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ABSTRACT

Although educational radio has been part of the American scene for nearly half a century, it does not enjoy the governmental participation and national commitment that it receives in many other countries. The position of educational radio did improve with the advent of Frequency Modulation (FM) broadcasting, and today there are more than 450 educational radio stations. Radio offers education an ear to the world, timely information, emotional impact, and a sense of involvement. It is currently used for curriculum innovation, in-service teacher training, continuing professional education, community service, and vocational education. A systems approach to education has combined radio with other media: printed materials, filmstrips, television, and tape recordings. Other cooperative media approaches have been made possible by FM multiplex equipment. Experimental studies have indicated that radio is as effective in teaching as the "conventional methods," and that its lack of visual elements is not necessarily a drawback. While radio, like all mass media, lacks the reciprocity and flexibility found in interpersonal discourse, some of these difficulties have been alleviated by recent technical developments. Apathy and financing are still problems. Yet, in comparison with other media, radio is impressively economical. (MF)

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INSTRUCTIONAL RADIO: A POSITION PAPER

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INTRODUCTION

It is the purpose of this paper to describe the nature, scope, and functions of radio as they relate to instructional applications. This, quite obviously, is a formidable task. The history of radio encompasses a fifty-year technological revolution that defies comprehension. In turn, this technology must be examined as it relates to the practices of a tradition-bound educational system and a science of learning that has not yet discovered the "wheel." The resulting dichotomy has helped to create qualitative discrepancies between hardware and software which make it difficult to explain the promise of one through the accomplishments of the other.

For the purposes of this paper, instructional radio can be defined as the use of radio transmission in any systematic process of education to extend the competence and intellect of the audience. Programming in this category is, for all practical purposes, restricted to stations operated by non-profit educational institutions. It should be noted that this definition excludes the commercial programming which constitutes an overwhelming majority of the radio industry. In a way this is unfortunate because the commercial area of broadcasting represents such a demonstrably potent social force that some even say the mass media themselves have become the "message" and that program content is insignificant in comparison with its mode of transmission (McLuhan). While this represents an extreme position in some respects, there is little doubt that the broadcast media have profoundly shaped our culture, even though their instructional efforts have for the most part been both unintentional and extracurricular.

EDUCATIONAL RADIO: THE BEGINNINGS

Educational radio has been part of the American scene for nearly half a century. For the most part, its history is a study in frustration. In the early 1920s, many universities engaged in radio broadcasting, but their efforts were usually an outgrowth of electronic experimentation and bore little relationship to a public service. During the years preceding 1936, there were 202 radio stations licensed to educational institutions; unfortunately, 164 of these licenses were allowed to expire, were transferred, or were revoked. The expansion of commercial broadcasting during this time rapidly filled the radio channels vacated by educational institutions, and today only twenty-five educational AM stations remain. If FM broadcasting had not been developed and if the Federal Communications Commission had not reserved part of that spectrum for education, instructional radio probably would not exist in the United States.

Other factors which retarded the early development of instructional radio were the apathy of educators and the inconstancy of financing provided by legislatures and school boards. The schools of today are often criticized for slowness in adapting to change, but they seem radical in comparison to the prevailing climate of radio's early years. Education's failure to involve itself with radio during this period is reflected in the fact that most broadcasts used in classrooms before World War II were produced by commercial organizations, rather than educational institutions.

Surprisingly, instructional radio has survived and, in several cases, has even flourished. In the course of its development the medium has been used successfully to teach subjects ranging from mechanical drawing and mathematics to dental hygiene and music appreciation. It has been successful in providing direct instruction and in supplementing or enriching curricula. It has served to motivate student learning and it has been used successfully for direct instruction, both in school and out, and with people of all ages and backgrounds.

EDUCATIONAL RADIO TODAY

In spite of early difficulties, it would seem that radio is more widely used for instruction today than in the pre-television era. Although the scattered nature of educational radio's development makes it impossible to accurately gauge its audiences, some indication of use can be seen in studies which show radios among the most common audiovisual devices found in schools (Forsythe, 1966). A further clue is provided by the general growth of educational broadcasting which is reflected in the following table showing the growth of school-owned FM stations (*Hidden Medium*). Significantly, two-thirds of these stations have gone on the air since 1960.

1938– 1	1950– 73
1939– 2	1954–122
1940– 4	1958–151
1941– 7	1962–209
1946–10	1966–292
1947–17	1970–457 (July)

Most educational FM stations are in the frequencies between 88.1 and 91.9 megacycles, the band reserved for their use, and approximately one third of the total are low-power stations with a broadcast radius of two to five miles. Educational radio stations are most commonly licensed to colleges and universities (75 per cent) and to public schools (20 per cent), with the rest divided among educational organizations, libraries and municipalities. As might be expected with such variety, the stations serve many functions. In the broadest sense of the term, all 457 stations broadcast instructional programs; however, if broadcasting directly to classrooms provides the criterion, only 10 to 15 per cent of the stations could then be described as primarily instructional. In data compiled for *The Hidden Medium*, it was found that

> The colleges and higher educational authorities use their stations for cultural enrichment, student training, and in a few cases, for student teaching. In addition, they tend to see their stations as having a public relations purpose. The school districts focus upon direct teaching and supplementary instruction. The non-profit institutions and public libraries are primarily concerned with adult education, particularly cultural enrichment, and the theological groups generally favor informal adult education, with a few accentuating religious education.

