of his scholarship. With the master teacher concept comes the romantic notion that, with television, the lecture can become 'once again the well-organized, disciplined experience it was a couple of generations ago'.

There is some question as to how this attribution of excellence to the lecture of past generations was made. It sounds very much like the refrain, 'Things were better in the old days'.

That part of Santayana's *The Middle Span* [23] in which he discussed his experiences at Berlin with Paulsen, Ebbinghaus, and Gezycki sheds light on this romanticism. After his first blush, and following an intervening trip to England, Santayana's enthusiasm was transformed into lasting disappointment. What he missed from these great professors, these great lecturers, if you will, was 'more unity of spirit in teaching and in student life'. 'Were there no inspired philosophers then in Germany?', he asks.

Little film research has yet been done on the problem of the effectiveness of lectures recorded on film. Thus, if television is to be converted into an instrument for the revival of the lecture in the grand manner in education, very little can be extrapolated from films in education to television.

However, it may reasonably be assumed that the three high-certainty policies of knowledge of film effectiveness can be extrapolated to television, and that ETV research problems are to be found elsewhere—in abundance.

FORMS AND CONCEPTS FOR FUTURE RESEARCH

The assigned task of this paper was twofold: to indicate where we stand, i.e., what we 'know' from film research, and to map out the areas that remain unexplored or inadequately investigated.

Identification of four areas in the zone of low certainty constitutes a partial topographic mapping of problems for future research. It is also possible, without stretching the point, to do some 'topological mapping' by applying to the field of communications media in education some of the concepts, the research methodologies, and the theoretical formulations that have been developing over the past ten or fifteen years. When this has been done, we can briefly examine appropriate research approaches and necessary shifts in emphasis.

NEW CONCEPTS

Obviously, it is no accident that this 'where-do-we-stand' seminar is syncretistic in its structure and membership. A fusion of hitherto independent disciplines and points of view is essential if we are to cope with the range of problems involved in the introduction and use of newer media in education and if we are to bring to bear on these problems the useful concepts that have been made available to us. Four such concepts will be mentioned.

The system concept

While we have long spoken of school systems, university systems, and educational systems, we have not taken the system concept sufficiently into account in research on films or other communications media in education.

The expanding field of automation involves conversion to more complex man-machine systems. This has introduced great turbulence in the labour movement—a turbulence also noticeable among teachers and educational associations with the introduction of educational television, particularly the total television-teaching-by-closed-circuit pattern. This television-generated turbulence is also evident among exposed students from high school through college and among educational administrators buffeted by pressures from educational foundations, taxpayers' associations, student groups, school boards, teachers' associations, etc.
It is not within the scope of this paper to deal with the problems of educational television, except by inference and projection. However, with the introduction of any new educational medium and its accompanying technology, many problems become understandable and manageable within the system concept.

A system can be defined as an arrangement of components with a common purpose. The importance of the system concept is in the notion of (a) components in a system; (b) the integration of these components; and (c) the increase in system efficiency achievable by trading improvement of one component against improvement of another or others. The last of these involves the ‘trade-off’ function. Trade-off is involved in the decision to increase educational efficiency of films either in the production stage or in the use stage. The basic mechanisms are the same. The components (teacher or film) are different.

It can be postulated that the more complicated the system technology becomes and the more often machines take over functions performed by man, the greater the probability of human resistance to the introduction of the technology becomes. Man does not surrender his historical prerogatives to machines without a battle, nor does he easily reconceive his historical role in the accustomed order of things.

Furthermore, as students of warfare have pointed out, the introduction of a new technology forces change in strategy and tactics. Applied to education, this means that the development of a new technology of communication forces change in the general and specific means by which educational objectives can be attained—change that is frequently resisted as disturbing and discomforting to the status quo.

If we are to cope adequately in educational media research and in the implementation of research findings, use of the system concept is intellectually and practically inescapable.

Theory of information and communication

These have expanded at a phenomenal rate during the past decade and have generated concepts directly relevant to communication in education. While it is not clear that the mathematical theory of information is specifically applicable to semantic information, it is clear that the concept of information as ‘news’, as having a quantifiable value in reducing uncertainty by reducing the range of alternatives, is a useful concept in education.

It is reasonably safe to infer that the development of communication theory is an outgrowth or concomitant of the development of information theory. Certainly, all of us are familiar with Shannon's and Weaver’s [27] discussion of communication theory, which is still valid. However, their discussion deals primarily with the structure of communication and only by implication with its dynamics. It does not go into the characteristics of information controllable by the source or the receiver, or both.

Rate, reliability, redundancy, ambiguity, time-phasing, quantity, and discriminability of information are primarily source-controlled. Exposure, selectivity, capacity, receptivity, and durability of information are primarily receiver-controlled. Feedback is system-controlled. Matching the source-controlled and receiver-controlled operations is the art of communication. It is in this matching that the characteristics of the audience (the receiver) play such an important role. It is in the trade-off between production techniques and teaching techniques that difficult system decisions are encountered, since many of the characteristics of information, assigned above to source or receiver, are to some extent controllable at either pole of the communication transaction, and indeed frequently involve or require attention and activity at both poles.

The least that can be expected from the use of information and communication theory in media research is an improved technical vocabulary that permits the researcher to deal with relevant variables. As previously indicated, an adequate technical vocabulary is not available elsewhere.

Theory of bureaucracy

There is very little question that innovation is the central problem of newer media in education. Unfortunately, we know very little about the process of innovation. Bedford [3] has dealt with the problem of innovation by working through Rashevsky's [21] mathematical approach to history, i.e., to cultural change. In this scheme, innovation begins with an innovator who, by definition, has engaged in the creative act of restructuring both his image of the environment and his ideas of ways of managing and improving it. Innovation proceeds as a network of communication is developed, and the reconstruction is accepted by others. The problem of acceptance of innovation in education is definable in terms of the bureaucratic structure of American educational institutions, i.e., in terms of change in bureaucratic behaviour.

Three characteristics of the behaviour of bureaucracies can be postulated. One, innovative action occurs on the operating level of the local bureaucracy, i.e., operational changes are made at the lowest action level of the bureaucratic hierarchy—in the classroom. Two, tentative or initial acceptance and approval of the idea of innovation, and sanction of its mode of operation, are made at the top level of the bureaucratic hierarchy, where policy decisions are made and transmitted downward through the bureaucratic structure. Three, as the initial policies are implemented, the demand increases for local
evidence that the innovation is situationally appropriate, situationally workable, and situationally satisfying.

Apropos of innovation in the educational bureaucracy, Kumata [13] observes that 'Policy-makers do not accept conclusions in this (ETV) area based on research which has not been done on their students, their instructors, and their courses'. Furthermore, he says that 'I have come to the conclusion that one has to fight the battle of acceptance for use of television over and over again'. For the most part, educational administrators and their operating personnel do not read the scholarly research journals, nor do they act on research findings, obtained in remote situations without localized proof, based on experience accumulated over a considerable time-span. 'Classical' research in education is not directly translatable into action at the local level where active change always occurs.

Operations research

Operations research is important to newer media in education for its concept more than for its bag of research tools (linear programming, set theory, game theory, etc.).

The crux of operations or operational research is its central idea of applying scientific methods and technologies of research to real-life operating complexes for the purpose of obtaining data on the basis of which policy and operating decisions can be made with greater certainty of outcomes. One of the significant characteristics of operations research is that it is generally applied to specific problems in specific (local) situations.

In the academic community, operations research has little acceptance or status. Consequently, in research done in academic institutions or by academically-oriented researchers, the tendency is to shy away from operations research. This is unfortunate, since it is quite clear that educational innovation neither begins with nor is accepted on the basis of the type of research studies applauded at professional meetings and published in the high prestige research journals.

INTERRELATION OF RESEARCH APPROACHES

Ordinarily, we tend to think of research as moving from the 'laboratory' to the 'field' situation, i.e., from basic to applied research. In practice, however, we can pursue the quest for understanding at any point on the continuum. Applied research, perceptively done, leads to 'hunches' to be verified, modified, or denied in basic research, and basic research leads inevitably to the use of identified mechanisms in the planned programming of 'real life' situations, particularly in applied sciences such as communication, and applied arts such as education.

The examination of emerging intellectual tools, such as those discussed immediately above, leads to a reconsideration of the more classic notion of where research emphasis is to be placed at any one time, and how we can best go about maximizing the effective use of newer media and devices in education.

If, as has been postulated, innovation in bureaucratically organized and controlled education is the central problem, it follows that operationally oriented research must be expanded by some exponential function. This conclusion, which I have elaborated elsewhere [8], casts considerable doubt on the adequacy of much of what has been called 'contextual' research. Contextual research is research done in operating educational situations. A fine beginning has been made in this field, but by its contextual nature, it cannot deal with sufficiently purified variables to be 'scientific', and, in practice, it has not dealt with the wide range of alternatives and the wide scope of decisions that must be made to maximize system performance in education in specific situations. 'Contextual' research is a hybrid, employing the controlled experiment to control variables which can best be controlled in the laboratory, and ignoring many of the critical operating decisions involved in the art of teaching and the art of educational administration.

Many educational people share my uneasiness over some of the pronouncements and some of the tactics of foundations, particularly in educational television. It is increasingly clear that this uneasiness arises from what seems to be a fixed, pre-experimental decision to promote the use of television in education exclusively within a manpower concept of the educational process, rather than to concentrate on the identification of the systems problems encountered with introduction of this new technology of communication. Identification of these problems permits the use of variable patterns and local expedients in the reduction, if not the complete solution, of these problems. Variable patterns and local expedients are inevitably developed in individual educational situations, with or without the benefit of research.

Since change in action patterns occurs on the operating level, and since change in action patterns is involved in the control and improvement of the educational process, it follows that research related to newer media of communication in education must move in an operationally oriented direction—from an almost exclusive concern with the what to a greater concern with the how. We already know more 'principles' and 'laws' of learning than we have exploited with even a minimum degree of efficiency in formal education. The research job ahead is to find out how to apply existing knowledge as well as how to extend this knowledge.
REFERENCES

CHAPTER 3

PROBLEMS OF SERIOUS TELEVISION

Henri Dieuzeide

THE RELATIONSHIP BETWEEN VISUAL INFORMATION AND EDUCATION

The devaluation of traditional institutions and concepts brought about by the sudden influx of visual information into daily life coincides with a reappraisal of the school's role in industrial society. As one of these traditional institutions the school has been reduced to the stage where its chief function appears to be the teaching of techniques, intelligence being considered just one technique among many others.

A fourfold analysis should lead to the gradual reintegration of visual information in education and restore the status of the school in a technological society, it being understood, of course, that the emergence of the visual image in developing societies raises many additional problems:

1. The era of the masses is leading to the abandonment of parental control. Adults are in a state of confusion, overwhelmed by the wealth of visions and pictures of the world presented to them by visual information media. They are unable to absorb these visions and pictures unaided, and live in a muddle of self-education and insecurity. We can analyse the age groups (credulity, revolt, critical period, assumption of responsibility).

2. How can we work out a new teaching system which will open the way to an integration of visual information? Any such system should be based on a reasoned theory of the world of the imagination. Hitherto visual information has featured in the curriculum only as a lifeless method of imparting knowledge and skills: (a) How can we work out a process which will regulate the world of the imagination and bring about a steady and complete development of the personality? How can we learn to see, interpret, organize and control visual communication? (b) What is to be the relationship between the spoken word and the visual image? Must the spoken word inhibit instinct? Or imagination? Should education be limited to mastery of the language, the instrument of social intercourse? How are we to interpret new visual forces and the new images of the world we live in?

3. If the school is no longer to impart knowledge, but to provide an effective framework for messages received from outside, what is to be the role of the guide (master, teacher, instructor)? The trend is towards three types of master: (a) The master who is integrated into the visual universe (the master teacher); (b) the organizer and curriculum-maker; (c) the intermediary who 'exploits' and controls the visual message.

4. What is the effect of visual information on the organization of education as a whole? Ought there not to be a reappraisal of the system of educational units based on the manipulation of words and on speculative methods (classes)? A rearrangement of the school in terms of time and place and of priorities? Should we not envisage school activities being undertaken collectively, as a mass operation (receiving visual messages from all planetary sources), with studies in micro-groups (under instructors) and independent individual work (use of mechanical teaching devices)? Instead of waging a hopeless war against mass tendencies, should we not use them as the basis of a system of teaching which will give a new and richer vision of the world?

How can we create a comprehensive system which will reconcile biological impulses with technical processes? How can we enable the child to attain a new equilibrium between the life force and the intellect?

The author has already stressed the urgent need for French education to develop a collective consciousness, alive to new forms of imagination and reality.

Education should find its place in this coming equilibrium between the printed word and the visual image, this fusion of the real and the imaginary which will form the basic pattern of our future

culture. Instruction unallied to television has become unthinkable. Forced as it has been to absorb the printed word, it will now have to identify itself with television . . . Look at the primary school of eighty years ago: there were no textbooks and no blackboards; most schools had no equipment apart from hand-written spelling books or tattered catechisms which the children used as an exercise in deciphering letters. Nowadays every peasant child comes out of school with a satchel crammed full of tools and textbooks. For better or for worse the school is linked to the development of material civilization and, especially, to that of information media.

SERIOUS TELEVISION

A utilitarian form of television for exploration and direct contact (closed circuits) is developing alongside the television of entertainment programmes. Is it not possible that this use of television for purposes other than entertainment has already begun creating new relationships between man and the world, between man and man and between man and his own image, relationships which are likely to multiply in the years to come?

1. Changes in the pattern of work, connected with automation, work becomes less real, information is centralized instantaneously, visual attention is promoted to a privileged position among working skills, solitude is produced by the tension of work and by the remoteness of tools and materials.

2. Changes in the traditional social patterns (new image of society) implying a ceaseless check on personal and civic activities, daily work, etc.; the consumer is directed towards goods made visually desirable (development of visual consumer-desires).

3. Changes in the relationships between persons (interplay between the perceiver and the perceived); men are re-divided into perceivers and perceived; serious television is developed in the 'concentrational' world: school, prison, factory (the petrifying gaze).

