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<p>Educational leaders in developing countries are becoming increasingly aware that traditional school models may be ill-suited for their countries because the classroom/teacher mode of instruction is so expensive and labor intensive that it may not be politically or economically feasible. Thus educational leaders are turning to educational technology in search of alternative systems that are more cost-effective. These include the use of radio, television, cinema, computer systems, and satellites. It is extremely unlikely that most of these exotic systems can be used at all in many of the developing countries. However, the instructional use of radio in both formal and non-formal situations seems to represent a feasible alternative to the traditional classroom instruction. There is little evidence that it would be less effective than the traditional forms of instruction, and also little evidence that use of more costly modern systems involving television or computers would be more effective. The use of instructional radio needs to be explored in developing countries to answer the question of how one can effectively design, develop, and deliver instruction via radio. Current knowledge regarding this is inadequate. A survey conducted by the Center for Educational Technology has shown that very little controlled experimentation and systematic evaluation has been conducted. CET proposed to conduct such a series of studies</p>		
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A PARAMETRIC STUDY OF
INSTRUCTIONAL RADIO

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INTRODUCTION AND OVERVIEW

There is a growing awareness among educational leaders in developing nations that traditional school models are ill-suited for their countries, and further that, in many cases, excessively large portions of that country's GNP would have to be allocated to the education sector to build classrooms and train enough teachers for the youth of the country.

In many developing countries it is not politically possible or economically feasible to allocate the resources necessary to provide a classroom and a qualified teacher for every group of thirty pupils. Thus, educational leaders are turning to educational technology in search of alternative educational systems that are more cost-effective.

Since education has been extremely labor intensive, it is not surprising that various forms of communication technology have been utilized as delivery systems. These include the use of radio, television, cinema, computer systems, and satellites. These often are used in a "tack-on" manner without substantially changing the curriculum. In other cases, the increased reliance on media systems forms a part of a total educational reform.

The exotic technologies (computers, television, and variations on these) have commanded a great deal of attention in the recent past, indeed, many of them have been offered as realistic hopes for utilization in developing nations. While the possibility does exist in many of the better developed countries for cost-feasible applications of these systems, it is

extremely unlikely that they can be used at all in many of the developing countries.

Many exotic systems have been designed, in many cases by proponents of the specific technology, and have failed to reach a cost-feasible criterion even in the highly optimistic planning stages. After serious review of the possible technologies, "radio emerges with the potential of having the brightest hope. It can meet the criterion of cost-feasibility in a large number of formal and non-formal instructional settings, it can be made available in an even wider range of locations, and there is much research data which supports radio as an effective means of instruction.

While it would be premature to form a final judgment on educational applications of communications technology in developing countries, available evidence seems to indicate that many forms of mediated instruction are at least as effective as traditional classroom instruction. In examining comparative media studies, there does not seem to be sufficient evidence at this point in time to eliminate any media system as being an inferior instructional resource.

There are two points of consideration that form the basis of this proposed project. First, developing countries must include low-cost media systems to reduce unit costs of education, and second, there is no a priori reason to suspect that more sophisticated costly systems (television, computers) will produce superior results to lower cost systems (radio). At this time, the instructional use of radio in both formal and non-formal situations seems to represent a feasible alternative

to the traditional educational model that would also be within the economic constraints of a developing country.

The first step in exploring the use of radio for instructional purposes in developing countries is to examine the accumulated knowledge related to instructional radio. The question guiding such a search is, "How can you effectively design, develop, and deliver instruction via radio?" Accumulated knowledge from theory, research, and practice was surveyed to determine what is known about instructional radio that would be useful to educational decision makers in developing countries. Such a survey was conducted by CET over a period of several months and is reported elsewhere in this document. This survey indicates that while there has been considerable applications of instructional radio in a variety of conditions, there is a lack of systematic evaluation and controlled experimentation. There is a scarcity of information regarding alternate methods of developing radio lessons, the use of various types of supporting materials, the use of people to complement radio broadcasts, and the use of radio in different settings.

Currently there is not an adequate knowledge base regarding radio instruction to guide decision makers in developing countries. If developing countries are to successfully implement instructional radio, a parametric study of instructional radio is needed. Such a series of studies would seek to establish the boundary conditions for optimal use of instructional radio. The Center for Educational Technology at Florida State University proposes to conduct such a series of studies.

Radio is the only advanced communication technique which has found its proper place in developing countries. Where conditions have permitted, it has become well established and widespread. Yet, it seems to us that insufficient educational use is made of this virtually universal method of distribution. People often seem to have been deterred by the reputedly greater efficiency of other media which, however, have the major defect, compared with radio, of being unable to hope for such widespread distribution -- or anything like it -- for a long time to come. The very low cost and adequate reliability in all climates of miniature transistor radios means that radio broadcasting should more and more be recognized as a particularly suitable medium for educational purposes.

The Center for Educational Technology proposes to undertake a program of research which will produce new knowledge concerning the use of radio as a "central system" for use in both formal and non-formal education. This research will include the definition of such a system, experimentation to determine the human, financial, and instructional resources essential to the system, and will evaluate the system achievements relative to defined educational and developmental needs. The major area of concern is that of designing and validating a system of radio education for use in developing countries around the world. This effort will be undertaken against the background that a "learning revolution" for immediate and massive educational development is just as important and just as possible as the "Green Revolution" is and has been for food production in Southeast Asia.