Networks

The most common network arrangement in educational broadcasting involves the exchange of tape-recorded programs. One such network, the National Educational Radio Network (NERN), has played a vital role in the development of instructional radio in the United States. A project of the National Association of Educational Broadcasters, this tape network regularly selects and distributes outstanding instructional radio series produced by member stations. Since over half of the "instructional" radio stations in the country operate with budgets of less than $20,000 a year they are forced to rely on NERN for much of their programming. Many large university stations also operate localized tape networks which distribute selected programs within their primary service area. While some (e.g., Purdue and Minnesota) include instructional materials, the majority offer general cultural or informational programs.

In addition to the distribution and exchange of recorded programs, there are some live interconnected networks in educational radio. Wisconsin, through its state university and Station WHA, operates a network of eleven stations which covers the entire state. Other such networks include the Eastern Educational Radio Network, a regional grouping of eight stations in four states and the District of Columbia, and the special two-way networks for professional education which exist in several states. National Public Radio, a new organization funded by the Corporation for Public Broadcasting, is presently engaged in establishing a national interconnected radio network of member stations, and various forms of state networks are currently under study in seventeen states.

Technological Developments

It is impossible to discuss the instructional applications of radio without considering recent technological advances which have already revolutionized the field. The most important of these is multiplexing, which permits one or more additional signals to be carried in the side bands of a main channel transmission. The best known uses of multiplexing have been for stereo broadcasting and for commercial music operations, but it is now developing also as a private point-to-point communications system in education. Since a multiplex signal can only be received on a special radio, it is well suited to the newer professional education networks which have been developed for groups of practicing professionals whose duties make it difficult for them otherwise to continue their education.

The first and largest of these networks is operated by the Albany Medical College, through Station WAMC. Receivers and transmitters are installed in participating hospitals where doctors then assemble to hear presentations by the Albany medical faculty. Slides, charts, and X-rays are also made available to the listening groups. Doctors in attendance may ask questions by means of transmitters at their reception points and these questions are heard throughout the network. The WAMC operation, described as the largest postgraduate classroom in the world, presently includes 60 hospitals in seven Northeastern states. Other such medical networks are found also in North Carolina, California, Utah, and Ohio, with other states still planning similar activities. The technique is rapidly being expanded to other professional areas. Ohio State University and WOSU are engaged in continuing teacher education using a somewhat similar system. Station WHA is using its multiplex system for continuing education in medicine, law, and veterinary science. To date, only fifteen educational stations have multiplex equipment, but others are proceeding to develop professional educational programs using open broadcasts and telephone "talk-back" arrangements.

Other related technological developments now used in conjunction with radio include the electrowriter, various types of speaker-phone arrangements, and slow-scan (still picture) television. Experimental work is also underway which may eventually permit radio stations to utilize computer-telephone systems to gather immediate audience feedback or response.

Instructional Radio in Other Countries

Broadcast systems in other countries can generally be differentiated from those of the United States on the basis of the extent and nature of government involvement. Although government involvement does not necessarily mean government control of broadcasting, it usually does mean a distinct system of financing and the indirect involvement of government in production. These conditions have frequently resulted in greater national commitments to educational uses of the medium. Radio Sweden, for instance, currently broadcasts more than 166 hours of instruction a year to over 12,000 participating schools. School radio publications number approximately two million copies a year in a nation of only eight million people (Loney). South Korea has recently instituted a national instructional radio service over KBS and provides programming for elementary schools. Its programs emphasize music, social studies, and anti-communist education. Their Ministry of Education considers the school radio service to be very important in raising educational standards and it has instructed all schools to make maximum use of the broadcasts (Hulsen). Radio is also being used extensively for instruction in Japan and India. In England, 79 percent of the 38,000 schools have and use radios (Wynne). Canada also produces many classroom programs.

Radio is also becoming an instructional force in Africa. In Cameroon, radio is used experimentally to combat illiteracy and with good results (Browne). Several African countries have conducted anti-malaria campaigns through radio. Radio Omdurman in Sudan carries instructional programs for the general populace and partially compensates for the country's lack of schools. Broadcasts include instruction in Arabic, in tribal history, and in social manners (Phillips). Radio is the primary form of national communication in Nigeria and further plans are developing to have it provide a major instructional service (Arms).

Most countries use radio for some instructional purposes and many are more actively involved with the medium at the national level than is the United States. Many "emerging" nations turn to radio both because it offers the most economical means for distributing instructional materials and because it provides an effective means of communicating with a generally illiterate population.

THE INSTRUCTIONAL DIMENSIONS OF RADIO

Various analysts have explored radio's potential for instruction and have cited qualities inherent in the medium which make it educationally valuable; they have also listed specific instructional tasks which radio can perform (Dale) (Levenson and Stasheff). These qualities and functions are presented here along with programming illustrations selected from current information provided the author by educational radio stations. In essence, this review is an attempt to summarize the theoretical constructs of instructional radio in a manner that will also provide some insight into its present state of development.