4. A changed picture of the self (in normal surroundings, unlike the enlarged picture of the cinema camera), the mirror is replaced by an autoscopic illusion (disturbance caused by self-discovery), decetration, the self seen from behind, the reversed mirror, etc., pathology of the surrealized self (transfiguration, miniaturization, etc.).

THE PARADOX OF VISUAL INFORMATION APPLIED TO LITERACY CAMPAIGNS

A study should be made of the efforts of governments and international organizations to use the literacy campaign as the key to progress for the populations of developing countries. It now appears that to achieve total literacy merely by extending the traditional educational systems might take the equivalent of the average lifetime of the next three generations.

This is why the systematic use of visual information, and of television in particular, for abolishing illiteracy is being contemplated just when, under the impact of this medium of information in the industrialized countries, certain aspects of general basic education founded on oral instruction seem to be giving ground everywhere before a new fundamental culture which is more intuitive and more practical. Can the task of overcoming illiteracy be entrusted to visual information at the very moment when it appears to be bringing about a general decline in the linguistic abilities of the masses?

In the author's opinion, visual information can be expected to make a positive contribution to certain essential tasks: mobilizing the attention of the mass of the people, inducing visual sensitivity, supplying motivation. But the importance of new problems of perception and new problems of educational psychology which may be of decisive importance to the effective employment of visual information should also be borne in mind.

THE PROSPECTS OF TECHNICAL DEVELOPMENT

The day is near when it will be possible to record electronic image signals on magnetic tape. The 'megacycle barrier' has been broken. The image will be recorded in the same way as broadcast sound, and will offer the same possibilities of editing and trick recording. The teletape will then be used like the tape recorder. Once the magnetic film becomes as common in the home as the microgroove record, the filmed image will be near to achieving its maximum explosive effect. By localizing the filmed universe, television makes it feasible at any time and place. Television presages new vehicles and original situations which, year by year, will drive fiction ever further into the heart of truth.

Thus there is already a blurring of the boundary between reality and the dreams of Huxley, Barjavel and Bradbury. In the United States of America miniature radio receivers are already being produced which can be inserted in the ear to cut off the wearer from the external world. In Italy there is excitement over a projector which requires no screen. Soon there may be 'iconic walls', perhaps spectacle receivers, which will enable the perception of reality to be inextricably mixed with that of the 'iconic' image. One day, no doubt, there will be images on buildings, landscapes and clouds. The busy passer-by or the housewife at her work will rub shoulders with phantoms of light and shade. Truly, the historian of the film, in assessing the magnitude of the break through achieved by television, can already parody Dostoievsky and say: 'If the screen does not exist, everything is permitted'.
CHAPTER 4

SOME PSYCHO-PEDAGOGIC PROBLEMS IN SCHOOL TELEVISION BROADCASTING

Michel Tardy

Most of the considerations which follow are the outcome of research at the Audio-Visual Centre of the École Normale Supérieure de St. Cloud into the characteristics of television for schools. A few preliminary remarks about this research will not be out of place.

It did not cover pupil reactions to audio-visual materials but aimed at determining the characteristics of these materials; the school television broadcasts were studied in themselves and not in their effects on a school population.

Nevertheless, the purpose of this analysis was to prepare the way for experimental research into pupil reactions; this research is propaedeutic in so far as it enabled a number of hypotheses to be advanced. The natural complement to this analysis is the preparation of plans for several experiments.

The research covered only eight kinescopes; this is not enough to admit of generalization. Yet several basic problems have emerged already and the analysis of kinescopes will, in any case, continue side by side with the conduct of the first experiments.

The research report is in two parts: one, a monograph (with kinescopes analysed under several headings—structure of the broadcast, vision, sound, presentation) and a general part, assembling scattered data and making a first attempt at ordering it. The considerations in this paper are from this general part.

The characteristics described concern school television but in many cases are equally valid for television in general.

This paper deals with three fundamental problems: (a) ’live’ transmission; (b) the treatment of space; (c) the commentary.

LIVE TRANSMISSION

Most television broadcasts use two types of picture—’live’ and filmed. In the former, the event appears on the television screen while it is actually happening and there is no time-lag; in the latter, the pictures belong to sequences filmed before the broadcast.

Comparison of the two types reveals a number of differences. ’Live’ transmission for instance has five main features:

1. The duration of the shot is usually longer in a live broadcast than in a filmed one.

<table>
<thead>
<tr>
<th>Programme</th>
<th>Average duration of live shot (sec.)</th>
<th>Average duration of the television film shot (sec.)</th>
<th>Extended shots ’live transmission’ (sec.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Life of Fish</td>
<td>13</td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>Mammals</td>
<td>14</td>
<td>9</td>
<td>85</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>10</td>
<td>10</td>
<td>72</td>
</tr>
<tr>
<td>Decorative Tapestry</td>
<td>29</td>
<td>10</td>
<td>144</td>
</tr>
<tr>
<td>The Skeleton</td>
<td>17</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>Polarization of Light</td>
<td>27</td>
<td>—</td>
<td>119</td>
</tr>
<tr>
<td>Robespierre</td>
<td>13</td>
<td>—</td>
<td>110</td>
</tr>
<tr>
<td>Colbert</td>
<td>18</td>
<td>—</td>
<td>73</td>
</tr>
</tbody>
</table>

Table 1 shows that the average duration of the film shot varies between eight and twelve seconds, while live shots last ten to twenty-nine seconds. Close scrutiny of these times shows a number of exceptions, but a clear tendency emerges—live broadcasts tend to use shots of longer duration.

2. The variety of shot is smaller in ’live’ than in film broadcasts. Films use the whole gamut from the long...
shot to the extreme close-up; ‘live’ as a rule uses only near shots ranging from the close medium to the extreme close-up.

Again this is no more than a tendency, but it seems that live broadcasting confines itself very largely to the close medium shot, near shot and close-up, whereas the film uses the whole range (see Table 2).

<table>
<thead>
<tr>
<th>Programme</th>
<th>Live shots</th>
<th>Film shots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Long shot</td>
<td>Medium shot</td>
</tr>
<tr>
<td>The Life of Fish</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Mammals</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>—</td>
<td>23</td>
</tr>
<tr>
<td>Decorative Tapestry</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>The Skeleton</td>
<td>—</td>
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</tr>
<tr>
<td>Robespierre</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Colbert</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

3. The live broadcast sweeps along all the débris of everyday life. Whereas the film world is ordered and pre-arranged, the ‘live’ world is immediate, imperfect in terms of content and technical performance. The chief characteristic of live broadcasting is the absolute impossibility of eliminating error.

From a study of live broadcasts a catalogue of imperfections can be compiled. These may originate on the one hand with the person in charge on the screen and on the other with technicians and directors.

On the part of the person in charge on the screen there will mistakes in language, hesitations, repetition, omissions and awkwardnesses. He suddenly stops, having forgotten something important, apologizes and takes up his argument again from an earlier point (‘The Polarization of Light’). Two participants make an error of movement in the studio (‘Decorative Tapestry’). A teacher seizes hold of a carp in an aquarium; the carp slips from his grasp and falls to the ground (‘The Life of Fish’).

Other defects can be laid at the door of the technicians and director—poor focusing, unsatisfactory framing, transmission of an inadequate picture, bad synchronization of image and commentary.

These examples show one of the basic differences between the live and the film broadcast. The world of live television is imperfect, full of débris; that of the television film is perfect with sound and visual material sifted to eliminate the dross of everyday life. This difference is of great importance. The film picture has a miraculous quality by showing persons who make no mistakes, who succeed immediately in whatever they undertake; there is a sort of dexterity, effortlessness, felicity of expression and action in the world of film; the live image, on the other hand, is closer to the awkwardness of real actions, showing the trial and error of everyday life. The film portrays a world of success ‘at first attempt’; live broadcasting a world of try and try again.

This does not mean, however, that the film image contains no errors, but rather that any such errors are intentional, meaningful, they are symbols carrying a message, whereas in the live picture, the error is meaningless, unintentional, the outcome of no internal compulsion; it is there by pure chance—the incursion of the unforeseen.

4. Live transmission has a special time structure different from that of film. Its characteristics is that time cannot be altered, as in the film, by ellipsis or cuts; the live transmission is bound by the rhythm of everyday life. For instance, the demonstrator in a scientific broadcast is obliged to wait for the chemical reaction to take place before he can proceed; or when a person moves from A to B, the camera has to follow him throughout, although this is not necessary to an understanding of the subject-matter.

Whereas the film has a certain freedom as regards time, the live broadcast has to coincide with the action. The actual duration is, as it were, caught up into the film dimension, whereas it imposes itself on television and take possession. In live broadcasting there is a choice of framing, camera viewpoint; its main feature is that it offers a choice in space but none in time. The film, on the other hand, offers both possibilities.

Live broadcasting can, of course, use certain artifices to break the monotony of time and endeavour to loosen the stranglehold of actual duration. Instead of using one camera only to show a person moving, it can show the movement with different picture compositions and from different viewpoints; but, above all, the live broadcast can resort to false ellipses by intercalating shots—another phenomenon appears on screen while the original action continues at its own pace.

5. The ‘live’ picture is centrifugal, whereas the film picture is strictly self-contained. They have in common the characteristics of being products, results; they both call for a technical infrastructure—cameras, projectors, microphones, technical personnel, cables, etc.—but all this outside activity, without which the
picture could not exist, is shut out by the film, whereas the live broadcast allows it to obtrude itself in the actual picture.

There are two ways in which the context may show in the television picture: (a) The technical infrastructure may be in the camera field and so visible in the picture, for example, when the control receiver used by the person in charge on the screen to verify its posture or the sequence, comes into the picture; or when the microphone is visible (microphone on table or portable microphone with cable running off the picture and inviting speculation about what is outside; or lastly, when the microphone is shown intentionally as part of the apparatus for an experiment ('The Skeleton', 'Polarization of Light'); (b) The technical infrastructure, without being visible in the picture, may be powerfully suggested—an operator, out of sight, moves his equipment noisily and so makes his presence known; the shadow of the microphone betrays the presence of the boom-operator and his eagerness to transmit the performer's words with maximum efficiency; it also happens that the person in charge on the screen calls out to the technicians to alter their picture composition or the director to get the picture he wants onto the screen.

These five characteristics of the television image, found by analysis of school television kinescopes, show that there is a special television technique apart from film technique. Where educational action is concerned, the live element brings with it a number of psycho-pedagogic problems which can be solved only by experiment on strictly scientific lines.

Three sets of hypotheses can be advanced and verified:

1. The live picture must make for better observation than the film picture; it can be assumed that shots of longer duration enable observation to be made more thorough (though too long duration, producing monotony, may impair sustained attention); on the other hand, it can be assumed that near shots must make for a more detailed observation (though there is the problem of reference to the whole: the observation of detail can be useful only if the detail is situated in relation to the whole).

2. The live picture must make for closer involvement of the child-viewer in the phenomenon to be observed, than does the film picture; for the television picture, being bound by the pace of everyday life, is more realistic and less pre-arranged than the film picture; television viewing is nearer direct observation than the film viewing.

3. The live picture must make it possible to eliminate illusion from the world of images and must be the possible first step in audio-visual education. In so far as the live picture contains defects which are those of everyday life, and in so far as the live picture does not altogether shut out the production activity involved, it can promote awareness of the technical and human reality of the subject-matter televised.

These hypotheses can be verified only by experiment. This will call for the preparation of two types of experimental broadcast: the same phenomenon presented by the film technique (a larger variety of brief shots, pre-arranged sound and visual material, alteration of time and space, elimination of the technical infrastructure) and by television technique (shots of longer duration but in a smaller variety, unprepared visual and sound material, real-life pace, various incursions of context).  

THE TREATMENT OF SPACE

The school television programme entitled 'Hydrogen' contains several typical examples of the very varied treatment of space. Presenting the experiment for the preparation of hydrogen by electrolysis, the demonstrator in charge starts with a description of the apparatus: he shows in turn the various pieces of apparatus, (battery, switch, light-bulb, volt meter, wiring, etc.). This is done by close-ups showing each piece of apparatus separately and long shots showing each piece in its place in the circuit. This presentation took twenty-one shots. In the same programme, eight shots were required to cover the introduction of iron filings into a test tube, and twenty-two to demonstrate the lightness of hydrogen (hydrogen-filled soap bubbles).

This presentation technique is fundamentally analytical. It is based on the continuity of the phenomenon and discontinuity in the treatment of space. This method has obvious pedagogic implications: the framing of detail in close-up results in an enforced direction of the attention; all subordinate elements are eliminated, only the essential is retained. Faced with this presentation, the pupil has only limited freedom—to look or not to look. If he looks, he has no choice as the picture shows only one element. This method therefore seems particularly effective. Yet it has a disadvantage—the problem of reference to the whole. In this analytical presentation, the possibility of reference to the whole does exist since detail in close-up and the whole in long shot are screened successively. But there is still a break in the process itself; when the long shot is screened the eye has to seek in the full picture the detail shown in close-up.

This is only one of the possible presentation methods, and there are several ways in which this space dimension can be altered:

1. Highly varied treatment of space. The subject-matter is shown in a succession of short shots and in alternating long shots and close-ups.

1. Audio-Visual Centre Research Programme, Project P 37: Efficiency of Live and Filmed Television, respectively, in the Communication of Knowledge (in progress).
2. Single fixed shot sequence. The camera is placed once and for all in front of the subject; framing is wide. The advantage of this method is to permit constant reference to the whole; attention can be directed to detail by certain pedagogic techniques (pointer, hand).

3. Long shot dissolving into close-up and vice versa by camera movement. First, the whole subject is shown, then the camera moves towards it to give a close-up of detail, then withdraws to show the whole again, and so on. This third method seems to combine the advantages of the other two methods, permitting close observation of detail and avoiding a break in the treatment of space while providing for constant reference.

These three possibilities have their advantages and disadvantages. Only experiment can show which will be the most effective. This will involve the preparation of three programmes showing the same subject by each of the three methods. The initial hypothesis is that the third method, combining the advantages of the other two and eliminating their respective disadvantages, is the most effective.¹

**The Commentary**

One point must be borne in mind from the beginning—while a broadcast consists of both live and film pictures, the commentary is always live.

**Types of commentary**

Study of school television kinescopes has shown that the commentary may be of one of several types.