STATEMENT OF THE PROBLEM

The question guiding this proposed research project is, "How can instructional radio be made optimally effective and efficient in developing countries?" Thus, the problem area to be investigated is composed of those variables that influence the effectiveness or efficiency of radio instruction. These variables include techniques for the development of radio lessons, the use of printed materials to accompany the broadcasts, the use of instructional personnel in conjunction with the lessons, individual and cultural differences among the listeners of the broadcasts and other such classes of variables. The research will be conducted in formal school settings and in non-formal settings, with literate and preliterate groups of listeners. A more detailed description of specific independent variables can be found in Appendix A.

The comprehensive and systematic research into the potential of radio will require large amounts of financial support - its pay-off, however, can be worth both the time, effort and costs.

The most immediate and tangible result from the proposed research will be a series of research reports describing each specific study conducted. Of more benefit will be the instructional radio users' guide that will be produced specifically for educational decision makers. This document will review and explain the research studies, and will present practical considerations for using instructional radio that are based on the research evidence.

While the major emphasis of this project is to conduct research, it is the intent of the Center for Educational Technology to develop and strengthen the capabilities that exist in host countries to effectively conduct radio instruction and to conduct applied developmental research. The strengthening of this capability in the developing countries will be a key result of the proposed project. CET is not proposing to go into host countries, collect necessary data, return to complete the analysis of the data, and prepare the final report. Rather, CET will work in conjunction with selected developing countries to conduct the proposed research. This may include the training of persons in experimental design methodology, instructional materials development, evaluation methodologies, and similar areas.

At the conclusion of this project CET would like to have enabled agencies and institutions in selected developing countries to continue to conduct applied developmental research with a minimum of technical assistance. Also, CET would like to have assisted in the refinement of radio instruction in these countries so that there is an immediate translation of research findings into practice.

REVIEW OF LITERATURE

Radio has been used for educational purposes since its beginning in the early 1920's. The application of radio to the educational problems of developing nations is not a new concept by any means. Most developing nations have broadcast capabilities to cover their geographic region. The main technical problem is the absence of receivers for all people. Some countries have governmental problems in allowing the import of transistors or radios for use by the populace. Additionally, radio broadcast technicians and educational radio format designers are very scarce in developing countries and academic programs need to be created on a large scale.

Those studies of the effect of educational radio often used materials not developed specifically for radio use, instead the materials were usually for classroom presentation or even ITV. The great gains in learning shown in radio lessons might therefore be even further enhanced by using materials designed specifically for radio use (see McLuhan).

Other areas of need are those of longitudinal studies concerning the effects of radio used over an extended period of time, and studies of single-session attention span of students.

Overview

Historical Background

During the 1930's and 40's most of the activities in educational radio were conducted through universities. Wagner (1939) provided a summary

of the most important work being done at that time. The following works cited are included in his summary.

At Kansas University, one of the pioneers in the field of giving classroom instruction in radio broadcasting, courses dealing with the program side of radio have been available to students since February, 1932. From the beginning, emphasis has been placed on training students for educational rather than for commercial broadcasting.

Ohio State University's "Evaluation of School Broadcasts" was a study sponsored by the Federal Radio Education Committee and involved the active cooperation of educators and of network and independent broadcasters. The major purpose of the undertaking was to gather evidence regarding the effectiveness of radio broadcasts, planned for use in school, in achieving a variety of educational objectives which broadcasters and teachers alike considered important.

The Research Project in School Broadcasting being carried on by the University of Wisconsin was to determine, through demonstration and evaluation, the place of radio in the classroom and to devise methods for its most effective use. During the seven years of experimentation in school broadcasting, the Wisconsin School of the Air has had a steadily increasing audience. The purpose of school broadcasts was to supplement and enrich rather than to give curricular instruction.

The School of Public and International Affairs at Princeton University established an Office of Radio Research in September, 1937. At that time a Rockefeller grant was secured to finance a radio research project to

be carried out by this office. A series of publications about the project was planned and, as the work of the project proceeded, a number of basic principles of procedure were formulated.

In the spring of 1937, Wayne University started an experiment to develop a radio research technique for measurement of listening habits which would be inexpensive and yet fairly reliable, and one which might best be carried out through the schools.

At the University of Mississippi, a questionnaire was formulated for the study of radio listening habits, effects of listening, and attitudes toward radio programs and governmental control of radio.

Research done at St. Andrews University, Scotland, involved collecting questionnaire responses for groups of British listeners. The results reveal significant differences in program preferences among occupational groups.

Fisk and Lazarfeld (1945) introduced the work of the Office of Radio Research, a division of the Bureau of Applied Social Research in Columbia University. They also illustrated the interrelationship of radio and other fields of communications research. The Office conducted research on the roles of radio from the standpoint of the educator, psychologist, and sociologist. Special attention was directed to the techniques of radio research, including surveys of listening habits and more specialized research pertaining to the effectiveness of one section or element of a program.