A Broadcast Medium

Radio is a broadcast medium which literally provides listeners an ear upon the world. In addition to broadcasting events as they occur, radio also has the advantage of being able to present educational programs that incorporate timely material. Many educational stations provide specially written newscasts for use in current events classes. Station WFBE, Flint, Michigan, produces a dramatized weekly news summary which is used in conjunction with special news maps that are distributed to the classrooms. Station WBAA, Purdue University, produces *News in Review* for the intermediate grades and distributes the series throughout Indiana on its tape network.

Radio's ability to provide timely instructional material is an advantage reflected in the growing quantity of programming for the disadvantaged. KBPS in Portland, Oregon, has received Federal funding for a special instructional radio project aimed at the culturally deprived. The station has been enabled to produce four series for children, including (1) a newscast for slow learners, (2) broadcasts of creative students' work, (3) dramatized biographies of Negroes and whites who have succeeded in spite of difficulties, and (4) a call-in series for the junior high school which discusses student problems. WFBE is producing a creative writing-participation series for the Flint inner city schools. KDPS, Des Moines, has produced *Mr. Achiever* for use in the inner city intermediate grades. Station KSLH in St. Louis and Station WBGO in Newark have both produced series in conjunction with Operation Headstart.

The speed with which radio can respond to instructional problems is further mirrored in Station WHA's special week-long broadcast from the ghettos of Milwaukee which led to the passage of an open housing ordinance, and Station WAUP's special instructional programs concerned with the military draft and with venereal disease. Other series, such as WBAA's *Spotlight on Careers* and *The World of Science* feature up-to-date information in fields which are constantly changing.

A Sense of Realism and Participation

Students who listen to an event as it occurs feel a sense of participation which can serve as a stimulus for learning. Broadcasters, in attempting to demonstrate this quality of the medium, frequently ask, "Would you rather listen to a football game or read about it in the newspaper?" The voices of actual participants convey shades of meaning that are lost in a written account. In addition, the listener hears background sounds which serve to enhance the effect of realism. A broadcast probably provokes a greater sense of involvement than other types of audiovisual presentation because listeners associate it with something that is happening now—an association that is not made when recordings or films are presented in class. Primary grade pupils can become so involved with radio that they seem to believe the radio teacher "really is in the little box." Series like WBAA's *Discovering Science* capitalize on this by employing direct dialogue with the listeners, allowing pauses for pupils to respond.

Emotional Impact

Radio can combine artistic elements in a dramatic form to create an emotional impact which heightens instructional effectiveness. A documentary which uses the sounds of tragedy to teach safety makes a strong impression. Radio dramatization of famous plays and of other great literature may be used both as direct instruction and as a means for motivating further study. Radio can also be an emotional force in the creation of attitudes which affect how students utilize knowledge. Some educational stations have approached the problem directly with series designed to improve social attitudes. Some of WNYE's recent efforts in this area include *Out of Many, One, Peter and Pepe, Senorita Jones, People and Places,* and *A World of Brothers.*

It should be noted that dramatized instructional formats are found more frequently in radio than in television because of the relative ease of production.

Presentation of Authorities

Educators frequently bring outside authorities into the classroom to stimulate student interest and to provide expertise in particular areas. In such a role, radio provides leading specialists in many subjects. Program series such as *The World of Science,* a series of talks by prominent scientists addressed to junior high school students, and *Speaking of Books,* a series in which authors are interviewed by a panel of students, illustrate ways in which radio can present authorities to supplement a classroom lesson.

Radio also serves instruction by engaging itself directly in the process. School systems may utilize radio to offer specialized subjects which would not otherwise be possible. As an example, the Supervisor of Elementary Vocal Music in Evansville uses Station WPSR to present the core of the primary grade music curriculum. There are a number of foreign language series on educational radio such as *Spoken German* and *Spoken French* produced by Station KUOW at the University of Washington. Also, several stations, such as WHA, KANH in Albuquerque, and KEBS in San Diego broadcast English lessons to local minority groups for whom it is a second language.

Uniqueness of the Medium

Radio is an aural medium and the ear is a channel of communication that is particularly appropriate for certain types of learning. Music appreciation, for instance, is one subject which has been well taught consistently by radio. The advantages of an aural approach to language study are reflected in the recent development of language laboratories and by the number of foreign language series broadcast by educational stations. WMUK in Kalamazoo is only one of several stations which has done extensive work with closed-circuit radio broadcasts of language drill materials.

Instructional programs which involve creative student responses are frequently better treated by radio than by other means, as was vividly demonstrated by the WHA experience with *Let's Draw.* This creative art program had been highly successful on radio but was transferred to television when that medium became available. It was soon discovered that the program was no longer successful because students tended to copy the television artist. The program was returned to radio and is still successful there. In art instruction, radio has also been used successfully at KRVM in Eugene, Oregon, at WBOE in Cleveland, and by CBC, Canada.

In other areas related to creativity, Station WBAA recently produced *Creative Thinking: The American Pioneers,* a series which used social studies as the basis for teaching the principles of creative thinking to third and fourth grade students. Two research projects related to this series indicate that children who used the programs significantly increased their creative abilities. Station WAMU, Washington, D.C., in cooperation with the District of Columbia Public School System, produced programs for disadvantaged children that used common sounds to evoke creative responses. The project was an effort to overcome the language barrier which separates ghetto children from an essentially middle class school system. Initial results of the project seem promising.