A first category might be called explanatory and didactic. Its purpose is to direct the attention to a specific part of the picture, to supplement the picture with an explanation, to give a preliminary analysis.

A second type can be described as a motivating commentary, because it either engages the child's mind and stimulates thought, or encourages him to do something after the broadcast. In the first case, the producer asks a question about the picture and waits a few seconds before giving the answer so that the children have time to think and find the answer for themselves. In the second case, he asks the children to perform some practical or theoretical operation on the pattern shown in the broadcast.

A third type of commentary is the interview. The producer invites one or more specialists to the studio and puts questions to them. In this case he is the spokesman of the pupils in the conversation with the specialist. Sometimes he translates the specialist's words into pedagogic terms; often he just repeats the terms for the benefit of pupils.

There is, however, the case where there is no commentary; but a picture is seldom shown without verbal accompaniment.

**The commentary in relation to the picture**

Two extremes can be observed, with several cases in between.

The most typical relationship between commentary and picture is close linking of the two elements, verbal and visual, creating a picture-word complex. In this case the virtues of word and picture interact; the word explains the picture and the picture illustrates the word. However, it may be asked whether one of the elements may not distract the attention of pupils from the other, whether the visual element may not obliterate the verbal element, for instance, and vice versa.

The second type of relationship is an extremely loose one as when the word has a life of its own and the picture, a pretext, merely serves as background. For instance, in the programme on 'Decorative Tapestry' the visual element consisted of a tapestry hanging on the studio walls; the commentary was made up of general remarks on tapestry and the tapestry industry.

**The commentary in relation to the person in charge of the programme**

In one case, the picture consists of a close-up of the face of the person in charge against a black or neutral background: the television programme then becomes the equivalent of a lecture and its substance is essentially verbal.

In the second case, the picture shows a situation actually involving the person in charge. Visible on the screen, he talks about the situation, also shown, or intervenes to change it.

In another case, the person in charge is involved in the situation as a whole, but is not visible in the picture screened, that is, in the part of the scene shown by television. Nevertheless his presence is evident through the commentary on the picture; his voice is 'off'.

Lastly, the person in charge is not involved at all; this happens when the programme consists of a television film sequence. The commentary is then superimposed on the picture.

The existence of the commentary in television broadcasts raises a number of problems: there is the question, first of all, whether the various types of commentary listed above cannot be assessed comparatively from the point of view of their effectiveness; but there is also the more general question whether it is possible to concentrate the attention for purposes of perception on the visual and sound components simultaneously or whether the one does not predominate and, if so, under what conditions.

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¹ Audio-Visual Centre Research Programme, Project P 38: Experimental Study of the Treatment of Space in School Television Broadcasts (in progress).
SUMMARY

A methodical analysis of school television kinescopes has enabled certain characteristics to emerge and prepared the way for a programme of research.

Three problems are dealt with here:

1. ‘Live’ transmission. Live television uses shots of longer duration and less variety; conveys a rather less than more pre-arranged visual and sound content; its time structure is continuous (choice in space but none in time); and it is centrifugal in character (context evident in the picture).

2. Treatment of space. Three types may be shown, shots of brief duration with great variety in depth; the single fixed shot sequence; the long shot dissolving into close shots and vice versa by camera movement.

3. The commentary. Types (explanatory, motivating, interview, absence of commentary); in relation to the picture (picture-word complex, the picture as pretext and the word independent); in relation to the person in charge (televised lecture, person in charge involved in the scene, person in charge off-stage, film sequence with commentary).
Television programmes for schools are here to stay: this much, at least, is now generally accepted by educationists. But television is a very versatile medium and the question of how it can best be exploited in the classrooms of this country is still much debated at conferences and in the educational press.

Discussion ranges over a wide field, but what seems to be lacking is any comprehensive survey of the present position on all the current television programmes and the plans of the producing companies, which can be used as a sound basis for informed discussion. This symposium is an attempt by the National Committee for Audio-visual Aids in Education, a very interested party in the current deliberations, to provide such a survey.

The National Committee has been most fortunate in securing the full co-operation of the four organizations producing programmes for schools, each of whom has prepared a special report on its past and present activities and its plans for the future. The National Committee offers its thanks to these organizations for their willing assistance.

BRITISH BROADCASTING CORPORATION

When two years ago the School Broadcasting Council published their report BBC School Television Broadcasting, they stated that their future policy would rest on the belief, reached during two years of experiment, that the television screen can be used to bring into the classroom the full wealth and variety of illustration which the medium affords. It would rest, too, on the belief that 'The effective use of everything which television can offer depends, as does everything else in schools, ultimately on the teacher's imagination and skill'. As that report went on to say, 'In the hands of imaginative teachers, its value extends far beyond what derives directly from the experience of viewing; some teachers are discovering through it unsuspected interests among their children, and are helping them to develop these; others see in it a means of sharpening children's powers of observation, and their critical faculties; others again welcome it for the stimulus and new ideas it can bring to their own teaching'.

The council at that time requested the BBC that its school television provision should be made a permanent one and the BBC responded by setting up what is the world's first nation-wide service. Not only did the BBC then state that the service would be a permanent one, but undertook to expand it at the earliest possible moment.

This, the fourth year of BBC school television, has seen an increase from five to nine series a week, with eleven repeat programmes, making twenty transmissions in all. The increase to ten original transmissions comes in 1961-62. The SBC's report also laid down the 'ground-plan' of what series, on the basis of the evidence examined in that report, appeared to be the most acceptable for the continuing service which the BBC guaranteed. As modified by the Programme Sub-Committees of the Council for the year 1961-62 this includes: one series running through the year for grammar schools; two series (one running through the year and one of one term) for primary schools; and the remainder of the termly spaces devoted to series suitable for secondary modern schools. In 1962-63 the BBC plans to transmit yet another series specifically designed for primary schools.

The BBC in its 1959 report recognized certain directions in which its provision should be constant and progressively developed: Current Affairs, Science, Natural History, English among them; but with room for experiment. In fact, the BBC school television has seen several innovations and a large increase (from 2,300 to 2,900) in the number of schools registered with the School Broadcasting Council for viewing. As well as innovations, what may be called 'old favourites' have continued. It may seem strange

1. A Symposium contributed by the BBC, Associated Rediffusion, ATV and Granada TV network.
This article was published in Visual Education (London), July 1961, p. 2-9.
in so new a service to speak of 'old favourites', but in a number of fields it is now clear that BBC television has established its ability to fulfil for schools a distinctive role, calling for regular (though only rarely repetitive) series of broadcasts.

Of the innovations, two commanding great interest have been 'Signpost', a miscellany series for primary schools, and 'Discovering Science', which has been offered as the 'core' of a first year science course for secondary modern schools. It is designed to help teachers who are not specialists or are inexperienced in science teaching. 'Geography' has branched out into a series on Britain, and a term of 'New Landmarks' showing how man is pioneering in his exploration and use of the earth. Film and filmmaking has been given a term in the year's English provision. For sixth forms there has been a unit (in French) on the French cinema to follow earlier units on 'People of the Renaissance' and Modern India.

Information and planning

Teachers inform the Council when programmes are meeting their needs: there has, for example, been a big welcome for 'Signpost', the BBC's second series for primary schools, and for 'Discovering Science'. They are also frank and often blunt when programmes fall short of their expectations; and the council's regional education officers keep a watchful eye on the extent to which broadcasts are realistic in anticipating the attitudes and limitations of the audience. Individual criticism must of course be viewed in the full context of other reports, written by teachers and by the Council's Education Officers after visiting schools, of opinion expressed at the many teachers' meeting organized regionally, and of comment coming in on the questionnaires sent out in the course of postal surveys. Stable and valid opinion emerges quite clearly in the course of such thorough inquiry. In the light of this, alterations are made to programmes if necessary: for example criticism of the planning and content led to the television 'Travel Talks' series for secondary schools being transformed into the primary school series 'People of Many Lands'.

Sometimes strong support from teachers has led to the expansion of a series. For example the programmes for less able children, tried out for one term in summer 1960 under the tile 'Friday Magazine', called forth a cry of 'disgraceful' when it was thought that it might not have further air space. It was described as 'a distinctive contribution' and many teachers offered detailed comment as to length and pace. Having taken note of these very widespread opinions the programme committee responsible requested the BBC for two terms of this series during the coming year (which have been granted) and has asked for a more realistic spacing and pacing of items.

Through the committee, and the reports on which it bases its recommendations, the experience of teachers using the series has been made available to the BBC, and decisions have been taken on their clear advice. This is only one of many instances of the kind of action which becomes possible only through a full liaison service in which the teaching profession itself shows confidence.

Plans for 1961/62

The series just described thus becomes, under the title 'Television Club', one of the two-term provisions for the coming year. For the first time the number of original weekly transmissions goes up to ten, with ten repeats. Established favourites continue (a mainstay of Science, Current Affairs, Careers, English, Geography), but many of them now introduce experimental variations, reflecting suggestions from the schools. This is happening in the case of 'The Music Makers' which has achieved two successful units on the instruments of the orchestra; many teachers have suggested that the possibilities of opera should be tried out, and during the summer term of 1962 classes will be invited to join in a performance of Britten's 'Let's Make an Opera'. 'Geography', too, will provide something quite new during the spring term. A school television production team will have been across the Atlantic to make specially shot film and this will be presented in a unit on the U.S.A. Physical geography for the first time receives attention during the summer term with units on climate and weather, and on landforms, erosion and weathering. The series will illustrate its themes chiefly from regions of the British Isles, and while being no substitute for field-work, it will make inaccessible sites accessible and bring depth and reality to the textbook diagrams.

In its early days BBC schools television attempted a contribution to the teaching of mathematics. The response was sufficiently encouraging to call for a second venture. The units of this series 'Mathematics and Life' will try to show simply the application of statistical methods and of measuring to everyday life and they will be designed to enrich work normally done rather than to provide a syllabus—unlike 'Discovering Science' which will continue throughout the year to give its radical assistance to non-specialist teachers and thus, it is hoped, do something to mitigate the effects of the shortage in this field.

Yet another series which is expanding from an original one-term experiment to two terms is 'A Century of Change' which will tell the story of the British people and of Britain's place in the world from 1850 to the present time; this is another example of teachers' advice being followed. It was made very clear that a one-term series on recent history was overloaded and moved too fast, though the material
was extremely welcome. Therefore we have this newly organized series, which will use film and dramatic reconstruction to bring the immediate past to life. It may help to fill a big gap in the teacher’s search for authentic and vivid source material.

It is impossible in this space to detail all the new developments. ‘Signpost’ continues as a primary school series—with such units as ‘Writing, printing and bookmaking’ and ‘The Romans’. Special mention must, however, be made of a unit of broadcasts aimed as the opposite end of the educational ladder. Together with units on atomic physics, architecture and contemporary life in France (in French), the series ‘For Sixth Forms’ has an autumn term unit on experimental psychology under the title ‘Exploring Behaviour’. These five programmes fill the first half of the term, and though self-contained, are followed by four programmes in sound broadcasting on ‘Thinking—an inquiry into mental processes’. Schools able to receive sound and television will be able to take a stage further in theory and philosophy what has been earlier demonstrated visually and experimentally. The council’s programmes committees consider this complementary planning to be an earnest of future possibilities. The council is also looking forward with great interest to the possibilities of the new discussion series ‘Your World’, which will aim to present aspects of some of the most difficult social and personal problems which face children as they grow into their late teens.

Teacher advice

The School Broadcasting Council is a body representative of the main organizations of the national system of education. It is not a merely advisory body. It initiates and is continuously responsible for the educational policy of the BBC’s School Broadcasting service in both television and sound. The BBC will broadcast nothing to schools except at the council’s specific request.

The council formulates its policy through its programme sub-committees, on which most of the members are practising teachers. The policy is then translated into programmes by the BBC’s School Broadcasting Department, most of whom again are ex-teachers, and the programmes are fully sponsored by the council.

The council’s policy is realistically based on a service of information and liaison provided by its own officers, and through these it further provides the educational world with expert help towards the better understanding and use of school broadcasting as an educational medium. The council is the sole channel of communication between the BBC and the educational world on all matters connected with school broadcasting.

Within the framework of the policies they have themselves laid down for various series, the programme sub-committees make suggestions, examine the proposals of the School Broadcasting Department, and are able to discuss intimately all plans with the Head of School Broadcasting and with the producers. Moreover, the day to day comments of teachers, made on their reports, made to the council’s fifteen regional education officers, and made through the thousand or so letters received annually, do influence policy in a very real way. When a special issue is under consideration, the council frequently calls a conference of specialists. By such methods, both regionally and by central consultation, teachers’ counsel is sought and acted on at every turn.

Administration

Until this year all television programmes have been the subject of recommendations to the Council’s Executive Committee from a Television Sub-Committee formed in 1956. This committee is now ceasing to exist and the various programme sub-committees (two for primary and two for secondary education) have, as is appropriate, taken over its responsibilities. This means, for example, that all proposals for sound or television programmes for primary junior schools are considered by the Primary II Programme Sub-Committee, and similarly for other age ranges. In this way complementary planning of sound and vision will be made easier, and by the methods of consultation already described, the BBC’s provision for schools can be considered as a whole by those representing the educational world in the council and its committees.

At as early a stage as is possible, the Independent Television Authority and the programme companies are informed of the council’s plans, and through this action timetable clashes or serious duplications have so far generally been avoided.

INDEPENDENT TELEVISION

As a result of a decision taken very recently, it is now possible to consider the programmes of the Independent Television contracting companies as a single co-ordinated service. Under an agreement which is to operate from September 1961, school broadcasts produced by all three companies contributing to this symposium will be networked throughout the existing ITV regions. This will mean, of course, that schools throughout most of Britain, regardless of their geographical position, will be able to benefit from ten series of Independent Television school broadcasts a week. They will cover, between them, a wide range of subjects and cater for the needs of all children between the ages of 9 and 18. In addition, each Independent Television region will carry
extra transmissions in subjects and at times chosen to meet the special needs of local schools. The advantages of such a unified service from education's viewpoint appear obvious.