Special characteristics of radio were explained. Fiske and Lazarfeld said that there are at least six characteristics of radio which distinguish it from other media. The most significant characteristic is radio's accessibility; another one is its auditory perception. Its accessibility, combined with its reliance on auditory perception, enables people to listen while carrying on a variety of other activities which do not necessarily interfere with their perception. But, at the same time, this quality of non-interference leaves the radio program liable to a low degree of attention. A fourth characteristic of radio is that it continues in time. Cumulative effects can be built up over long or short periods. Also, a national network may reach into homes all over the country if it confines its appeal to a general one.

Recent Reviews

Recent surveys of the uses of instructional radio can be found in Jamison, Suppes, and Wells (1972), Forsythe (1970), and Lynch (1966). Further information is available in Madden (1968), a comprehensive bibliography with 432 references; a more selected bibliography prepared by Educational Technology in 1969, and in Sparks (1970), a bibliography of doctoral dissertations in television and radio, listing over 900 titles.

Jamison, Suppes, and Wells provided a history of the use of educational radio in the United States and abroad, followed by a description of a number of experimental studies designed to show the

effectiveness of radio as an instructional medium. They concluded that, although radio has been used extensively for formal classroom instruction, there are only a limited number of good evaluations of its effectiveness. "These evaluations indicate that instructional radio (supplemented with appropriate printed material) can be used to teach most subjects as effectively as a live classroom instructor or ITV."

In a review of some forty-one articles on educational radio, Forsythe (1970) covered the span of application of radio in American education and highlighted some international projects. He noted that the greatest use of radio for instructional purposes occurs in the United States, Sweden, Japan, and Canada.

Some characteristics and uses of radio identified in the review include:

1. The ability to present students with events as they happen. Radio can be combined with visual elements to create an emotional impact which may heighten the effectiveness of instruction.
2. Radio provides listeners with a sense of involvement and allows the listener to hear authorities or programs that are beyond the scope of the typical school system.
3. Radio may be used jointly with other media such as television. Multiplexing offers the opportunity to use single-image facsimile transmission or the use of electrowriters.
4. Radio is capable of copying almost all educational projection

that television can do, and at substantial lower production and reception costs.

5. Other services offered include; in-service teacher training, continuing professional education, community service, health and vocational education, etc.

Forsythe concludes that radio has been shown to be an effective medium, through extensive research. In fact, radio has been shown to be as effective as "conventional methods." Furthermore, the use of additional visual materials with instructional radio has not been uniformly helpful and in some cases is actually harmful. Essentially, Forsythe cites that no research has proven that multiple channel communication is more effective than a singular mode (radio).

Lynch (1966) included articles by over forty authors concerning the uses of radio and television in the secondary school. Parts one and two provide the historical perspectives of commercial and educational radio and television. Part three concerns the use of radio and television for enrichment or basic education. Part four discusses future uses of these media and Part five offers suggestions for needed additional study on the effectiveness of radio and television in the school.

Current Status

Sandler (1967) discussed the re-emergence of radio as an instructional medium and the rediscovery of some of the features that make radio particularly appropriate for certain purposes. He pointed out that with

the rise of ETV, radio had to re-establish itself as a viable medium. That it has done so, can be seen in the growth of FM educational stations, in the use of new techniques such as multiplexing, in the wide range of broadcasting offered, and in the creation of National Educational Radio, in 1964.

From a 1966-67 survey, a status report was made on educational radio by Land Associates, Inc. (1967). As of April, 1967, 346 educational radio stations existed in the United States; 244 in colleges and universities, over 50 in public schools, and 37 operated by other groups.

Over 50% of the stations had budgets of less than \$20,000 a year, 1% had budgets of over \$600,000. 77% report that they are inadequately staffed and are confronted with problems caused by disinterested school administrators, lack of facilities, and weak promotion.

Little is known about the stations' listening audience. Over 50% conducted no audience research or research on the effectiveness of programs. Most of the research was done by school district stations.

Programming in educational radio includes public affairs, community affairs, service to special audiences, news, general education, in-school instruction, agriculture, and cultural enrichment. The National Educational Radio Network supplies programs to its affiliated stations in seven categories: 1) current information and orientation, 2) physical sciences, 3) social sciences, 4) art and literature, 5) mental and physical health, 6) music, and 7) programs for children. The network also has in-school offerings for use in kindergarten through the 12th grade.

Young (1970) conducted a survey of public radio in the United States. The article described problems in budgeting and personnel, and discussed trends evident in public radio over the past few years.

Possible Uses

One of radio's greatest strengths is the diversity of programming possible. In addition to direct instruction, in and out of the classroom, radio has been used to provide supplementary material, aid in motivating students, and increase community awareness and involvement.

Dreyfus (1966) suggested uses and gave examples of educational radio and television in direct instruction, where the materials are an integral part of the teaching-learning process, as supplementary materials prepared for use within the context of a course or curriculum, and as enrichment materials not specifically related to the instruction.

Hilliard (1968) in an address to the annual college conference of the International Radio and Television Society pointed out the potential for radio and television in urban ghettos using innovative techniques. He also emphasized the importance of radio for international communications.

Burrow, et. al., (1969) reported on the use of radio in conjunction with an already existing booklet and a tutor system to train factory shop stewards in human relations.