Another instructional area that lends itself to an aural medium is listening. Skill in listening is considered so important by educators that it is included in most elementary curricula. While any use of radio tends to focus attention on listening, many instructional radio series have been developed specifically to assist in the teaching of listening skills. WBGO, for instance, indicates that *Learning to Listen* has probably been its most successful instructional series, due largely to the essential identification of the series content with resources of the medium.

It is said by some that radio "plays in the theatre of the mind" because it encourages listeners to use their imaginations to visualize the action. It is this form of listener involvement which makes radio a more personal medium than television and which leads Marshall McLuhan to describe radio as a "hot, active" medium, and television as "cold and passive" (McLuhan). Certainly, radio drama demands more of the listener than its television counterpart and in return it gives more. To illustrate the effectiveness of sound alone, students of broadcasting are often asked to analyze their most terrifying experiences. Their responses are usually focused on the hearing of ominous, unidentifiable *sounds.*

Overcoming Space and Time

When audiovisual theorists discuss radio's ability to overcome the barriers of space and time, they are referring to the way in which it can transport listeners around the world or back or forward in time. Radio's ability to originate broadcasts from any point on the globe and even from points beyond has been clearly demonstrated. Instructional series have used both on-the-spot accounts and simulated travel in such series as WFBE's *Mike Cable, Special Correspondent,* KBPS's *Exploring Scenic Oregon,* and WBAA's *Our Hoosier Heritage.* Countless instructional series have also broken the time barrier with dramatized history; two of the best known are *You Are There,* produced by CBS, and *The Jeffersonian Heritage,* produced by the National Association of Educational Broadcasters.

Curriculum Innovation

School systems which have made more than a token effort to use radio see it as a valuable way to introduce new materials and new curricula. For example, Newark, Cleveland, St. Louis, Indianapolis, and Portland stations have all produced radio series designed to acquaint their teachers with the "New Mathematics." Also, Station KUOM has presented a linguistic approach to English in a recent series, *Our Living Language;* WBAA has introduced economic education into the primary grades with *Our Working World* and cultural anthropology into the intermediate grades with *Faces of Man.* Virtually all educational stations oriented to instruction have effectively assisted with the introduction of new curriculum material or with changes in the emphasis of old materials.

In-Service Training for Teachers

Radio is being used to improve teaching skills in two ways. First, it provides classroom teachers with opportunities to hear selected and experienced teachers who have had more than the usual time and assistance in preparing their lessons. Second, radio provides training programs specifically directed at teachers. KBPS has several series for teachers, all produced in cooperation with the superintendent's staff. Station WDTR in Detroit has had outstanding success with city-wide teachers' meetings, using telephone lines for talkback, while WOSU's professional network uses a similar system to extend in-service training across several school boundary lines.

Extension of the School

Most universities view their radio stations as part of the extension function and many of the stations are thus administered by university extension officers. These stations frequently broadcast college courses either on a credit or non-credit basis. As examples, Stations WAMU and WHA are among those currently broadcasting university courses for credit and both report satisfactory results. Their students are required to enroll in the university and to meet occasionally for discussion and testing.

Purdue University offers both undergraduate and graduate level courses on radio using test-out procedures for students who wish to establish credit. During the 1970 calendar year more than 3,100 people monitored WBAA broadcast courses in philosophy, sociology, psychology, economics, broadcasting, health, art, and English. On another level, WNYE operates a "High School of the Air" for more than 600 homebound and hospitalized children.

Community Relations

A school radio station is a logical public relations or community relations arm of the school system and it can function in this capacity in many ways. While parents can and do listen to classroom programming to develop a better understanding of their schools, many stations also prepare special programs just for them. WWHI in Muncie presents interviews with teachers and WEBS in Elgin broadcasts P.T.A. discussions. WMTH in Park Ridge has a program entitled *Main Line* which gives listeners an opportunity to call and to ask questions concerning the school. A number of public school stations also broadcast local school board meetings.

Vocational Training

Educational radio stations are usually involved to some extent in the training of students for careers in broadcasting. Most school stations depend upon student assistance to operate and some even see their primary function as the providing of vocational training. Station WGVE, owned by the Gary public schools, has recently undergone a major physical expansion because of its vocational education program. Many university stations are directly administered by academic departments and exist mainly as student training facilities.

Non-Broadcast Service

An instructional radio broadcast can obviously be recorded and distributed on either tape or disc. Some stations, such as WHA, WNYE, and WBAA, make program recordings available to schools and individuals. Practically all instructional stations encourage teachers to record programs off-the-air if scheduling problems prevent normal use of the broadcast itself. Actually, educational radio stations constitute aural production centers that can serve many instructional functions that are unrelated to broadcasting. These functions are becoming more important as the availability and use of cassette tape recorders increases.

RADIO AND OTHER MEDIA

An important trend in instructional technology is toward the design of systems which provide for the use of various communication techniques as each is appropriate to the educational task at hand. This multi-media approach to instruction is reflected increasingly in the broadcasting practices of educational radio stations.