ASSOCIATED-REDIFFUSION

This company has just completed four years of school television broadcasting: in May 1957 the first regular service of its kind in the Commonwealth was inaugurated with a programme on 'Looking and Seeing', one in a series planned to encourage children to look; to observe, record and appreciate the world around them with a more attentive and lively eye. Since that date, the company's educational and production staff have built up a service for the schools which is shaped, in equal measure, by a regard for established educational practices and by a healthy spirit of enterprise and experiment.

Since the structure of Britain's educational system is very different from that of, say, France, it has not been easy to evolve a broadcasting timetable which is generally acceptable to the increasingly large body of teachers, in widely separated parts of the country, who are using the programmes. However, we all rightly value the independence enjoyed by individual head teachers in this country, who are not tied to a common syllabus. The variety to be found in our schools has made it all the more necessary and desirable for Associated-Rediffusion, throughout the development of school television, to collaborate very closely with the teaching profession at every level, consulting its members both as individuals and as spokesmen for different organizations, local needs, and schools of thought. From this invaluable two-way traffic of ideas and shared experience a recognizable pattern, still open to change, has emerged.

Associated-Rediffusion's programmes, directed mainly at children between the ages of 10 and 16, fall into four main (but overlapping) categories. There are programmes primarily designed to stimulate children towards some activity or investigation of their own, perhaps out of school hours. Recent examples were two series on 'Books to Enjoy', six programmes on leisure-time activities, and programme on dance drama and ways of preparing a school play when only the poorest staging facilities are available. The elementary science programmes for children of around 10, which are a regular feature of Associated-Rediffusion's timetable, in some respects enter the same category, concentrating as they do on the kind of simple experiment which can be carried out with no elaborate equipment in school or as 'follow-up' at home. A series of this kind is serving a double purpose, for it is not only stimulating the children, but also, by putting into practice certain tenets of progressive educational thinking, helping the teacher to give more to his job.

Another type of programme seeks to draw on the unique resources of television to provide an experience which would otherwise be difficult, if not impossible, to come by. Comparatively few children ever get the opportunity of seeing such plays as 'Macbeth', 'Twelfth Night', 'The Winter's Tale', 'She Stoops to Conquer' or 'Arms and the Man' performed in a theatre. Associated-Rediffusion has not only mounted full productions of these plays, but, in most cases, has also produced supplementary analytical programmes exploring central dramatic themes and selecting and repeating sequences likely to present difficulties in the classroom. In much the same way, the regular weekly Elementary French series 'Chez les Dupré', which is concerned with the day-to-day activities of a provincial French doctor and his family gives children the opportunity of hearing the language spoken (slowly but colloquially) by native speakers, and of relating their new vocabulary to observable and therefore meaningful surroundings and situations.

There is another category. It is not, of course, the desire or intention of this company or its Educational Advisory Council to try to perform the teacher's task for him. At the same time, television can very well trace the pattern of the syllabus and illuminate those aspects of it that lend themselves to the screen's powers of creative illustration. Geography is a case in point. A series of twenty-four programmes, running throughout 1960/61, explored in some detail the regional geography of the British Isles, using both specially shot film and the apparatus of the studio (models, animations and so on) to provide a picture, both up to date and scholarly, of how man and his environment have shaped each other in regions as far apart as the Weald and the Scottish Highlands.

Teacher reaction and advice

It is fair to claim that the reactions of the teaching world to Associated-Rediffusion's schools programmes have been generally favourable. Of course mistakes have been made, and are bound in the nature of things to occur. The important fact to remember is that the development of this service is in the hands not merely of the producers, but also of the teachers who use it. Why this is so has already been indicated; a word on the machinery involved may be useful. The profession influences programme planning in various ways, both formal and informal; through the company's Educational Advisory Council; through ad hoc meetings attended by, for example, primary or English teachers; through the everyday contacts established when the programme staff visit viewing schools, Training colleges, parent-teacher associations, conferences—any place where ideas and experience can be exchanged and compared. The result is that many people concerned with edu.
cation, by commenting regularly on the programmes they see, and passing on the children’s reactions and opinions, are helping to build up a picture, enlarged by the reports made by the company’s schools liaison and education officers, of how this latest development in visual education is progressing.

Plans for 1961/62

The company’s plans for the school year 1961/62 were settled in March, and schools will have received details of the programmes early in the term which has just ended. These need not be repeated here, as regular announcements appear in the advertisement columns of the educational press. It will be noted that the Elementary French programmes are to continue, that ‘Hamlet’ is to be explored in depth and produced in as full a version as possible, and that an attempt is being made to meet, in a single ‘General Interest’ series the needs of both older Primary and younger Secondary children. There will be other programmes covering scientific and literary subjects, and a series on the applied arts.

ASSOCIATED TELEVISION

Associated Television’s first venture into schools television broadcasting, in the spring term 1961, consisted of two series of programmes designed to supplement the teaching of French: their aim being to create a greater familiarity with various aspects of French life, thus quickening interest in a study of the language and literature. It was felt that the intimate qualities of television presentation could do much to re-create in the classroom that particular atmosphere which is the essence of a foreign country. The production of the programmes was undertaken in co-operation with the French Embassy in London, the French Ministers of Education and Cultural Affairs, and of many sections of the French public from the editors of leading newspapers to the stallholders in the market-place at Chantilly.

The series ‘French from France’, which is designed for second or third year students of French is a new development in that it is the first occasion on which an outside broadcast unit has been used abroad to provide a complete series of language programmes. The linguistic pattern of the broadcasts is built up on a distinction between background speech at normal speed, and the carefully planned close-up dialogue spoken by young French actors and actresses. The object of the series is to present France rather than French, background rather than grammar, and current phrases by means of intonation and gesture.

‘Ici la France’, on the other hand is a series for sixth forms, devoted to presenting the very air and atmosphere of cultured France, and to providing background material for the sixth former’s study of French literature and contemporary institutions. The aim is, in fact, to show life in France today as it affects the activities of the young—for example students of the same age as the sixth form viewers. Few ‘concessions’ to linguistic difficulties were made in the first programmes, but students seem to have found this approach a challenging and exhilarating one.

Future plans

Apart from the continuation of the two series of French programmes, ATV’s Education Advisory Committee is now giving careful thought to the school subjects not, so far, covered by television broadcasts. In the autumn, ATV will be broadcasting two new series of programmes. ‘Primary Mathematics’ is intended to supplement the teachers’ work in two ways; by attention to the basic ideas necessary for a proper appreciation of number, quantity and their simpler relationships, and by suggesting experimental work in which the child observes, records and discovers. A series of ‘Chemistry Experiments for VIth Forms’ will cover those experiments which are difficult or impracticable for the individual teacher to set up in class.

Longer-term plans will possibly include further languages, as it is felt that television has a particular contribution to make in this field.

Teacher co-operation and advice

The successful development of television in education requires an active partnership between teacher and producer. ATV’s Education Department have found an immense amount of enthusiasm among both teachers and pupils, and already much valuable information has been made available to the advisory and production teams.

It is hoped to maintain and increase existing links with schools and other educational institutions, for there is much work to be done in stimulating thought, discussion and research on the subject of educational television. The Education Department hopes to co-operate with the national network of Teachers’ Visual Aids Groups (who have in the past done so much to pioneer the widespread use of classroom film) in the organization of courses and conferences. Teachers must play their part by means of candid assessment and constructive suggestion if television is to continue as a potentially powerful teaching aid.

GRANADA TV NETWORK

Educational television is still a highly experimental medium. Granada TV, recognizing this and wishing to take part in the experiment, decided to begin in
the field of science and in the age group of the sixth former. Why science, and why sixth forms?

Everyone is aware of the current demand for more and better science training and more scientists, so the choice of subject was fairly easy. As for sixth forms, though they constitute only a tiny fraction of the total school population, intellectually speaking they are the elite. So Granada decided to start with them. The next thing was to choose the form the programmes should take. It seemed right to avoid any attempt to compete with, or substitute for, live personal teaching in the classroom. The aim of the programmes would be to try to add something to classroom routine which would not otherwise be available. The idea was to stimulate the enterprise and imagination of students by bringing them into direct contact, through the television screen, with leading personalities in all branches of science, who should talk in their own way, with demonstration and experiment, about their own branch of research.

This science series—under the general title 'Discovery'—therefore formed the first transmissions of programmes for the northern ITA region in the autumn term of 1959.

After this successful start, Granada set about providing a parallel series of programmes for Arts sixth formers. The first series was chosen from the field of public affairs. A series of ten programmes was transmitted under the general title of 'Inquiry', in which the leading authorities in their own fields introduced programmes explaining the workings of a wide range of national institutions such as 'The Trade Unions', 'Parliament', 'Prisons and the Penal System', 'The Law' and so on. Sir Charles Morris, Vice-Chancellor of Leeds University gave a programme on 'The Universities', and the Earl of Harewood one on 'The State and the Arts'. These programmes were also well received, and a further series for Arts sixth formers will be continued throughout the school year 1961/62, beginning in September with a series on 'Design', aimed at encour-

raging students to perceive the importance and value of design in small things and great.

**Educational advice and liaison with teachers**

At the outset, before any decisions of any sort were finally taken, Granada sought the advice of a small but highly qualified and diversified group of educators, who agreed to serve as a working party to explore areas, in terms of subjects and age groups, most likely to prove profitable from an educational point of view. In this they had the valuable assistance of the British Association for the Advancement of Science.

A little later a Schools Advisory Committee was set up, representative of the major teachers' unions, of the Association of Education Committees, and of other educational bodies in the northern region, which Granada serves. The chairman of this committee is Professor Mansfield-Cooper, Vice-Chancellor of Manchester University.

Particular emphasis is laid by Granada on close liaison with schools, in order to ensure as full a feedback of comment and criticism as possible from teachers and pupils, to guide the producers in framing the programmes along suitable lines. Not only are personal visits made to schools, including attendance at classes while programmes are being viewed, but detailed questionnaires are circulated to both teachers and pupils by means of which reactions to individual programmes can be collated and acted upon. In this way a valuable link has been established which is felt to be of advantage to everyone.

We should be the last to claim that we have discovered all the answers. On the contrary, as has been observed before in a wider context, so far from knowing the answers we don't in some instances even know the questions. This is a condition which we believe we share with all other bodies engaged in educational television in this country and, indeed, so far as we have yet investigated, in every country in the world. It is partly this very circumstance which makes the whole enterprise of educational television so stimulating and worth while.
The law on strengthening the ties of school with life stresses the fact that the extensive use of television as well as films in schools is essential in order to render teaching methods more active and teaching itself more visually effective. Television, like other audio-visual aids, is a new phenomenon in the teaching process, and the interest taken by educationalists in the role it can play in education is closely linked with the extensive development of television in the U.S.S.R.

There are at present more than 100 television stations and 200 relay stations in the country, with over 75 million viewers. The number of TV sets in use exceeds 6 million.

Educational television is regarded as one of the important visual media which a teacher can use, with other teaching aids, to make his teaching effective, and its development is organically bound up with that of educational films, our long experience in the use of which is particularly valuable when it comes to choosing topics, programmes, content and methods of presentation of school television broadcasts.

The aim of school television should not be to replace the teacher, whose role in the teaching process remains the paramount and decisive one. But he can use the various types of school television broadcasts to enhance the educational effectiveness of the teaching work organized and directed by him.

VARIOUS WAYS OF USING TELEVISION FOR TEACHING PURPOSES

Practical experience in the use of television for educational and teaching purposes has shown which type of broadcasts are of potential and practical value to the school, the teacher and the pupils, and which characteristics are distinctive of each type.

Presentation of educational films

Television may be used as a medium for showing educational films, and its use in this way makes it possible to provide considerably better film services for the vast network of schools throughout the country. The regular presentation by television studios of educational films (including 35 mm. films), both during and outside school hours on topics being studied by the pupils, enables all schools to make wide use of films for many of their lessons.

The use of television rather than a projector to show educational films in the classroom is preferable not only for practical and technical reasons (television saves the cost of film, projectors and technicians; there is no background noise, as with a projector; and there is no need to darken the room), but also for methodological reasons. The teacher does not always need to show his class the whole of a film, and sometimes finds it difficult to decide which sequences to present. There are also purely technical difficulties connected with the editing of a film which do not arise if television is used. In editing educational films and selecting the most educationally valuable sequences, television studios are advised by highly qualified educators having wide experience in the use of such films. This method of using the available film material to the best advantage was adopted by the Central Television Studio in Moscow for the school year 1961/62.

The programme of educational films to be televised during the year was drawn up by the educational Film, Radio and Television Laboratory of the Institute of General and Polytechnical Education of the R.S.F.S.R. Academy of Pedagogical Sciences in collaboration with the Moscow Teacher Training Institute's Film and Television Bureau.

Most educational films are shown in an abridged version, consisting of a selection of the most important parts of the film. As a rule, a number of films on different subjects are shown on the same day.

The films are introduced by experienced educators, who explain to the pupils how the film is related to the topic they are studying in class, and direct their attention to key passages. After the showing, the teacher in charge of the broadcast questions the pupils in order to impress on them what they have seen and show them how to use it in their school work.
The programme for December 1961 may be given as an example:

<table>
<thead>
<tr>
<th>Date of broadcast</th>
<th>Grade</th>
<th>Subject</th>
<th>Title of film</th>
<th>Length of broadcast</th>
</tr>
</thead>
<tbody>
<tr>
<td>First week</td>
<td>IV</td>
<td>Natural history</td>
<td>'Glass'</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>VII</td>
<td>Geography</td>
<td>'South American fauna'</td>
<td>20</td>
</tr>
<tr>
<td>Second week</td>
<td>IX</td>
<td>Geography</td>
<td>“The electrification of the Soviet Union”</td>
<td>30</td>
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<tr>
<td>Third week</td>
<td>VII</td>
<td>Biology</td>
<td>“The development of an embryo chicken”</td>
<td>15</td>
</tr>
<tr>
<td>Fourth week</td>
<td>VIII</td>
<td>Physics</td>
<td>‘Newton’s Second Law’</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>VI</td>
<td>Geography</td>
<td>'London'</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>VII</td>
<td>Chemistry</td>
<td>‘Oxygen in nature, and its use’ (montage)</td>
<td>18</td>
</tr>
</tbody>
</table>

Popular science broadcasts ‘For schools’.