A report by the Corporation for Public Broadcasting (1970) describes phase one activities of the Public Broadcasting Environment Center. The Center is engaged in efforts to apply the capabilities of public

broadcasting to environmental education.

In an effort to increase possible applications, radio has attempted to make use of innovative technology. Cosford (1969) described "radiovision," a coordinated radio broadcast-color filmstrip medium. The emphasis in his article is on "radiovision's" applications to the learning process. Jamison (1968) described the economic and technical attractiveness of satellite-based radio instructional systems.

International Applications

Multinational Reviews

Instructional radio has been used extensively in developing countries. While there has been little empirical research, there is a substantial descriptive literature.

W. Hugh Walker pointed out in an address to the 1969 International Conference on Arid Lands in a Changing World, that radio could be used as an effective instrument of instruction, especially in adult education, in areas isolated from urban centers.

The importance of radio as an instructional medium had been previously pointed out in the 1967 European Broadcasting Union's International Conference on Educational Radio and Television. The more than 600-page final report discussed applications of instructional radio from all parts of the world and included detailed descriptions of exemplary programs.

DeFever (1971) suggested several guidelines for success of rural agricultural broadcasting programs:

1. Rural broadcasts must be made regularly and on a continuous basis, on fixed days, in order to induce the habit of listening.
2. Programs should be on the air at fixed times, convenient for farm listeners, usually at night.
3. The subjects dealt with should be topical, and
4. Broadcasts should be presented as far as possible, by the same person.

Riitho (1971) described uses of radio which offer some obvious advantages as a communication medium for family planning education in Africa. The program consisted of various broadcasting in such formats as short messages, spot announcements, interviews, panels, talks, etc.

In introducing the content, local customs, holidays, and taboos were considered. Problems included getting the villagers used to fixed schedules, nationwide scheduling, the uniqueness of the radio, and the fact that only 6% of the population owned a radio.

UNESCO has been very active in exploring the use of radio in developing countries. In a study of radio and television in Asia, some of the conclusions drawn were that radio can be an instrument to promote social and economic development and expand the educational systems of less developed countries. According to the 1967 UNESCO report this is due to the independence from traditional ground communication, instant and flexible production, emotional and intellectual appeal, individual or group participation, cheapness of production and reception, lack of

necessity for electricity and personalism. This is especially true for Asian countries which are characterized by small percentages of economically active individuals, moderately large percentage of school age populations, irregular distribution of educational facilities and opportunities, scattered distribution of persons in these countries, and wastage.

The potential of educational radio to meet the needs of the entire Asian population has not been developed. The cost of broadcasting drops when used on a large scale when its assets are fully used, rather than when used on a small scale to supplement instruction. However, Asian countries have used educational broadcasting only on a small scale. The majority of this radio time is devoted to secondary school education followed by primary school broadcasts, with few hours devoted to vocational training and pre-school programs.

UNESCO (1956) has also supported studies of cultural radio broadcasts. The results of their experiences show that cultural broadcasts have attempted to popularize knowledge in general and also to attract the more sophisticated audience. In both cases, countries have aimed at the highest standard of performance.

Programming in all cases covers a multitude of subject areas such as national literature, history, science, music, economics, and religion.

Great Britain, Germany and Palestine have attempted to appeal to the most intelligent audience, assuming a prior knowledge of the subject.

The Soviet Union, India, Rumania, Egypt, Italy, and Poland broadcast in various subject areas but with an aim for a larger, less specialized audience.

It has been pointed out that programs now used in other countries would probably be successful in Asia due to the high Asian regard for knowledge and education. John Morris, head of the BBC Third Programme, feels that material incomprehensible to westerners without the printed page would be readily absorbed by the Asian people who are accustomed to absorbing knowledge by ear.

Radio Forums

One of the most important uses for radio in developing countries is the radio forum or radio club. The model for most forums is the Citizen's Forum in Canada. India has been the leader in adapting the Canadian model for developing countries. Recently, efforts have been made to expand the forum's possibilities through the use of two-way radio.

Mackie (1968) presented a history of the Citizen's Forums in Canada from 1943 to 1963. He pointed out that successful educational radio depends on skilled field leadership, extensive promotional activities, and continuity in format and broadcast time.

Hindley (1972) discussed the radio and visual education network developed in Canada for their Indian and Eskimo populations. The system uses two-way signal side band radio on the reservation under

the direction of the Indian people. The article also discussed possible applications to urban areas where people suffer from lack of information.

An overview of the Radio Rural Forum in India is provided in Schramm (1967). He discusses the original Poona pilot project conducted in 145 villages in 1956. The project was well staffed and a detailed evaluation was conducted by the Tata Institute in Bombay. Conclusions reached by the evaluation team indicated that there was significant learning by forum members, that villages with forums were more active than non-forum villages in starting community projects, and that the forum was beneficial to the illiterate as well as the literate members of the community. After the conclusion of the Poona project the forums continued on a nation-wide basis. Schramm points out that although the forums are considered generally successful, none have come up to the standards reached at Poona. Reasons include insufficient funds and personnel, and the great difficulties experienced in such a widespread effort. Nevertheless, India's experiences provide important lessons in the use of radio as a force for community awareness and involvement in developing countries.