WHA, University of Wisconsin, is currently combining multiplex transmission of lecture materials with telephone question-and-answer periods for continuing education in medicine, law, and veterinary science. The system is also used for high school student science orientations and for meetings of various regional specialists. Another technique, used in conjunction with an art course, is called "radio vision" and involves the use of film strips correlated with instructional radio broadcasts. WHA has also cooperatively produced and simulcast television programs.

WFBE, Flint, Michigan, distributes radio books containing the reading exercises broadcast in their series, *Reading, Writing, and Radio.* Various art prints are also distributed to classrooms for use with their *Symphonic Melodies* series.

WDTR, Detroit, Michigan, has used radio in combination with television to teach English in grades 4, 5, 6, and 11. Radio broadcasts have also been combined with the classroom use of audio tapes in elementary German and Spanish series.

WBOE, Cleveland, Ohio, distributes colored slides that are coordinated with radio programs in fifth and sixth grade art. A similar technique involving the overhead projector is used in senior high classrooms with the CBS series, *Listening to Pictures.* In addition, senior high English programs are related to newspaper and magazine articles, television broadcasts, and motion pictures. Radio programs are also used to prepare students for their exposure to Shakespearean theatre productions.

KLON, Long Beach, California, distributes picture books with their kindergarten language arts program. They also provide listeners with a science kit that is used to perform experiments in conjunction with their two elementary science series.

Several stations have used various combinations of radio and television for instructional purposes. KDPS, Des Moines, has several series on both radio and television. KUOW, Seattle, used the two media for a course entitled *Spoken German.* KRVM, Eugene, has produced a music series for several years using radio programs as a follow-up to television broadcasts. They have also produced a physical education class in folk dancing that used television to present the lesson and radio to provide the music and participation part of the program. KSLH, St. Louis, broadcast a science series in cooperation with KETC-TV, alternating programs between radio and television. KDPS, Portland, has also experimented with radio-television simulcasts.

Several professional education networks, such as the one operated by Albany Medical College and Station WAMC, are using various combinations of FM multiplex channels, telephone or broadcast talkback arrangements, and correlated visual materials distributed directly to listening posts.

An Iowa mathematics project uses telephone techniques in combination with the electrowriter for the transmission of equations and other notes. This particular combination can be directly adapted to FM multiplex transmission and holds great promise as a means of accomplishing those instructional tasks which only require a voice and a "blackboard."

Many techniques initially developed in language laboratories and with audio-tutorial tape recordings can be used in conjunction with instructional radio. Programmed learning techniques are already being used in educational broadcasting with excellent results. Slow-scan television, when fully developed, will make possible the FM transmission of still pictures. Research is also underway to link radio stations, push-button dialing systems, and computers to provide, among other things, a possible answer to broadcasting's perennial problem of feedback.

INSTRUCTIONAL RADIO RESEARCH

There can be no doubt that radio is an effective instructional tool. While it has never been subjected to the intense experimental scrutiny focused on television, the accumulated evidence is no less positive.

Of the studies that have been undertaken many compare the effects of radio with those of other forms of instruction. Phillips compared "face-to-face" presentation with speech via radio and found that more facts were gained by direct listening to a formal speech, but that the reverse was true for an informal speech.

Ewbank, reporting on current events presented by radio, concluded that lessons supplemented with school broadcasts were more effective than those taught by teachers without radio. Lumley found that pronunciations of students who studied foreign language by radio were superior to pronunciations of students trained by conventional methods.

Harrison (1932) in an experiment with rural-school children, concluded that radio is equal or superior to ordinary classroom instruction in teaching music appreciation and nature study. Carpenter used radio to teach science to students who ranged from fourth grade through senior high. He found that radio students learned as well or better than those taught by conventional methods.

Brewer also used radio in the science instruction of elementary school children. Post-test scores indicated that the radio students learned significantly more than did the control group and that they had greater interest in and more favorable attitudes toward science.

Heron and Ziebarth conducted an experiment in which a group of 98 college psychology students was divided with one-half attending classroom lectures while the other half listened to the same lectures over radio. Tests conducted throughout the course indicated that radio was as effective as the face-to-face instruction.

Wiles found that junior high school students learned more from listening to a series of news broadcasts than did a comparable group of students studying current events in the classroom.

Miles found advantages for the radio group in the learning of elementary science when their performance was compared with that of a comparable group taught conventionally.

The University of Wisconsin undertook an extensive two-year study of school radio broadcasts at several grade levels and in seven subject areas (Wisconsin Research Project...). Teachers of both the experimental and control groups taught from the same lesson plans. As might be expected, results generally indicated no significant differences although they consistently favored the radio groups in the field of music. In other subjects the comparisons yielded mixed results. Cook and Nemzek also found no significant differences in the information acquired by radio and non-radio students.

Nelson compared two methods of presenting *Meet the Press* by studying groups who had heard the program on radio or on television. He concluded that for this type of program, radio was as effective as television.

Barrow and Westley presented randomly selected groups of sixth graders with news background programs on both radio and television. Although the television group scored higher on an immediate-recall test, differences between the two groups were not significant on a delayed-recall test administered six weeks later

Popham reported a comparison of two education classes, one taught by tape-recorded lectures and the other taught conventionally. He found no significant differences in measured learning.