Several times a week, the Central Television Studio and the studios in Leningrad and other cities broadcast popular science lectures for school pupils, talks on topics relating to natural science, geography, history, literature and other subjects, accompanied by demonstrations of experiments and films. These programmes are broadcast out of school hours, and often deal with topics outside the actual school syllabus. They are designed to widen and deepen the children's education, satisfy their curiosity and interest in science and technology and promote their general cultural development. They often take the form of dramatizations of popular science themes, with the parts being played by professional actors or young amateurs, lecture-concerts (music and drama), and interviews with scientists, engineers, inventors, worker-innovators and distinguished collective farm workers, who describe modern technical achievements and the creative work of the Soviet people.

These out-of-school broadcasts are designed for pupils in the junior grades (I-IV), intermediate grades (V-VII), and senior grades (VIII-IX) age-groups. Those in grades X and XI (boys and girls of 17 and 18) watch the special broadcasts arranged for young people.

These broadcasts for schoolchildren are not school broadcasts in the strict sense: they are not directly related to the process and organization of school teaching and hence tied in with the school curriculum and syllabus and directly connected with the lesson, which is the basic form of organization of the teaching process. However, for the past two years the topics dealt with in the Central Television Studio's popular science broadcasts for children have related more and more closely to the school syllabus material, thanks to the establishment of closer contact between pedagogical institutions—particularly the R.S.F.S.R. Academy of Pedagogical Sciences—and television workers, with the most successful teachers and specialists in teaching methods co-operating in preparing television programmes and conducting broadcasts. Approximately one hundred and forty broadcasts in the series ‘For schools', each lasting 25-30 minutes, were given in the school year 1960/61, their subject-matter and mode of presentation being specially selected to meet television requirements. Two broadcasts, one in the humanities series and the other in the natural science series, may be cited as examples.

The first is a half-hour ‘For schools’ programme on Tolstoy, for grade IX, broadcast on 14 January 1960 by the Central Television Studio and presented by an experienced teacher of literature at one of the Moscow schools.

In a brief introduction, the teacher stresses the importance in Tolstoy's life and work of his country house at Yasnaya Polyana near Tula, not far from Moscow: to have seen Yasnaya Polyana is to acquire a fresh outlook on Tolstoy's works; and the striking documentaries made there during the writer's lifetime and after his death, and the memoirs written about him by his contemporaries, permit a reconstruction of his surroundings and the conditions under which he lived and worked.

The introduction is followed by a close-up of memoirs and documents, which the teacher, turning the pages, urges the young viewers to remember and read. 'Just imagine,' he exclaims, 'if we could meet and talk to someone who knew this great writer for many years as one of his close friends, and who often visited Yasnaya Polyana for long periods, what interesting things he could tell us!'

And he thereupon introduces A. B. Goldenveizer, author of the memoirs entitled Tolstoy and his friends, well-loved doyen of Russian pianists and professor at the Moscow Conservatory, who had been invited to take part in the broadcast.

From the screen, a charming, grey-haired, venerable old man, whose pensive eyes have looked so often and so long at the great Tolstoy himself, gazes gently and affectionately at the enthralled spectators, who listen, with bated breath, to his fascinating
account of the times he spent with Tolstoy at Yasnaya Polyana and at Moscow, and how he played his favourite pieces for him.

He goes over to the piano. ‘And now, children, I shall play for you two of Chopin’s preludes which Tolstoy was particularly fond of. Tolstoy loved music and knew a great deal about it, and was himself an inspired player. When he listened to the works of the great composers, his face would light up, and he would be sunk in profound meditation. Music aroused the deepest feelings and thoughts within him. What a pleasure it was to play for him!’

The magical notes of Chopin’s music are heard, and as the young listeners listen to the masterly playing of the pianist, the contemporary of Tolstoy and his friend and admirer, they, too, are transported in mind to world-famous Yasnaya Polyana, that legendary place where everything recalls and gives silent witness to the long life and tremendous literary output of the genius who lived there.

The enchanting notes die away, and pictures appear on the screen.

‘And now,’ says the commentator, ‘the cinema, which recorded a number of interesting incidents in Tolstoy’s last years (1909-1910), will take you to Yasnaya Polyana.’ And it is with the screening of these unique documentary sequences that the literary broadcast for grade IX pupils, who had at that time been studying Tolstoy at school, is concluded.

The second example is the half-hour broadcast ‘For schools’ given by the Central Television Studio on 13 October 1960 on ‘The physics of sound and music’ (sound being one of the subjects in the grade IX physics course). The programme was presented by a highly-qualified physics master at one of the Moscow schools, a practical specialist in the teaching of his subject.

It begins with music and a close-up of the fingers of a schoolboy running along the keyboard of a piano. He is surrounded by the boys and girls in grade IX. The teacher is there with them, and gives a brief definition of music as an artistic combination and fusion of a wide variety of sounds produced by the human voice or by musical instruments, with arouse thoughts or feelings. ‘What an enormous number of sounds there are! But what is a sound?’

The teacher answers this question by carrying out a physical experiment with vibrating discs which produce sounds of different pitch. Then, by means of a tone generator, he produces sounds of various frequencies—20, 30, 40 and 50 cycles per second—within the range of the human voice. The pointer moves up to 80 cycles—the lowest sound a bass singer can produce. The experiment continues: 100 cycles is heard—the droning sound made by a transformer—and then 150, 200, 300 and 400 cycles, the latter being the sound made by a tuning-fork. The young pianist strikes this note on the piano, and a girl violinist tunes her violin to it. The frequency increased to 1,000 cycles (1 kilocycle per second), the sound made by a siren, then 2 kilocycles, the highest sound the human voice can produce (the third F above middle C), which only the famous Peruvian singer Yma Sumac can reach. At a frequency of more than 2 kilocycles, a sound resembles a whistle. But there are higher frequencies still—8, 10, 15, 20 kilocycles. This is the highest frequency perceptible by the human ear. Frequencies beyond it are not perceptible by man and are called supersonic.

By means of short film sequences, the teacher shows how supersonic sounds are used in technology and industry, and in certain circus turns and conjuring tricks.

Sound vibrations can not only be heard but also seen. An electronic oscillograph traces a graph of the sound vibrations registered by a microphone placed near it. Then the oscillograph records the sinusoid, a graph of the sound vibrations of a tuning-fork, and then the sound vibrations of a piano string. The note ‘A’, when sounded by the strings of a violin, produces a particularly complex graph.

After discussing the periodic and rhythmic vibrations of musical sounds, the teacher goes on to explain the physical nature of non-musical, non-periodic sounds—the sound of hand-clapping, of a child’s rattle, the whisper of grass, or a rustling sound.

And what of the sounds of human speech, which, as distinct from singing, take the form of words made up of vowels and consonants? What sort of line do they produce on the oscillograph?

The pupils taking part in the broadcast pronounce various sounds into the microphone placed next to the oscillograph. The vowel sounds are musical—their oscillations are periodic, whereas the consonants, and especially the sibilants, are non-musical, and their oscillations are non-periodic.

The teacher switches on the tape-recorder, in order to reproduce sounds recorded on the tape—the thudding of a stick, the beating of a drum and other percussion instruments used in a jazz band. The vibrations they make are recorded on the oscillograph, and the pupils can see for themselves whether they are musical sounds or not.

The teacher then explains the physical nature of low-pitched and high-pitched musical sounds, playing sounds of various frequencies on the piano by way of illustration.

The rise and fall of the scale depends on the length and thickness of the vibrating strings; a short, thin string produces high frequency vibrations, whereas a long, thick one produces low frequency vibrations. This is demonstrated by one of the girls playing the violin. She plays a simple tune, and her fingers can be seen moving over the strings, shortening or lengthening the vibrating part of each, and modifying the pitch accordingly.
To conclude the broadcast, the teacher gives a short summary and shows the pupils how all they have heard and seen on the subject during the broadcast relates to the account of it given in their physics book.

In preparing the programme of broadcasts for the ensuing school year (1961/62), even greater attention was paid to school requirements as regards audio-visual instruction on a wide range of complex subjects. Programmes were prepared for physics, chemistry, biology, history, geography and literature, according to the following schedule: Subject of broadcast; Grade; Date; Starting point of the broadcast; Equipment needed; Name of person presenting broadcast.

The chemistry programmes, for example, covered the following topics: 'Solid carbon dioxide (dry ice)—its properties and uses' (grade VIII); 'A municipal water purification plant' (grade VII); 'In an electrolysis plant' (grades IX and X); 'The ceramics industry' (grades IX and X); 'New washing processes' (grade X), etc.

The geography programme covered the following topics included in the school syllabus: 'What is physical geography?' (grade V); 'Valleys and mountains' (grades IV and V); 'The fauna of South America' (grade VII); 'The electrification of the U.S.S.R.' (grade IX); 'London' (grade VIII), etc.

Since 1961, definite days and hours have been set aside for the 'For schools' series, and this, together with the introduction of a new system of informing schools of forthcoming broadcasts and their subjects through Ucitel'skaja Gazeta (Teachers' Gazette) and the issue of special notices for schools, will greatly increase the possibilities of using television for school work.

The experience gained in conducting broadcasts on topics related to school syllabuses will soon enable television to be extensively used in the classroom itself.

Television broadcasts as an aid to pupils in their homework

The purpose of this type of broadcast is to use the many television sets owned by private individuals to help pupils with the more difficult parts of their lessons and with their personal homework.

The Odessa studio has acquired very significant experience in this field. In collaboration with research workers in the University Department of Education, it organized fourteen broadcasts on topics in the Soviet literature course in order to help pupils with their literature homework, adopting various procedures and methods for presenting the material, driving the lesson home and recapitulating what had been taught.

The broadcasts took the form of talks for pupils in grades VIII and IX and of synoptic lectures for those in grade X. In all cases, documentary films on Pushkin, Gogol, Shevchenko, Chekhov, Tolstoy, Gorky, the revolutionary poets, etc., were used to illustrate the lessons, together with extracts from screen plays and dramatic representations based on works by the authors studied.

The general arrangement for broadcasts of this kind is as follows. The teacher conducting it begins by indicating the nature and scope of the lesson, and tells the pupils what parts they have to do orally, what they have to do in writing, and what parts of earlier lessons they have to revise. He sets his television class questions on the study topic which they should be able to answer and which—if they are short, as they should be—he invites them to write down in their notebooks. He then explains how the work covered by the broadcast must be done, referring to the relevant pages in the textbook (which the pupils are told to have by them, open at the right page), and stressing the main facts by illustrating them audio-visually. During his exposition, he writes on a blackboard or indicates on a chart the essential points to be remembered—terms, names, dates, formulae and diagrams. He ends up by telling the pupils what they have to do after the broadcast—what they have to learn by heart or write down, how they should tackle the problems they have been set, and so on.

These broadcasts vary according to the subject dealt with and the nature of the homework. In some cases, they supplement textbook material: the pupil are taken on a television tour of a museum, or a film is shown to help them understand their work better and grasp the connexion between the textbook lessons and everyday life, work and production. The role and importance of this kind of educational television is at present growing as a result of the development of the various forms of independent work in the school teaching process.

Television lectures and lessons for correspondence pupils

This is a type of television broadcast on which increasing attention is being focused in connexion with the reorganization of the public education system and the consequent rapid development and expansion of evening and correspondence courses at secondary level. Studios throughout the country are carrying out research into the use of television in this field. Outstandingly successful has been its use for foreign language courses, and thousands of pupils are now studying a foreign language (mostly English) by television. These courses are a particular boon for pupils in outlying districts, where not all schools may be equipped with the full range of visual aids permitting the best results in language teaching.

Even if a correspondence school can send its pupils sets of visual aids, gramophone records or tape-
EXPERIMENTS AND RESEARCH IN CONNEXION WITH EDUCATIONAL TELEVISION

Television as an audio-visual aid to education is quite new to our country, and its use in this field is only in its infancy. This makes it all the more necessary to examine thoroughly the practical work being done on the subject by television studios and by scientific institutions and schools, while experimental laboratory research is also necessary. It is for this purpose, in fact, that the above-mentioned 'Educational Film, Radio and Television Laboratory' was set up at the Institute of General and Polytechnical Education, one of its tasks being to make a close study of questions of educational television and conduct experimental research in that connexion.

The laboratory is housed in one of the institute's pilot schools, where an experimental classroom has been specially equipped for research purposes with television cameras and receivers of different kinds and various-sized screens. Adjoining the classroom are specially equipped rooms from which experimental school broadcasts can be transmitted in closed circuit. The broadcasts may consist of audio-visual illustrations for an ordinary lesson given by a teacher, or they may be television lessons given by a teacher to several parallel classes. In the latter case, the pupils in one classroom listen to the teacher, and see his demonstrations, experiments, etc., directly, whereas the other classes receive the same lesson by television. Everything the teacher says, his demonstrations and the pupils' questions, answers and general reactions are tape-recorded and filmed for subsequent analysis. In addition, experimental lessons are systematically observed from adjoining rooms.

Another arrangement is for groups of pupils to be invited to come to the experimental classroom out of school hours to view the Central Television Studio school broadcasts being studied by the laboratory. Each broadcast is preceded and followed by a brief discussion, and the children are asked a number of questions, their answers to which show how successful the broadcast has been from an educational standpoint, and enable their opinions and interests to be taken into account. The educational effectiveness of the broadcasts is studied by the laboratory in conjunction with the studio's school programmes service and the teaching staff of a number of day and boarding schools.

It is clear, from the experience gained in educational television, that there is great scope for the use of television in teaching. It makes for a better standard of education; and while it is not the intention that television teaching should replace the teacher, it does give variety to the education process, stimulates the pupils to greater efforts in their studies and develops their intellectual faculties.

Experience shows that if television teaching is to be used to the best advantage, there must be close collaboration between the teaching staff and the staff of the studio. Such collaboration may take all manner of forms—teachers may conduct or prepare the broadcasts, a teachers' council may be formed to advise the television staff on methodological questions, reviews of school broadcasts may be given in educational journals, and so on, and in this way, a consensus can be reached on the aims and nature of educational television.