Sitaram (1969) completed a study on whether radio increased the awareness level of the rural Indian population. He found that awareness of political, cultural, religious and family issues was greater in villages with radios than in those without radios.

Jain (1969) investigated theoretically and empirically the functions of group radio listening, discussion, decision, commitment, consensus

on the effectiveness of Indian radio forums. Theoretical conceptualizations of radio forums and the predicted role of group discussion, group decision, and the public commitment is rather well supported by the data. However, he was not able to demonstrate the usefulness of private commitment and group consensus.

Kahnert (1967) reported on the regular broadcasting of an educational radio program for adults in Togo, where villagers gathered in listening clubs under the direction of a club leader to hear and discuss the programs. The programs which were broadcast were in French and two of the local dialects, covered five general content areas.

The project began in 1964 and by the end of 1966 had more than 1,000 active clubs participating. There has been no formal evaluation of the project, however, it appears that despite difficulties due to financing, coordination, and communications with club leaders, a meaningful dialogue has been established between the administrators and workers in the villages.

A study of the Farm Radio Forum Project of Ghana was conducted by Abell (1965). This project was carried out in eighty villages divided into four groups; two experimental and two control villages. Through pre and post broadcast questionnaires, it was found that the listening groups contributed to villagers' comprehension of inter-village cooperation, formation of cooperatives, and food nutrition.

LePiane (1967) reported that Niger is conducting an experiment in the use of radio to improve communications between the villagers and the administration. Broadcasts and follow-up club discussions deal with topics in education, social awareness and civic awareness.

The project emphasizes a strong feedback and evaluation system and programming reflects needs identified by the clubs. Despite initial problems of a cultural nature which include shyness in front of a microphone, lack of strong village chief support, and fear on some local governmental levels, the program has become an important part of village life.

The extension of the forum through the use of two-way radio in Senegal is discussed in an article by Cassirer (1970). Broadcasting in Senegal has become more than an instrument for the dissemination of information, entertainment and instruction. Through this two-way communication medium villagers have begun to assume an active political role in the country.

Radio Schools

"Accion Cultural Popular" (ACPO), was established in Colombia in 1947. Broadcasting as "Radio Sutatenze" it has become the most important institution in the field of popular education in Colombia and is a model for the promotion of rural development in all Latin America. ACPO (1973) now comprises 250,000 registered students, and nearly 20,000 radio schools throughout the country.

Primarily directed toward isolated peasants, ACPO provides a fundamental and integral educational system. Schools are founded and organized by local peasant leaders who receive training in two special institutes located at Sutatenza and Caldas. Radio broadcasts provide special educational programs for the schools as well as entertainment, radio theater commentaries, news, and music. There are also five instructional booklets, a weekly newspaper, and a Peasant Library offering low cost opportunities for the peasants to practice and improve their acquired knowledge.

Esteban Musto completed an in-depth study of ACPO in June, 1971, under the auspices of the Deutsches Institut für Entwicklungspolitik. His results indicate that ACPO has led to important improvements in the life of the peasants.

The results of the field study are not sufficient to evaluate, in a strict sense, the educational activities of ACPO. Nevertheless, they are sufficient to draw some relevant conclusions regarding the structure of the scope and character of influence exercised by the institution. The radio schools exercised their greatest impact in the field of explicit behavior of peasants and not in the field of teaching to read and write or in the attack on the traditional mentality. . . . Investigations confirm that ACPO has achieved great improvements in the level of subsistence economy. Its latent effects may contribute to the encouragement of other public and private ideas to promote rural development.

Research completed in April, 1972, by Stephen Brumberg, funded by the World Bank, provides an excellent overview of ACPO's experiences. Some of the findings were:

1. A mass media educational program coupling radio, printed materials and local staff appears to be effective in teaching campesinos (peasants) to read and write.
2. Multiple media must be employed in a coordinated manner, and personal contacts must be eliminated.
3. The educational content of a mass media program needs to be practical and motivational, applicable and applied.
4. In a mass education program that seeks to treat the "whole man" a clear ideological stance is important.
5. A mass education program must gain the support and approval of the local power structure if it is to be effective within given communities.
6. Mass media educational programs require effective feedback mechanisms to ensure that the right messages are being broadcast, that they are being accurately perceived, that a loyal listening audience is being built up, and that the learning offered is put into practice.
7. A mass educational program is a long term effort and depends in large part on the presence of other development inputs into rural communities.

In large part, ACPO demonstrates the effectiveness of a mass media based educational program as a major complement in rural development efforts."

Radio schools based on ACPO have been established throughout Latin America and many of these organizations rely on Sufatenza for training and help. Representatives from Latin American countries, Canada, and

West Germany attended an ACPO sponsored conference in September, 1972, at which an international organization of radio schools was established.

Accion Cultural Popula Hondurena (ACPH), Honduras, uses radio for literacy and basic education training. (Lyle, 1967) Beginning and advanced cycles are offered using radio as the primary instructional mode with adjunct textbooks for literacy and arithmetic. Results of the experiment have been encouraging, however, problems in organization, financing, repair, and control of examinations, made it difficult to draw firm conclusions about the program's effectiveness.