Menne *et al.* compared live lectures to audio-taped lectures using students in an introductory college psychology course. The experiment, which was conducted in the fall and repeated during the spring quarter, confirmed that taped lectures are as efficient as traditional lectures in supplying information to college students.

Some of the more recent comparisons of radio teaching with conventional techniques have been undertaken in foreign countries. To cite Chu and Schramm's review of the literature,

> "Radio has been found effective in teaching English to elementary school children in Ghana (Kinross, 1961), and in teaching French to native school children in Tahiti (Medard, 1962). In Thailand, a sample of schools which had access to radio instruction was compared to a control group consisting of schools of similar characteristics, except for the absence of radio instruction (Xoomsai and Ratamangkala, 1960). Grades two and three were compared in music, grades six and seven in English. For grades two and three, the radio group had a

significantly better average performance than the control group. For grades six and seven, the radio group scored significantly higher on reading and writing tests, although no significant differences were found in aural tests between the two groups."

Mather and Neurath equipped 145 villages in India with radios and selected a like number of villages to serve as controls. Twenty special farm programs were broadcast; tests administered before and after the broadcasts showed a significant increase in knowledge in the radio villages and only a negligible increase in non-radio villages.

Two experiments conducted by NHK in Japan both favored radio. In one (NHK, 1955), two groups of seventh grade pupils were taught English from the same book, but one group listened to regular summary broadcasts on radio. Tests indicated that the radio group learned substantially more than the control group. In the other experiment (NHK, 1956), elementary school pupils received a fifteen minute music program on radio within their regular music class, while a control group studied in the conventional manner. The experimental group scored higher on all tests but the differences were not statistically significant.

The preceding studies are typical of the experimental investigations that have attempted to assess the instructional effectiveness of radio. Although they suffer from the same ills attributed to most of the recent educational television studies, they collectively represent an important body of evidence attesting to the instructional effectiveness of radio.

Much of the rationale for the use of audio-visual aids in instruction is based on a view which relates instructional effectiveness to the number of sensory channels employed in the teaching process. The use of radio has also been questioned on the grounds that the ear is not the most efficient channel of communication. Carver, in a series of seven experimental studies, used 39 Harvard undergraduates and 52 adults to investigate the relative effectiveness of auditory and visual presentations of identical material. He found among other things that

> . . . the effectiveness of auditory presentation is limited to meaningful material (as opposed to nonsense syllables), and tends to be superior for subject matter that is concrete and serial in nature. If other conditions are constant, the mental functions of recognition, verbatim recall, and suggestibility seem more effectively aroused in listening; whereas critical attitudes and discriminative comprehension are favored by reading. The human relationship involved in the auditory situation is of value for certain types of communication (e.g., aesthetic and humorous) where the personal factor customarily plays a role.

Cohen investigated the relative effectiveness of silent reading and radio listening in the teaching of facts to several hundred New York City school children. He found no significant difference between the reading and listening groups at any grade level, either on immediate or on delayed-recall tests.

Goldstein attempted to compare reading and listening comprehension at various rates of presentation, using adults as subjects and phonograph records and visual projections to provide materials. He concluded that listening comprehension was greater than reading comprehension and that the difference became increasingly noticeable as the intelligence of his subjects and the difficulty of the material decreased. His findings also indicated that individuals vary in listening ability much as they do in reading ability.

Lanman and Henderson compared the attitudinal change effected by listening to a radio program, by silent reading, and by teacher reading. They found the changes induced by both the radio program and by silent reading to be significant, while those produced by teacher reading were not. No significant differences were found between the radio group and the silent reading group.

Robert M. W. Travers and members of the Bureau of Educational Research at the University of Utah recently reported a review of the research and theory related to audio-visual transmission of information (Travers *et al.*). In summarizing their chapter on the relative efficiency of auditory and visual transmissions of information, they state

> The information reported on the relative advantages and disadvantages of the visual and the auditory senses in terms of the number of available dimensions for the coding of information point to the conclusion that vision has more codable dimensions than does hearing. On the other hand the transmission of information through the auditory sense has advantages over vision in that the reception of information does not require specific muscular adjustments or head position. Sources of visual information are thus far more easily blocked than are

auditory sources which may force themselves on the perceptual system of the person who is exposed to them.

While the early studies of the value of transmitting redundant material through more than one sensory channel at a given time provided results purportedly showing that simultaneous transmission through more than one sensory modality improves learning, such a conclusion may well be questioned on the grounds that none of these early studies utilized a test of significance.

Studies conducted at the University of Utah which have attempted to repeat earlier work with the introduction of proper controls have failed to demonstrate any particular advantage for the transmission of redundant information through more than one sensory channel.

Elsewhere in his report, Travers indicates that at any given time during communication, one sensory channel of the receiver seems to predominate and that simultaneous presentations through two channels results in blocking of one. Obviously, a multi-channel communication presents options to the receiver that a single-channel communication does not; however, it seems that the receiver can seriously attend only to one channel at a time.

Chu and Schramm, in their recent review of instructional television research, concluded that the effects of visual images on learning were not uniformly beneficial and seemed to depend on the kind of learning task involved. The evidence indicates that "the use of visual images will improve learning of manual tasks, as well as other learning tasks where visual images can facilitate the association process. Otherwise, visual images may cause distraction and interfere with learning."