The latter, as a means of disseminating the most recent scientific findings and as a valuable audio-visual instrument, is a special branch of television,
with its own methods. It should bring the school something that it cannot get from films or from any other audio-visual aid. We therefore consider that educational television should deal primarily with the facts, events and processes of contemporary life.

Only on that condition will televised teaching be able to achieve a higher degree of authenticity in the transmission of knowledge than the educational film, and to lay just claim to rank as a modern audio-visual aid in its own right and to be developed as such.
Teachers in Japan, especially in the junior high school, face great difficulties in programming when they use television in the classroom. Initially, they are unsure of the effect such a form of teaching will have and secondly they have to prepare their pupils for the entrance examination to the senior high school, the latter already placing a heavy burden on teacher as well as pupil.

Television teaching is being introduced into the classroom not so much to show that it is theoretically useful as to demonstrate that it can be an aid to preparation for the entrance examinations into the senior high school. For these reasons an experimental study was carried out on a group of seventh-grade pupils studying science, the objects being to determine: (a) what effect television programming has had on their progress in science; (b) whether or not their interest in the subject, has increased as a result; and (c) what changes, if any, occurred in their attitude towards study. The television programme used was 'The science classroom of the seventh-grade pupils' produced by the national education television network (NHK).

The first step in the experiment was to form television classes (T) and control classes (C). Two classes were chosen, from both the Shiun Junior High School at Takamatsu and the Takuma Junior High School, Mitoyo-gun, Kagawa Prefecture. In each school, the classes were arranged so that they contained pupils who were similar in their intelligence and scientific knowledge. The achievement test given by the Kagawa Prefectural Board of Education when these pupils were in the third semester of the sixth grade was used as the basis of assessment for the experiment.

Each teacher in the test was required to teach both an experimental class and a control class. Mr. Eguchi and Mr. Morita thus held two classes each in their respective schools during this phase of the experiment.

Both teachers planned their own curricula. Although available school facilities and the Recommended textbook dictated the nature of the curricula, Mr. Eguchi and Mr. Morita saw to it that the total hours of lessons in one week and in one semester should be the same in regard to both experimental control groups.

For twenty minutes each week the pupils in the experimental classes watched the television programme, 'The science classroom of the seventh-grade pupils'. In the lessons conducted without television, the teachers rearranged the contents of the textbook so that the pupils might learn science side by side with the television programmes. When it was impossible, they taught different units in two kinds of lessons. In the Shiun Junior High School the students continued to see four programmes dealing with the botanical materials of 'The science classroom of the eighth-grade pupils', as they had a direct relation with the school curriculum.

Meanwhile, in the control classes the contents of the lessons were the same as in those of the experimental classes, but the pupils received no television instruction. However, all other visual aids available were used to improve the scientific knowledge of the pupils.

In order to evaluate the results of the experiment, not only the results of the objective measurement test but also the questionnaire filled in by the pupils and the analytical records of the teaching process were used. The measurement test was chosen to evaluate the pupils' achievements during the first semester of the seventh grade, in accordance with factual knowledge, understanding, critical thinking and skills. The test was based on the curriculum of each of the schools. M. Fujisawa was in charge of this part of the experiment. The test was given to the pupils three times, in April when the experiment was about to start, in July when it was over, and at the beginning of September, six weeks from the end of the experiment. The results were expected to indicate the attainments of pupils just before the start of the experiment, the results the experiment brought about and the degree of retention some weeks after the experimental teaching.

Certain controls were placed on the organization of the test. Little attention was given, for example,
to the television programmes. The testing supervisor neither viewed the programmes nor consulted the teachers' guide to them, lest the test should favour the experimental classes. In order to nullify any advantages the repetition of the same test might bring, the arrangement and forms of the question were changed in the test of July. In addition to the objective test mentioned above the teaching team tried to determine how the pupils' interest in science changed before and after the experiment, how voluntarily they had worked outside the classrooms from that time, and the degree of difficulty experienced in understanding visual materials.

Before the experiment took place boys in the experimental classes had slightly better scores than in the control classes, while girls were a bit poorer in the former. As a whole the experimental showed a slightly higher level of attainment than the control classes.

After the experiment, both boys and girls in the experimental classes had higher scores than those in the control classes, but there was still no significant difference between pre-test and post-test performances.

In the September test, six weeks after the end of the experiment, the results were quite different. Both boys and girls had better scores in television than in non-television classes. There were statistical differences between these two kinds of classes in the case of the whole class and the girls alone, though the level of the difference was slight, ranging from 0.10 to 0.25. As the level of the difference fell short of 0.05, this suggested that use of television in the classroom enables pupils to maintain their rate of progress longer than under conventional teaching methods. This is especially true of girls.

Test differences are mainly visible between boys and girls. Boys do not provide much basis for distinguishing between the scores in the two kinds of classes in any test. The difference in the test scores, if any, is statistically insignificant. In respect to the effectiveness index, however, the television classes are somewhat better in July, and in September were 6 per cent higher. On the other hand the effects of television instructions are remarkable in the case of girls. The control classes had the better records in April. The difference is statistically significant at 0.10-0.25 level, while in July the results of the test are radically changed. The television classes are better. In the September test this tendency goes further. The experimental classes were 7 per cent and 11 per cent higher in July and in September respectively.

These results suggest that: the use of television is of immediate benefit to pupils in acquiring basic knowledge and, moreover, that it helps them to retain this knowledge. This is again, especially true of girls.

As for boys, the television classes showed the higher scores in April. This is statistically significant at 0.10-0.25 level, but in July and September this difference disappeared. In the index of the tests the experimental classes were inferior by 5 per cent in July and by 3 per cent in September. On the other hand in the case of girls little difference was discerned in the scores and index in the April and July tests. Meanwhile in September the experimental classes attained the higher scores, with the difference statistically significant at 0.10-0.25 level. The index was 7 per cent higher, too. Assuming that the difference between boys and girls consists not in intellect but in total achievement and in the interest in learning it is possible that television is of greater help to those who lack the basic understanding and learning interest. If this assumption is accepted, then one must conclude that it is more difficult to produce successful understanding of the relations and laws of nature through the television programme than through the conventional method. Television is comparatively effective when pupils lack basic understanding of or interest in the lessons. For other pupils the traditional way of teaching is probably more powerful.

What has been the effect of television on the development of critical thinking? As with other fields the September scores were again higher in the experimental classes. Boys reached higher standards in all of the experimental classes, but this tendency had developed before television was introduced and shows little change even as the special teaching proceeded. Meanwhile, girls in the control groups registered high enough scores to make significant statistical differences at 0.10-0.25 level in April, but in the tests of July and September this difference ceased to exist. This is because the index of the experimental classes rose by 3 per cent in July and 10 per cent in September.

In the light of these results it appears that television is more useful than traditional methods in the development of critical thinking, but that it cannot be said to be especially useful for boys. This conclusion tallies with the effects on the understanding indicated in the third section.

However, it may be said that the effects brought about by television continue longer than those brought about by conventional teaching methods.

The development of the pupils' interest in science is not the only aim in science teaching but it is useful in promoting understanding of the subject taught. In order to ascertain how attractive television teaching was, pupils were asked just before the start of the experiment and in July immediately after it, whether or not they enjoyed the subject.

As a whole, no distinction was seen in the interest in science between two classes in April. In July those who 'liked' the subject decreased in number in both
classes, but 'indifferent' pupils increased by 10 per cent and those who 'disliked' it decreased by 7 per cent in the experimental classes, while, on the contrary, those who 'disliked' it increased by 12 per cent in the control classes. If we examine this difference by the chi-square test, we get the answer '.10 > P > .05'.

As for boys the control classes showed the higher interest in the subject in April. The difference is significant by the chi-square test (.10 > P > .05), while in July the result was contrary. The boys in the experimental classes had the intenser interest in the subject. The difference is significant (.01 > P). What is noticeable is, that the pupils who disliked science decreased by 6 per cent in the television classes, while they increased by 12 per cent in the non-television classes. As for girls, little difference was seen in their interest in the subject between two classes in April and in July, but those who disliked the subject decreased by 8 per cent in the experimental classes, while they increased by 5 per cent in the control ones. This tendency is the same as that seen in the case of boys.

The investigation mentioned above leads to the conclusion that the use of television is not so effective as to develop the interest of the pupils who have above-average achievements, but that it is helpful in encouraging the inferior pupils.

The effects of visual aids, such as television and movies, on pupils depends mainly on their ability to grasp the images on the screen and to understand the way of expression of these media. The degree of understanding is expected to increase the more opportunities pupils have of viewing television and movies. In order to establish the degree of ability attained by pupils during the continuous learning from the television programmes for one term, the television classes were compared with the non-television ones in respect of degree of comprehension of the visual materials. The instructional science movie 'G. Galileo' illustrating the laws of falling bodies in April, was used along with 'How airplanes fly' in July. Neither are directly connected with the contents of the television lessons. Both before and after the movies, no attempt was made to teach pupils how to grasp the subject-matter. Immediately after each showing student understanding was tested and the results between the two groups compared.

As the experimental procedure was not strictly controlled no final conclusions can be drawn but the facts are as follows. In April, in only one test item among the eight, were pupils in the experimental classes superior to the control classes, with the 0.05 level of statistical difference in respect of the percentage of the correct answers, while in July, though the item which showed the 0.05 level of difference was only one, they were superior in two other items with 0.10 level and 0.20 levels of difference respectively. It seems likely that the use of television is not only helpful to the study of science but helpful in developing ability to learn from visual materials.

Contrary to what was expected, this short experiment showed that the use of television may be more helpful in science teaching than is generally thought in the following ways:

1. The conception that television is not useful in a science achievement test is erroneous. In reality it is helpful to pupils in their studies.
2. Learning from television develops a high degree of retention.
3. The use of television is most effective in developing factual knowledge of the four aims of science teaching.
4. It is useful to the understanding of the relations and laws of natural phenomena and the development of critical thinking, at least to those pupils who lack a basic understanding and interest in the subject. In the case of superior pupils the new method is not more effective than traditional ones.
5. The use of television may be expected to develop the learning interest of pupils.
6. Television helps to stimulate pupils' voluntary study outside the classroom and increases their interest in learning.
7. Television is expected to be useful in future training and in developing the ability to learn from visual teaching materials.
Chapter 8

The Language Laboratory

Mabel A. Sculthorp

Language teachers persuaded of the importance of the aural-oral aspects of language and wishing to use the direct method as fully as possible have welcomed a succession of aids over the years: wall-pictures, sets of picture-postcards, filmstrips, ciné films, gramophone records, tape-recorders, radio and television. The use of these aids has undoubtedly enlivened language teaching. But always there remains the problem of providing the opportunity for students to acquire and practise the skill of speaking the foreign language. Although chorus-drills may be useful in a crude way, individual oral work is essential but difficult to carry out in classroom conditions. The performer may be self-conscious; his performance may be unhelpful to the others, who will probably be finding the proceedings tedious. When the tape-recorder was a novelty in the classroom there was a noticeable sharpening of interest, even among those awaiting a brief turn. The teacher realized that, now that he had for the first time the means of allowing students to record and hear themselves objectively, he could turn to excellent purpose in the language class the mid-twentieth century interest in gadgetry. His wish, now more than ever, was that conditions could allow each student a longer period of practice and also avoid the spells of inactivity which lead to loss of interest.

Then one heard of the language ‘laboratory’ and inquiries showed that the conception varied from the classroom where audio-visual apparatus is stored and used, the prep-room or library annexe where a small number of students can work privately with listening/recording equipment, to the specialist room where a professional installation provides for a greater number of people to work on aural-oral assignments simultaneously, either guided and controlled or individually. There is now widespread and urgent interest in this country in the provision of such facilities and much experimentation is likely over the next few years to find the most satisfactory conditions for achieving the best results. Meanwhile the pioneers are happy to have got started, while the more cautious are hoping to benefit later from the fruits of the others’ early experience.

At Ealing Technical College we have a language laboratory installed by the Educational Foundation for Visual Aids, where sixteen students can work. The student-booths are all provided with simply operated Ferrograph tape decks, with complete record/playback equipment, headphones and microphone. The sides of the individual booths are lined with sound-absorbent material and the front panel is of glass.

A control console enables the language-teacher to give instructions to the group or to individuals and to supervise all work being done in all the student-booths. This control console offers multiple possibilities: recordings can be made, up to sixteen copies of pre-recorded tapes can be produced simultaneously, pre-recorded tapes can be played and heard through an amplifier or over the students’ headphones, and recordings can be made silently on to all the student-tapes either before the group arrives in the laboratory or as part of the instruction during the session. Perhaps it should be emphasized, for the sake of language-teachers who have a complex when faced with mechanical and electronic equipment, that all these operations are easily mastered and that there is usually only one switch in play, and never more than two.

A visual unit is fitted in the laboratory—a filmstrip projector behind the booths and a screen in front where all students sitting working with the audio-equipment can see it. Filmstrips or slides can be projected, and frames are changed automatically from the control console.

In this country we have as yet no experience in the use of language laboratories. A few teachers have seen them in action elsewhere, and more have read about them, but our present efforts remain experimental. At Ealing Technical College we are proceeding on the basis that at this early stage, work done in the laboratory must be justified on two counts: it will aid the comprehension of the language or give oral practice in the language, and the exercises carried out there would not be as effectively done

elsewhere. So far the most satisfactory and cohesive work has been achieved by using a completely audio-visual course in French. In the September issue of *Visual Education* S. R. Ingram wrote about the T'avor Aids course suitable for use in schools. With adult students we are using the audio-visual course for adult beginners evolved at the Centre de Recherche et d'Étude pour la Diffusion du Français at Saint-Cloud.

The course, based on a carefully selected vocabulary of 1,500 words and an essentially functional grammar, presents in thirty-two lessons typically adult situations in conversation form. It offers the possibility of learning in some 250 hours of instruction the natural everyday speech used by the French themselves. Each lesson, consisting of filmstrips and tape-recordings, is in three parts: the first concentrates on introducing and using the relevant vocabulary, bringing in a limited number of new words; a second part presents a similar pictured situation with the known vocabulary but teaches and gives practice in grammatical structures and drills; finally, without visual illustration, there is another dialogue on the same theme and using the known elements, this time for specific phonetic practice. As there is no course-book and no writing is used in the early stages, this system depends on aural perception and oral practice, and the course is consequently much more effective if part of it can be given in the laboratory, where a whole group of students can speak without interruption to the concentration or work of each other.