Classroom Uses

In addition to the special attention given to radio forums and schools, experiments with radio for use in the regular school system have been carried out throughout the world.

A comprehensive look at the system in Thailand was reported by Schramm (1967). Educational radio which began in Thailand in 1958, has been favorably received. Programs are broadcast for grades one through ten for teachers, and there is a home program aimed primarily at parents. Teachers are supplied with scripts of the programs and instructional guides.

Koomsai and Ratanamangkala (1960) conducted a series of controlled experimental studies in Thailand schools. Student performance was significantly improved in the areas of music and social studies. Although no significant difference was found in the two grades tested for ability to

understand spoken English, there were differences shown in the students' ability to write English. Since the experiments Thai officials have greatly revised the English programs.

Kenya has used radio in teaching science in the upper primary grades since 1964. Ball (1971) described the development of the project and identified problems and steps taken to solve them. Studies have been conducted concerning the children's attention span and techniques have been developed for getting the children's attention and coordinating the broadcasts with pamphlets and simple experiments. Eighty percent of Kenya's upper primary children are currently using the broadcasts.

Hulsen (1967) reported that radio education in Korea began in 1951 as an emergency wartime measure. School participation was low partly because only fifty to fifty-five percent of the schools were equipped with suitable receivers and partly due to pressure of the National Middle School Examination which put great emphasis on facts and rote memorization.

In Italy radio is used to supplement classroom instruction in primary and secondary schools. Guarrera (1972) provided a description of the program and reported results of a survey to determine the extent to which radio was being used. A periodical is regularly sent to teachers describing upcoming broadcasts. The results of the survey indicated that 68% of Italian primary schools and 36% of the secondary schools use the broadcasts. It was also found that rural and small urban areas make the most use of radio.

Correspondence

Radio as a regular part of correspondence study has been used in Japan since 1951. In 1961, the Japan Broadcasting Corporation founded a correspondence school to study and perfect techniques of radio and television integration with correspondence education. The school, as described by Schramm (1967), consists of a four year high school course including radio (or television) broadcasts, textbooks, workbooks, papers, and reports to be submitted, and a special twenty-day per year in-school session. Formal evaluation has been limited but results seem to indicate that the broadcast correspondence school is at least as effective as normal school.

Ewing (1967) discussed the two forms of educational radio used in New Zealand. The first is an adjunct to the regular correspondence school and the second is a series of regular school broadcasts. Although no formal evaluation has been done there to assess the effects of radio, students from the correspondence schools do well when they transfer to regular schools, and informal reports from parents and teachers indicate that radio is effective as used in the regular school system.

The role of radio in Australia's correspondence schools, as a supplement in the regular schools, and the radio university are described by Kinane (1967). 95% of Australian schools have radio facilities and make use of some of the thirty different weekly programs. The programs are coordinated with the regular curriculum and the correspondence school.

There has been no formal evaluation of radio's effects in either the correspondence school or the regular school but they are considered generally helpful.

The Radio University operated by the University of New South Wales offers graduate studies, professional non-credit courses, general interest courses, and a college preparatory program. In addition to regular radio broadcasts, tapes of the series are available. The broadcasts are supported by printed notes and a seminar held at the university at the end of each course sequence.

Other International Examples

Brazil is engaged in a project (Minerva Project) to supplement the work of the regular educational systems by providing education for adolescents and adults (Medici, 1972). The project is designed to reach all levels of education, and has a broad pedagogical and professional orientation. In addition to individual use, the project has organized groups of twenty-five to thirty students under the direction of a monitor and has provided supplementary written material for group use.

Funtan-Pueyo (1971) suggested some possible uses for instructional radio in Venezuela. His study focused on applications of radio as part of a multimedia program including television and filmstrips in adult education and family planning.

Experiments have been conducted in Africa on the instructional uses of radio. Inqoui (1964) reported that Ethiopia has experimented with

radio as an aid in general community education. The project includes literacy training for adults, information on health and agriculture, and entertainment for adults and children. Dahomey's educational radio project, which is being assisted by the Office de Cooperation Radiophonique, Paris, was described by Tevoedjie (1969). The article outlines the project's current programs and its plans for future expansion.

Griffith (1967) reported that the government of Malawi has supported the development of educational radio. Facilities are limited and attempts are being made to make the system self-supporting. Programming centers on agriculture, rural development, public health, literacy, adult and formal education. Problems include lack of suitable equipment and lack of receivers among the native population.

LeFranc (1967) reported that radiovision is used as part of a large literacy program in Niger. There has been no formal evaluation of the program and no assessment of the effects of the radiovision segment. However, between fifty to sixty percent of the students who begin the program finish and gain the ability to read and write in their vernacular, count and do basic arithmetic, and speak elementary French.

Ruiz (1971) described a Spanish experiment designed to encourage small rural townships to develop an interest in their cultural heritage.

A study of radio as a solution to some of Jordan's educational problems was conducted by Alami (1965). The objectives of the study were to locate, describe, and analyze the major educational problems and needs of the Jordanian educational system which could be alleviated

by the establishment of a national in-school radio service.

The Cyprus Broadcasting Corporation was described by Christofides (1969), in terms of the laws and regulations which brought it into being. He defined its activities and the provisions for its financial support. Special attention is given to the relationship between the corporation and the Ministry of Education, who jointly produce educational radio and television broadcasts on a regular basis.