PROBLEMS IN THE USE OF RADIO FOR INSTRUCTION

The major difficulties encountered in the use of radio for instruction can be classified as human, or administrative, failures. Other problems are derived from the nature of the medium and are generally centered in the areas which can be described as (1) reciprocity, (2) flexibility, and (3) single-sensory input.

Administrative Problems

The major difficulty facing instructional radio broadcasters must be stated as a lack of administrative support. The failure of many educational administrators to view radio as a viable instructional system has resulted in a group of related problems, the most important of which has been lack of money. Approximately half of the educational radio stations in the United States operate on total yearly budgets of $20,000 or less (*Hidden Medium*). With current financing, stations are obviously understaffed and without the means for proper promotion or development of their programming. This, of course, contributes to a general apathy and the establishment of a downward cycle.

From the consumer's point of view, scheduling is the largest single problem in the utilization of radio and television classroom programming. Many factors are involved in getting student groups in the proper place at the proper time and radio has been particularly handicapped by educational administrators who rarely consider it when compiling class schedules. As a result, educational radio stations have tended to concentrate their instructional programming at the elementary school level to avoid the difficulties caused by departmentalized subject matter. They have also emphasized general enrichment programming for the same reason. The failure of school administrators to include radio in their instructional planning has forced many educational broadcasters to develop a non-specific type of instructional service that frequently fails to demonstrate much of the medium's potential.

Reciprocity

A broadcast is essentially a one-way communication which lacks the interaction of interpersonal discourse. The separation of speaker and receiver imposed by the medium makes it difficult for the broadcaster to adapt to the individual needs of listeners while programs are in progress. Theoretically, it is possible for the classroom teacher to observe the reactions of students as she teaches and to modify her presentation to correct misunderstandings as these develop. (In practice, her ability to do this successfully is open to question.) The broadcast teacher cannot react similarly because audience feedback, if it is forthcoming, is usually available too late.

Educational broadcasters are aware of the problems caused by the lack of feedback and are continually trying to improve the flow of information from the listener to the studio. Some techniques

commonly used for this purpose include evaluation forms, questionnaires, interviews, and direct observation of listeners. Much effort has also gone into the development of talkback arrangements, using telephone lines or remote transmitters to permit students to question the broadcast teacher.

In summary, reciprocity in the communications process is desirable, but no mass medium provides it. A viewer does not enjoy a reciprocal relationship with a television program, a book, or a film. While books provide a degree of redundancy through individually controlled exposure as partial compensation for the lack of reciprocity, radio programs can be recorded to accomplish the same purpose.

Flexibility

As a mass medium, radio must contend with the problems inherent in the presentation of single, fixed instructional messages to large and often heterogeneous groups. Such presentations are difficult to integrate into a curriculum that is related closely to individual student needs and differences. However, ideal situations are rarely encountered in education and instructional materials are commonly developed for large numbers of students; thus, the problems faced by radio broadcasters are hardly different from those encountered by producers in other media.

Since it is possible to develop radio programming correlated with all of the curricular options provided within a school system, the lack of flexibility is most obvious in the delivery system itself. Most educators tend to view a radio program as a "one-shot" presentation and this has made the medium seem more inflexible than it actually is. Tape recordings, central sound systems, and multiplexing equipment now make it possible for a radio station to provide a greatly increased number of scheduling alternatives and the interconnection of school units by coaxial cable would further increase the options for program distribution.

Limitation of the Physical Senses

Most educators believe that teaching effectiveness is positively related to the variety of physical senses employed in the process. Since radio's appeal is to the ear, it is generally considered inferior to the audio and visual medium of television, at least insofar as classroom applications are concerned. As discussed earlier in the review of research, this issue is not as clearly defined as it might seem. For instance, the aural nature of radio makes it particularly appropriate for certain types of instruction. Also, there are several studies which directly challenge the view that multi-channel presentations are inherently superior to single channel.

The usual argument concerning the relative merits of instructional radio and television centers on the importance of pictures and other graphic non-verbal cues. Television producers cite the importance of the visual dimensions in instruction and the totality of television as a broadcast system. Radio producers counter with statements concerning the uniqueness of their medium and the fact that it provides nearly the same services for a fifth of the cost. In this argument, radio broadcasters stress several points. First, television is much more expensive than radio in all areas of its operation. Estimates have placed the cost of television at fives times that of radio (Chu and Schramm). Second, they point out that most current instructional television programming could transfer to radio with little or no loss of effectiveness because most instructional television programs use talk-oriented formats. They note that, if necessary, crucial visual materials can be distributed by means other than television. It is common practice in radio, for example, to distribute manuals which contain visual supplements. A similar technique called "Radio-Vision" (radio and correlated slides) has been extensively developed, especially in Scandinavia and Africa. Other alternatives for the distribution of visual materials are provided by facsimile transmission and by electrowriters. Personnel in educational radio point to the fact that extensive post-graduate medical education is successfully being conducted with radio-vision and they contend that the idea can succeed in a variety of other instructional situations. The available evidence supports this contention.