Ample preparation for laboratory practice is always needed in the classroom first. The lesson is presented, comprehension is tested, gross errors are eliminated in the preliminary attempts at reproducing the French dialogue, and frequent repetition ensures that the dialogue is partially memorized. Laboratory practice should be introduced at the earliest stage. At the end of the very first hour's hard work, the absolute beginner—with a respectably accent already!—can introduce to you Monsieur Thibaud and his wife and can tell you that his friend, who lives in the Place d'Italie in Paris, is an engineer. He can answer the door, greet the visitor, invite him in and ask him to sit down, and can make introductions all round. He and his fellow-students are already capable of working usefully in the laboratory. This is a course that inspires great interest from the beginning, by its content and by its use of modern devices, and there is especial eagerness for the laboratory phase.

The student-machines have been pre-set: they are switched on to start recording when the teacher releases the holding switch. The filmstrip is in the projector, the tape is on the control console. The students are asked to sit down comfortably in front of their machines, to put on their headphones and to adjust them correctly. Now, from the console, the teacher can talk to the group over the intercommunication system, speaking into his microphone and being heard through the earphones. He instils confidence into any nervous students: they should do nothing but watch the screen and listen to the dialogue coming through their earphones—it will be the familiar material already dealt with in the classroom. When the holding switch is released, the master-machine and all the student-machines start, and the material on the master-tape is being heard by the students and at the same time is being recorded on to all the student-machines. This done, the visual material is used no more and the students are ready for individual oral work. Over the intercom. the teacher reminds them of the procedure: run the tape back to the starting point identified on the indicator switch to 'Record', flex the microphone close to the mouth, start the machine, listen to the master-recording, repeat the phrase in the silence, continue to the end of the exercise, stop the machine; finally, for the listening stage, run the tape back, switch to 'Playback', listen to the master-recording, listen critically to oneself and then, at will, run back, listen, record, playback, with perfection as one's aim. (Verbal description of the mechanical processes of using the machine is cumbersome, whereas manipulation of the few controls quickly becomes automatic.)

The master-recording on the student-machines can never be interfered with by the students working—it will remain there untouched until a fresh recording from the master console erases it: the master-tape, consisting of recorded phrase-units interspersed by silent intervals, is simultaneously reproduced on bottom and top tracks of the students' two-track tapes, whereas the student-machines record the students on the top track only.

\[ M = \text{Master-recording.} \quad S = \text{Student-recording} \]

While the students now work at their own pace, the teacher monitors systematically. Switches numbered to correspond with the appropriate booths allow him to listen in without interference to the work being done by each student. As he wishes to correct or communicate with any student, the same switch is used to stop the student's machine, whereupon a two-way conversation can be conducted. As the switch is released, the student's machine is restarted. If a student needs help, he can press a button, when a buzz and a red light under his numbered switch will soon attract the teacher's attention. During the practice period, all the students are purposefully busy the whole time. The illusion of privacy encourages an unself-conscious attitude and focuses attention, and many students prove capable of a high degree of self-correction.
As a good audio-visual language course seems to offer a better opportunity than any other classroom system to students wishing to understand and speak a foreign language in as short a time as possible, it is to be hoped that more such courses will become available. Tavor Aids have now produced a course in English as a Foreign Language, and the Saint-Cloud team are also working on our language. One hears of research for similar courses in other languages being carried out in America, Russia, and Yugoslavia. Meanwhile, the teachers of all languages other than French at Ealing Technical College are being asked to devise their own methods for using the language laboratory as a normal part of their classes. Some commercially-produced tape-recordings following existing textbooks have been examined, but have not proved helpful for laboratory use. Several experimental tapes have already been made by our language staff. Some give practice in phonetics and conversational intonations, others train in reading, deal with question-answer techniques, or set substitution exercises. Trials are being made to find whether the language laboratory can be used to help a group of scientists learning Russian primarily for purposes of consulting Russian scientific papers and journals. It is thought that the hearing and vocalization of texts being used at the beginning of such a course may lead to the speedier reading of the Cyrillic script, and that the ear may prove a help to the eye and to the memory later in the comprehension of the language. Lecturer-prepared tapes, in the hands of those scientists eager to save time in acquiring the language, could cut down much class-time. If it could be arranged for students to cover preliminaries before the class-meeting, valuable time at present taken up by the teachers' explanation and by the students' consideration and absorption of it could then be more actively used. It can be seen that our language teachers are here faced with a severe challenge to show imagination; a competence quite other than that ever before asked for, and the willingness to devote many more hours of their own time to the new teaching techniques.

Individual use of the laboratory is envisaged and can be of the greatest benefit to adult students with special needs. Suitable recordings can make up for classes missed, revise previous lessons, offer additional practice, or prepare for coming work. To a certain degree, therefore, the student-equipment could be regarded as a teaching-machine, with a function similar to that which the library of books fulfils for readers. The organization of a tape-library is therefore necessary, with provision made for the control of the storage, issue and return of the tapes.

The language laboratory must be expected to be in use for several hours of the day and evening in a large establishment, so that it is essential for all equipment to be very sturdy and to stand up reliably to hard wear. The language teachers, under a laboratory director, are responsible for policy and practice and the more they develop their own skill with the new media the greater the benefit to their own students can be. But they reasonably expect technical assistance, and a laboratory steward is necessary in any big installation. In our own laboratory we have two spare student-machines that can rapidly replace equipment that has developed faults. The minor troubles that have not unexpectedly shown themselves in these first months have been dealt with on the spot, and one should not feel apprehensive about the equipment available in this country—equipment that has won praise from generous competitors.

The availability of new equipment gives a most welcome fillip to teaching and often allows teachers to put over their methods more effectively. I believe that the provision of language laboratories, with the adaptations considered necessary for different types of teaching establishments, will soon be acknowledged to be as essential to the teaching of the spoken aspects of language as the laboratories for the teaching of science. It is hoped that linguistic research and the professional production of good material will be timed to meet the imminent requirements of eager teachers, employers, and those many learners faced with new modern needs for person-to-person communication in foreign languages.
INTRODUCTION

Human aspirations and ideals are intimately related to human emotions. The emotional attitudes of approval and disapproval in a given culture are usually expressed through certain words. It is often difficult to disentangle the attitudes expressed by those words from their descriptive meaning. Since the Industrial Revolution a continuing complaint has been heard that the use of machines has led to the debasement and the materialism of our civilization. The word 'machine' has thereby acquired a heavy emotional burden. The same burden is now rapidly piling up on words such as 'automation'. Thus the phrase 'automation of education with teaching machines' represents such a summation of horrors for some people that it blocks intelligent inquiry into the merits of teaching machines.

I believe this accounts for the paradox that some reporters, editors, radio and television commentators, whose very jobs were created by such developments, utilize the most modern automated machinery to disseminate their uncritical emotional reactions against machines. Fortunately, the mechanization of the media of communication has not mechanized the minds of all those who have something to communicate. No more will the mechanization of the method of presenting instructional materials mechanize the materials to be presented. In the end, the widespread use of teaching machines will not depend on emotional reactions to a word but on the machines' value in helping us to cope with urgent educational problems.

A teaching machine is simply a mechanical device for presenting to a student a succession of instructional items requiring some discriminative response and providing the student with an immediate check on the accuracy of his response. Mechanical tutors of this kind can free human tutors for other teaching tasks wherever instructional materials can be satisfactorily programmed for this method of presentation. This has obvious implications for any country either unable or unwilling to reward its teachers well enough to recruit them in adequate numbers. On this score alone, the potentialities of the teaching machine are worth examining and exploiting as rapidly as possible if they prove their value.

There is another less obvious but no less important advantage to be gained in exploiting the teaching machine. The machine makes it possible to provide some of the conditions that we have long known to be necessary for efficient learning. A savage instructing his son in the use of the bow and arrow knew that the son needed plenty of practice and that he had to see where the arrow went on each shot if he was to make any improvement on the next. The importance of this immediate feedback was formulated years ago by Thorndike as the 'law of effect'. According to this law of learning, an action which leads to a satisfactory result tends to be repeated. In the contemporary terminology of B. F. Skinner, of Harvard University, immediate reinforcement or reward is important in the learning process. As far as the application of this principle is concerned, we do a much better job of teaching rats, pigeons and football players than we do of teaching mathematicians and physicists. Teaching machines designed for individual use make it possible to provide this immediate reinforcement for every student.

Any improvement in the control of conditions providing more efficient learning should have important consequences. It may be possible for a given instructional unit to be learned more thoroughly and easily in less time. To state the same point in another way, a student should be able to learn more material more easily and more thoroughly in a given unit of time. The further development and rapid exploitation of the teaching machine is one of the most promising approaches to the problems of teaching the increasingly complicated body of modern knowledge to ever larger masses of people. The teaching machine offers hope that this may be done without abandoning our democratic ideals of

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education and lowering our ambitions to the education of an intellectual élite.

TEACHING RATS AND HUMANS

Full exploitation of the potentialities of the teaching machine will require a great amount of work by many people. The number of research projects related to the teaching machine is rapidly increasing. The kind of research project most likely to produce quantifiable and convincing results is one relatively small in scope and concerned with a limited number of controllable variables. Much more of this is needed. But not all of the important questions can be stated in terms suitable for a tidy laboratory research project. If we look only for problems which can be so formulated, certain of the most important issues may be ignored. Furthermore, some attempts to use the teaching machine in regular courses will be helpful in determining some of the research problems likely to prove most valuable.

Laboratory experiments have demonstrated that the use of immediate reinforcement techniques is a very efficient way of training animals to make a discriminative response to selected stimuli. Rats and pigeons can be trained to perform a whole series of such responses in sequence. Their actions then form a complicated ‘chain’ of events.

In certain areas in human learning a drill technique has traditionally been employed. The mechanical presentation of the questions and answers has an obvious application wherever it is felt appropriate to use drill methods, but it is not so obvious that it has any wider application.

Psychologists do not offer a curriculum of courses in maze running and bar pressing, but this is the best of my knowledge, no science of maze running to be taught. The order of right and left turns in a maze is arbitrary for each maze. The only reason a rat should turn to the right rather than the left at a certain point is that it is that turn which leads to reinforcement. No better reason can be learned because there is none.

Students sometimes pass courses in logic and mathematics in the same way. They learn to write down certain words or numbers in answer to questions because those are the answers which produce reinforcement in the form of passing grades. Frequently they cannot imagine why the teachers prefer these answers to other equally attractive answers, but they hope to keep the teacher happy by giving the answers they have learned he wants.

A student who gives a particular answer merely because that is the one the teacher reinforces has not learned a subject such as mathematics or logic. I make no claim that knowing mathematics and logic requires some special reasoning faculty or involves some mysterious insight into a special world of numbers and logical entities. But the reason for saying ‘valid’, for example, must be more than the fact that saying ‘valid’ caused the teacher to produce a reward. Reinforcing a response is part of the cause for the student’s learning. But if the student has learned only that the response causes reinforcement, he has not learned logic or mathematics. The answers the teacher will reinforce are not selected by arbitrary decision or whim. They are the right answers, in the sense that they are required by the rules of the relevant system. To learn mathematics and logic, the student must learn to produce answers because they are the right answers. A familiar difficulty for the teacher is to discriminate right answers given for the right reason from right answers reached by guesswork. Only the former should be reinforced.

Mathematics and logic are two of the most highly organized and integrated subjects that confront students. Both require much more than rote memory. Thus logic constitutes a good test for determining the usefulness of teaching machines in developing complex high-level intellectual skills.

Last year, with the help of a grant from the Fund for the Advancement of Education, John Jacobson and the writer started an experiment in teaching logic at Hamilton College. Our experience has convinced us that the most effective teaching aid now available is a programme of questions and answers designed for a teaching machine and that the most efficient method of presenting such a programme is in a machine using microfilm and designed for individual use.

The use of the programmed materials we developed gave us a new experience in teaching. We found many advantages and no disadvantages. Among the advantages we noticed the following:

1. We wasted no class time on routine checking or on drill.
2. We wasted no class time on unprepared students. We knew in advance exactly who had done the work on the programmes and who had not. We believe that evidence of work on programmed material should become a ticket of admission to class.
3. Examination of student work on the programmes enabled us to prepare for a class period with prior knowledge of the points that needed further clarification.
4. In the classroom work we could presuppose a common background of experience with a large number of relevant examples encountered in the programmes.
5. We wasted no time trying to locate and correct misconceptions students had acquired through unchecked practice.
6. We could usually count on a working command of basic concepts and principles. Class time could therefore be devoted to further development of the concepts and their application to new areas.
7. Classroom efficiency was increased by at least one-third. Instead of a standard three hours a week we met two hours a week. Yet we were able to cover more material more thoroughly than ever before.

8. Individual differences were not entirely removed, but the range was greatly reduced, with every student moving closer to mastery. I had at least three students in a section of twenty who, in my judgement, would have failed the course in the preceding year. They passed with a very safe margin.

9. Fewer private conferences with individual students were needed. In the conferences that were necessary it was possible to diagnose the difficulty very quickly by analysing the student's answers to the programmed materials. More often than not, such conferences led to revisions in the programme in the hope of avoiding such troubles for other students.

10. The programmes constitute an excellent diagnostic instrument in locating individual and class differences; an analysis of student answers provides an equally good diagnostic instrument in locating shortcomings in a programme. After testing and revising programmes a certain number of times, we should have programmes which we know from experience will enable the vast majority of students to master complex materials in a minimum time.

11. There was a great increase in interest and improvement in morale.

12. One student taught himself the first semester's work with little help from us.

13. During the summer of 1959 some of the materials prepared for Hamilton College students were used in a programme of advanced studies for gifted junior and senior high school students presented by the Board of Cooperative Services in Oneida County, New York, in another project aided by the Fund for the Advancement of Education. Examination results compared favourably with those of college students.