Radio Research

Attitudes and Psychological Implications

While not directly related to education, much can be learned from research on commercial radio that focuses on listeners' attitudes. Link and Corby (1939) collected evidence which showed that the size of radio audiences was not a reliable measure of the effectiveness of the programs in selling a product.

They summarized many radio advertising studies made by the Psychological Corporation revealing primary emphasis on the qualitative rather than quantitative aspects of radio programs. This emphasis has usually included a measure of the extent to which the program stresses desirability of the product upon the mind of the listener, and a measure of the extent to which these impressions are being converted into new customers. Another study done by Psychological Corporation in 1933 compared the relative effectiveness of four important media - radio, newspapers, magazines and billboards. In some product areas radio

appeared to be the most effective medium. Other studies of radio audiences indicated that when popularity of the various programs was computed, major differences were discovered between upper and lower income levels.

Link and Corby also gathered information about educational broadcasts. Their method was based on personal calls. The results showed that the more strictly educational stations had very small audiences, and the listeners designated as "educational" a substantial number of commercial programs which had hitherto been thought of primarily as entertainment.

For many practical purposes in radio research it is necessary to judge what radio means to different groups of people. Olbry and Smith (1939) developed an index of "radio-mindedness." They describe the procedure for deriving the index in detail, and show the consistency of the index. It was found that men are less radio-minded than women, and older people less than younger people. There exists a strong positive association between radio-mindedness and actual listening and a negative correlation between radio-mindedness and interest in cultural programs.

Roos and Heil (1939) measured listeners' attitudes toward a radio art appreciation course for college students. Illustrations of all the works of art discussed were printed in pamphlet form and were available to listeners upon request. For evaluation of the course a questionnaire was sent to approximately 750 people who had written for the pamphlet.

125 questionnaires were returned by the listening group. Any interpretation made of the results involves a doubly selected group of listeners. The data indicated that the listening group seemed to like the broadcasts, but that not much had actually been learned as a result of the broadcasts. This inference may be documented by the relatively low percentage of desirable responses to questions of the objective type and the relatively high percentage of desirable scores on questions of the subjective type.

In order to obtain a more accurate evaluation of children's reactions to certain types of radio programs, a dictaphone was set up in a New York 5th grade classroom to record the pupils' actual comments during a classroom discussion. From the annotated excerpts, O'Brien (1941) concluded that in a literature radio series, children want good stories, accurate portrayals, adherence to the plot, plots which have depth and are well organized, good diction, good sound effects, and good background music.

Henderson (1968) conducted an opinion survey of high school mathematics teachers in Wisconsin on the basis of one fifteen minute broadcast. Comments on fifty-nine returned questionnaires indicated that the broadcast was successful because of the quality of the experimental program. All fifty-nine teachers answered "yes" to the question, "Do you feel that future radio broadcasts can be of value to you during your teaching high school students the subject matter of mathematics? "

Britt (1938) emphasized two principles in educational broadcasting: those principles of the learning-remembering process which are inherent in any type of educational situation, and those factors of learning-remembering which are peculiar to radio education and differentiate it from classroom education.

Obviously, there are fundamental differences in "mental set" between classroom listeners and radio listeners. A multitude of other factors differentiate a known, visible, and rather homogeneous classroom of students from a group of unknown, invisible, and heterogeneous listeners. Also, polarization toward the speaker is very limited in educational broadcasting. Britt suggested that radio educators camouflage the program somewhat with materials high in entertainment value and sustain interest by encouraging listeners to take notes and send in questions.

Robinson (1940) presented a preliminary report on factors in radio listening after investigating a large-scale factor analysis of program preferences with 146 Princeton University students for eighteen types of radio programs. The eighteen kinds of programs produced three factors. The programs with a significant loading on the first factor either emphasized or directly involved drama of some kind. The second factor was more difficult to see. As a rather wild speculation, it was named as an "inspirational" factor, involving awakening, quickening, a sense of the meaning of things. The third factor was not large enough even for speculative purposes.

Nias and Kay (1954) reported an experimental study concerning immediate memory of a broadcast feature program. The aims of the experiment were to find out how much of a lengthy feature program could be remembered shortly after being heard, to examine how remembering differed for various types of material, and to relate this remembering to the intelligence, occupation, age, and sex of the subjects.

After playing a record of a half-hour program which presented information about the legal rights and responsibilities of innkeepers, the group of eighty-one subjects completed a short questionnaire which was followed by a brief discussion. Thirty specific questions were answered and a fifteen-minute intelligence test was taken. Eighty percent of the answers on the story were accurate and fifty percent of the legal points and trivial details were correct. The group with the highest intelligence test score, scored 70% on law and trivial questions, and the lowest group scored 20%. The range among groups was limited for the story items; from ninety to seventy percent. There was no difference in the scores of men and women.

Experiments by Allport (1935) involved a comparison of the mental processes of an audience listening before the radio and of the same audience when it is in the physical presence of the broadcast. Two equivalent small audiences of six persons each were used. One audience sat before the broadcaster, while the other audience received the broadcast in another room. The subjects in these two situations were administered

tests for several mental processes and abilities. The chief difference between these controlled experimental situations was the absence of emotional appeal for the loudspeaker group. Results indicated that the face-to-face situation seemed to have a facilitating effect upon attention and mental work.