SUMMARY

Radio has been part of America's educational scene since its development in the early part of the century. Although its instructional applications were restricted during the twenties and thirties, that situation improved somewhat with the development of FM broadcasting and with the government's reservation of part of the FM spectrum for education. Today there are more than 450 educational radio stations, most of which have gone on the air since 1960. Many of these stations are seriously underfinanced and must rely on outside sources for programming, a condition that detracts from their efforts to meet local needs. Unlike the United States, broadcasting in other countries usually involves more governmental participation and a greater national commitment to educational radio. Many countries, including Sweden, Japan, and Canada, make extensive use of the medium for instruction.

Radio has much to offer education. First, it is a broadcast medium which provides students an ear upon the world. It can broadcast events as they happen, as well as present programs consisting of timely information, because the technical characteristics of radio allow fast response to events. Radio can combine artistic elements to create an emotional impact which may then heighten the effectiveness of instruction. It also evokes in listeners a sense of involvement in the events being broadcast. Radio can be used to present authorities and programs that are beyond the means of individual school systems, and it is particularly appropriate for presenting certain types of subjects, as those requiring creative responses. Radio is currently used for curriculum innovation, for in-service teacher training, and for continuing professional education. Educational radio stations also serve their institutions as extension arms for community service and as aural production or recording centers. In addition, they frequently serve a purpose in vocational education.

The systems approach to education has involved radio in combination with other teaching tools. Instructional radio broadcasts are usually coordinated with printed materials which include many types of visual aids; the use of correlated filmstrips with radio programs is commonly called "Radio-Vision" and has been a highly successful technique. Radio has also been successfully combined with television in many situations. The development of FM multiplex equipment has opened new avenues for cooperative media approaches to instruction which involve facsimile transmission and electrowriters. Until this equipment is more generally available, instructional broadcasters will probably continue to use telephone techniques to provide talkback and conference facilities. Tape recording and audio-tutorial programmed learning techniques are also being used within instructional radio.

Research clearly indicates that radio is effective in instruction. Experimental studies comparing radio teaching with other means or media have found radio as effective as the so-called "conventional methods." Even though radio has been criticized for being only an audio medium, studies have shown that visual elements in learning are not uniformly important. In many educational situations visuals may be more harmful than helpful. Also, the efficiency of combined audio and visual media has been challenged by studies which show that multi-channel communications may not be inherently more effective than single channel presentations.

The problems directly related to the nature of radio which are encountered in using the medium for instruction are reciprocity, flexibility, and single-senseness. While all mass media lack the reciprocity and flexibility found in interpersonal discourse, the aural nature of radio presents unique problems. Recent technical developments have greatly alleviated some of these difficulties, but instructional radio broadcasters are still faced with the human problems created by apathetic school administrators and inadequate financing.

CONCLUSIONS

From the standpoint of instructional technology, radio can be viewed as a delivery system, a piece of hardware that has the capacity to disseminate material from a central location to schools or listeners scattered over a wide geographic area. Recent technological advances make it possible to accomplish this transmission either by open broadcast on a regular AM or FM frequency or by a "closed" broadcast to special receivers via an FM sub-channel. Radio programming can also be distributed over an interconnecting wire system which utilizes telephone lines or coaxial cable, or it can simply be recorded on tape for use by anyone with playback equipment. While it is possible and frequently desirable to utilize all these methods of program distribution, it is radio's broadcast capability that sets it apart from all other educational media except television. In discussing the merits of their own medium, television broadcasters often neglect to mention that radio can also share one good teacher with many classrooms simultaneously, and, in doing so, it can free the faculty for other things; radio can also provide experiences impossible for individual schools to equal. It can carry instruction to places where there are no schools, as in western Australia, for example, and to students who are unable to attend school conventionally. Most importantly, radio makes it possible for schools to extend their resources into the homes and business places of the community. The only other medium which provides this capability is television and it is far less flexible than radio and is at least five times as expensive.

The most reasonable approach to the question of which teaching device to use begins with analysis of the instructional task to be performed. Then, when the needs have been defined, the available alternatives should be considered on the basis of cost effectiveness. Given a sufficient population, radio offers the least expensive means of communication available to schools. When its cost is considered in the light of its demonstrated effectiveness, its unique advantages for certain types of instruction, and its adaptability to various types of technological systems, radio must be accorded a prominent place in the developing educational armamentarium.

Many events in the history of instructional radio are a source of concern for broadcasters, teachers, national leaders, and lay citizens. With some justification, they can contend that radio has not had a fair chance to win consideration and intelligent adoption by educators. In the early days, during the 1930's, friends of instructional radio stood almost alone as advocates of innovation and the use of technology in instruction. Few funds were available to innovators then and little support, financial or otherwise, was invested in exploring or investigating the uses of radio.

These early difficulties are compounded now by several recent developments in education. With the advent of educational and instructional television, many broadcasting practitioners and many of the qualified research personnel gravitated to the newer medium; hundreds of ITV facilities were established, hundreds of ITV evaluative studies conducted, and, predictably, interest in the instructional uses of radio declined. If present circumstances were the product of systematic planning and convincing evidence, few would resist them, but that unfortunately is not the case. On the contrary, it is more reasonable today than ever before to regard radio as a versatile, a practical, and an effective instructional medium. In comparison with other media, especially television, radio is impressively economical. Hopefully, now that the climate for consideration of all educational innovations has improved, many educators will achieve the perspective necessary to review carefully the applications of radio in dealing with instructional problems.

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