PROGRAMME REQUIREMENTS

Probably every teacher has at some time been baffled because a student could not see a point that was perfectly obvious to the teacher. When this happens, a good teacher knows that it is necessary to back up and to lead the student step by step until he can see the point for himself. In its simplest terms this procedure indicates what is required for a good programme. Two traditional techniques are combined in modified form: the Socratic method of teaching by asking questions and the Cartesian method of analysing a problem into its smallest parts and proceeding from the simple to the complex.

However, the kind of analysis needed goes beyond the Cartesian analysis of a problem into its smallest logical parts, which is necessary but not sufficient. In symbolic logic one can find some of the tidiest, neatest systems ever developed. In presenting a system, we may start with the simplest elements, a few rules of operation, a few axioms and postulates, and then deduce everything in rigorous order. Yet a course in symbolic logic taught in this tidy fashion is probably one of the most baffling courses many students will ever encounter.

There are indeed some situations in which it may be best to start with relatively simple elements and then put them together to form more complex units. For example, in propositional logic we may start with a simple statement such as 'the window is open'. We may then construct larger units by connecting two simple statements with words like 'and', 'or', and 'if... then'. It may then be shown that the truth of the larger unit depends on, or is a function of, the truth of its parts.

But if all problems were treated in this manner, disaster would result. Suppose we try to teach the parts of an argument in this fashion. We present the statement 'the door is open' as an example of a conclusion. Then we present 'the window is not open' as a premise. Next, we present 'the door is open, or the window is open' as a premise. This would probably confuse the student at first, but with practice he could learn, to call it a premise. Finally, we are ready to put these elements together to form a complex unit called an argument. We then have:

The door is open, or the window is open.
Hence the door is open.
The window is not open.
Hence the door is open.

If he has mastered the preceding steps, the student will confidently identify 'the door is open' as the conclusion. We must now baffle him by saying that in some cases 'the door is open' is a premise rather than a conclusion.

The trouble here, of course, lies in the fact that statements constituting parts of an argument are not classifiable out of context. The same statement may be a conclusion in one argument and a premise in another. Furthermore, there is no single clue which can be used as a reliable guide even in context. The conclusion is sometimes stated first, sometimes in the middle, and sometimes at the end of an argument. It is sometimes in the middle, and sometimes at the end of an argument. It is sometimes identified by the words 'therefore', 'hence', or 'thus'. Sometimes it is not.

In this illustration we simply cannot start with isolated simple parts. We must start with a whole argument and train the student to recognize the parts as they appear in context. To do this we can start with some examples in which the required discriminations are easily made. Initially the discrimination may be made quite obvious by some device such as underlining or otherwise setting off one part and asking questions requiring direct attention to that part. Further examples lead through major variations.
Extra clues are reduced, and the cases gradually become less obvious. After a student has worked through a programme of such carefully selected and graduated examples, his perceptual habits are modified. He no longer sees merely a set of statements. He begins to see premises and conclusions as related parts of a larger complex unit.

This illustration points up one of the most important advantages of a teaching machine. In the textbook an author is necessarily restricted to the use of a very few examples to explain a point. Unfortunately, every example exhibits many different characteristics, and it is not always easy for the student to distinguish the relevant from the irrelevant features of the illustrations. The easiest way to learn to make the necessary discriminations is to examine a wide variety of examples. In a very short time a well-organized sequence of items on a teaching machine can provide the experience needed for the learner to identify the relevant characteristics for himself. Furthermore, in such a sequence of questions it is possible to start with examples familiar to every student and to lead him step by step to develop general principles and surprisingly complicated formulae for himself. Since he has derived the general principles from his own experience with specific cases, there is no problem of sheer verbalism or the mechanical manipulation of meaningless symbols.

In working on textbook exercises, a student who has trouble with one problem is frequently tempted to skip on to the next. More often than not, this leads to increasing difficulties. The teaching machine presents the items in a controlled sequence of graduated steps. The student always has the information needed for the next step. If a particular sequence of questions does not, in fact, develop the intended understanding, then it should be revised until it does.

I am not suggesting that the use of textbooks and classrooms is obsolete. However, it is important to note that the questions in a good programme are not drill questions based on prior textbook readings or lecture notes. The subject-matter is learned through answering the questions. The numerous examples encountered in the programmed material provide the background experience necessary for ready comprehension of a text or a lecture, for intelligent participation in discussions, and for the application of what has been learned to new areas.

The considerations mentioned above suggest the following requirements for a programme of questions prepared for machine presentation. The programme must start with something familiar to the student. With machines using microfilm, it is possible to provide some of the necessary background experience through such means as pictures, charts, diagrams and maps. There must be examples of sufficient variety if the essential features are to be distinguished from irrelevant details. The questions must be graduated in difficulty so that the student may take each new step for himself.

There is much discussion over other features of a programme. Some urge the use of multiple-choice questions. Others recommend questions requiring a student to construct an answer. For certain purposes multiple-choice questions may be quite satisfactory. On his first trip through a maze, a rat must make a guess at each fork in the path. There is no better way to select a path, for the connexion is completely arbitrary. In human learning there are also many arbitrary connexions to be learned. It is possible that multiple-choice questions are satisfactory in such contexts.

However, not only mathematics but all subjects taught in school have some structure imposed by the subject rather than by the whim of a teacher. Where structure is important, the guessing encouraged by multiple-choice questions is surely the wrong way to arrive at a right answer. For this reason we have been using constructed answers almost exclusively in our logic programme. The wording of the questions and the context set by the sequence of questions are usually adequate to indicate the type of answer required. Occasionally this is not so. Then the quickest way to set the context is to indicate the relevant alternatives.

Some machines are designed to re-run a set of questions a second time—presenting only those questions missed on the first run. This process is continued until all questions have been answered correctly. Again, this method may be efficient where the connexion between the question and answer is wholly arbitrary and must be mastered by drill.

However, there are two reasons for not following this routine in programmes for structured subject matter. In the first place, the context is very important in a carefully graduated sequence of questions. If a student misses Question 16 because he did not get the point of the fifteen questions leading up to it, he can only be more baffled by getting the same question repeated out of context. He needs to go through all the steps again or, better yet, through an alternative sequence using a different approach. In the second place, in such subjects as logic and mathematics nothing is of less importance than memorizing that 'valid' or 'invalid' are the answers to certain specific questions. What is important is to learn that 'valid' is the correct answer under certain conditions. A mistake on Question 16 is of no consequence if the student profits from it and successfully handles subsequent problems similar to that of Question 16.

Programming techniques may vary in other ways as well. One variation is illustrated in the scrambled textbook. This technique requires multiple-choice questions. Each alternative directs the student to turn to a certain page to see whether or not his
answer is correct. On the pages for the wrong answers he may find explanations of his error, further clues to the right answer, and perhaps a little scolding. The page for the right answer will contain congratulations and directions to the next question.

This technique is intriguing in some respects, but it is prodigal in the use of time and materials. For example, a sequence of forty questions with only two alternative answers per question would require forty extra pages in a text or frames in a film to carry the wrong answers. This appears insignificant in connexion with an isolated experimental set of questions. However, its economic importance becomes clear when one must think in terms of a possible 10,000 questions for one course and thousands of copies of a programme prepared for widespread use. To justify the large extra material costs, the advocates of this technique must demonstrate a very marked superiority over a straightforward programme. Furthermore, the advantages gained by explaining the reason for an error may be obtained by presenting it along with the correct answer. This is indeed helpful in situations where common-sense misconceptions lead most students to the same wrong answer.

Another proposed technique involves a complicated internal structure for the programme with corresponding complications in the machinery. The questions presented to the student are in part contingent on his prior responses. Suppose, for example, that a set of ten questions is inserted in a programme to check a student's mastery of a certain principle. If he runs into any trouble, presumably he needs more work on the same principle. A computer with a complex memory circuit and indexing circuit can be programmed to present further examples of the same principle. However, if the student runs through the key set of questions with no difficulty, it is presumed that he has mastered that unit. The computer may then offer the student a choice among several branches in the programme. One branch may lead to the next unit. Other branches may involve an extension of the concepts just mastered or various applications of those concepts.

In dealing with the problem of individual differences, this branching technique has certain obvious advantages. Again, any widespread use of machinery for automatic branching is economically unfeasible. However, the advantages of this technique may well be obtained in another way. Practical considerations suggest packaging a programme in relatively small lesson units. A quick check of the results on one such unit may be used to indicate which lesson is to be offered next.

After having considered the practical requirements for widespread use of this, the characteristics indicated by the psychology of learning, and the structure of materials to be learned, we would suggest the following general system:

1. Programmes should be packaged in relatively small units.
2. Cost of duplication is important. Film is easily reproduced at low cost.
3. The packages must be easy to store and to use without being damaged. This may be done by inserting strips of film between plastic sheets.
4. Machines must be easy to operate.
5. A group of machines may be arranged in a room with a check-out desk. A student arrives at his scheduled time, picks up the appropriate lesson, inserts it in the machine, and goes through the lesson. He then returns the lesson to the desk.
6. At the same time that the student picks up his lesson, he obtains and signs a score card, which is inserted in the machine for automatic scoring. This score card has several functions: (a) it gives the student information about his work on that lesson; (b) the teacher will find it helpful in diagnosing individual difficulties; (c) a glance at the cards for the whole class will locate difficulties requiring classroom attention; (d) records easily derived from these cards will be very useful in evaluating and revising sets of questions.
7. All programmes to be used in the visual machine would be packaged in a standardized manner. The same machine would therefore be suitable for any subject.
8. An audio unit may be plugged in for automatic co-ordination of visual and auditory instruction. This will permit the construction of programmes using any combination of visual or auditory questions requiring either written or oral replies. This has obvious advantages for instruction in language or music.

Implications for our educational system

It cannot yet be said that the effectiveness of the teaching machine has been fully demonstrated. However, if it turns out to be as valuable as early evidence indicates, there are many possible consequences for our educational system. Suggesting a few of these will serve to emphasize the importance of further investigations.

Even a modest increase in efficiency of the learning process has very significant cumulative effects. For example, if we express a 12.5 per cent gain in terms of time, the average student would master in fourteen years what he now learns in sixteen years.

Any gain on the time dimension will be accompanied by a gain in mastery. By present standards it is a gentlemanly achievement to do approximately 70 per cent of the work in a course satisfactorily. A grade of 60 in one course is usually considered adequate evidence of preparedness for the next course. Difficulties for student and teacher are cumulative when the 30 to 40 per cent of unlearned...
material is needed for work at the next level. Satisfactory programmes presented by the machine should permit every student to master the essential elements at one level before proceeding to the next.

Correlative with a gain in mastery is a decrease in failure. Instead of eliminating scholastic failure by automatic promotion, we may be able to eliminate it by nearly automatic achievement. Furthermore, students who discover the pleasure of success in school are unlikely to feel compelled to develop skill in throwing rocks through school windows.

It should be possible to develop programmes for teaching machines which would produce a genuine mastery of basic skills at a very early age. It is by no means inconceivable, for instance, that high-level mathematical skills should become commonplace rather than the result of specialized training for a few.

The individual teacher should welcome this form of teaching aid. He can cover more ground more effectively in fewer hours spent in the classroom and conference room. Furthermore, the time he does spend with students individually or in groups may be used much more effectively. He knows just what can be assumed as a basis for further work.

An increase in general efficiency has a double significance for both private and public institutions. The reduction of class contact hours for a course from three hours to two hours a week represents a saving of teacher time and a saving of classroom space. Both factors are becoming more and more important as the school population and the costs of education simultaneously increase.

Inasmuch as the teaching machines discussed here are designed for individual use, they do not need to be installed in large rooms or even in school buildings. It might even turn out in the long run to be more economical to place a teaching machine in every home than to double the size of school buildings.

Finally, some possible consequences for human values should be mentioned. It should be kept in mind that the teaching machine is merely an instrument for presenting instructional materials. In effect, it provides superior private tutoring for every individual. The tutoring will be superior because programmes in teaching machines may develop more alertness and spontaneity than the average classroom situation.

Our democratic goals of education are frequently criticized for bringing about a levelling down of standards and achievement. Problems created by increasing numbers have led some persons to abandon the democratic goals and to concentrate on training an intellectual élite. The large-scale use of tested programmes in teaching machines may make it possible to cope with the growing problems and, at the same time, raise our standards and actual achievements nearer the point of mastery.

Recently I heard a woman complain that her son had been assigned to a teacher no one liked, and she was afraid her son would not work well for this teacher. This is a phase frequently forgotten in praising the inspirational qualities of a good teacher. Good programmes presented by machines will surely not hamper an inspiring teacher; but they should diminish the number of such comments as, 'I would have been able to learn physics if I had only had a good teacher when I started mathematics'.

Finally, it is worth noting that a programme presented by a machine has a dual kind of objectivity. In the first place, every student answer is either right or wrong, or in some respect either satisfactory or unsatisfactory. This is not at all the same thing as a true-false test in which the student must respond with the words 'true' or 'false'. If a student is asked to identify the author of a sonnet, the answer is either right or wrong. In order to progress, the learner must know whether his performance is correct or incorrect. A sequence of questions and answers which provides such knowledge at each step guarantees objectivity.

In a good programme of questions and answers the student should have little difficulty constructing the correct answers. The difficulty lies in the construction of the questions and organizing them in sequence. The teacher must learn to ask questions which elicit answers that both teacher and student can easily recognize as correct or incorrect. If a teacher cannot ask any questions requiring the student to make some discrimination that is clearly right or wrong, it is doubtful whether that teacher is teaching anything but shifting whims.

Programmes presented by machines offer another kind of objectivity. Failing students frequently rationalize their difficulties by charging that the teacher doesn’t like them. A machine develops no likes and dislikes. It has equal patience for the slow
and the quick. It does not discriminate between rich and poor. It makes no distinctions with regard to race, colour, or creed. We do not yet know what part of our educational programme should be presented in this manner. But it is clear that thoroughly tested programmes will make it possible to come closer to realizing the democratic ideal of equal educational opportunity for all.
We should like to draw the attention of our readers to the Unesco Coupon Scheme, which may enable them to purchase materials listed in this periodical. Because it is often difficult to send money from country to country for the purchase of books, films, laboratory equipment, etc., Unesco has created a sort of international currency, the UNESCO COUPON. These coupons enable schools, universities, teachers and students in many parts of the world to buy freely the materials which they need for study and research.

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