Hartlage (1936) investigated the differences in listening comprehension of the blind and sighted. Fifty blind and fifty sighted high school students in various states, matched according to age, sex, and intelligence with the aid of several tests, listened to a recorded prose selection. When tested for comprehension of material, no statistically significant differences were found between the groups, however, the variable of intelligence for both groups correlated highly with comprehension scores.

Effectiveness

Available data on radio as an instructional device indicate that it can be highly effective. Studies have been carried out in classrooms with radio playing varying degrees of importance, in industrial and vocational education, in career education, in professional education, as an aid in community development projects, and as a motivational aid.

To find out the types of lessons or demonstrations that can be presented successfully by radio to pupils, Dickson (1924) carried out an experiment involving eight lessons for 7th through 10th graders. Dickson's primary purpose was to investigate the possibility of radio programming as a supplementary service in addition to classroom teachers. The results

were positive and Dickson suggested that through radio it would be possible to plan for more effective use of standard tests and measurements. A period of twelve to fifteen minutes seemed to be about the maximum time that instruction should be given without some break.

The Chicago public schools, through the Chicago Radio Council, broadcast to schools each week nine fifteen-minute radio programs. Reid (1940) evaluated the effectiveness of the above series in achieving certain educational objectives. The experiment was designed to answer the question, "To what extent does the series of programs, plus the teachers' utilization of them in the classroom, stimulate reading interest?"

Changes in reading interests in terms of amount of reading and writing ability were measured by a reading interest questionnaire administered to the students before and after the experimental period. The series of radio programs failed to increase reading interests. The author stated that one of the reasons for this result may have been that the experimental period of six weeks was too short a time in which to expect changes. However, the series of programs did stimulate the students to read more books.

The St. Louis Vocabulary Development Project was developed to help children cope with the increasing vocabulary demands in content areas encountered in the 4th through 6th grade. Reports by Kottmeyer (1970) and the St. Louis Public Schools (1971) indicated that: 1) the project

had positive effects on measured achievement growth in general vocabulary and spelling, and on reading achievement and intelligence, 2) the effects on achievement variables were greatest for students in predominantly black schools, and 3) teachers favored the project.

In 1965, ten Negro and Puerto Rican girls received clerical training for eight weeks using Gregg audio materials adapted to a machine technique. In the preliminary report of the prototype system of simultaneous, multi-level, multiphasic audio programming, Adams (1968) suggests the feasibility of FM radio broadcasts for reducing costs by making training available to large numbers of trainees.

The National Institute of Health (1970) used radio as a recruitment tool for the health occupations. They hypothesized that the broadcasting approach would better attract students, particularly minority students, to a professional career.

Eleven science classes, in high schools having large percentages of minority students, participated in the San Francisco area. The students participated in two-way radio broadcasts with a radio lecture followed by a question and answer period.

Although attendance figures and other statistical data were incomplete, the project staff reported that the programs were extremely effective in producing initial interest and enthusiasm in both students and counselors, and in giving minority students a feeling of being needed and wanted in the health professions.

The Department of Postgraduate Medicine of the Albany Medical College in New York (1967), with government support, investigated whether knowledge and skills of practicing physicians in solving diagnosis and treatment problems were affected by two-way radio instruction. Developed as an instructional and data-collecting device, the new radio instruction has been designated a "Diagnosis and Treatment Conference."

For the analysis of the project 7,315 doctors who participated in the Albany network presentation, were pre and post-tested on twenty diagnosis problems. The data indicates significant improvement and that the practicing physician performed better on the tests than the resident and intern. Those physicians working in a hospital with a bed capacity of one hundred or less showed the greatest improvement in diagnostic ability.

Early (1972) provided a full description of the broadcasting and operation of WHRS-FM which serves migrant workers and their children. The goal of the project was to evaluate FM radio as a solution to the serious problem of communicating with the migrant family. Specific aims included reducing children's absenteeism and increasing the participation of the family in school-related activities.

Radio education was given to children and adults at different times. Comparative data about absenteeism and test scores were maintained for a control group in 1969-70 and measured against the data for 1970-71. Dairy information about students' and adults' participation in broadcasting

and learning achievement was provided by teachers. Children and adults both showed interest in the radio education program and average daily attendance of students showed a definite increase.

The Workers' Educational Association and the BBC local radio station in Liverpool jointly prepared an educational radio series for working class adults. Jones and Lovett (1971) described the setting, conduct, and results of this research project.

The project was conducted under the hypothesis that cultural education by radio can help adults who have not had good experience in School. The objectives for the series were an extension of vocabulary, critical awareness, and the use of concepts and action. Reports from tutors indicated that the vocabulary building objective had been generally achieved in all the groups and that critical awareness was achieved in some cases. Several of the tutors commented that their groups were so unfamiliar with the subjects that they lacked the confidence to express their ideas which might have ultimately led them toward the perception of the concepts.

The student radio station at Morehead State University in Kentucky (1970) conducted a community service and continuing education project through broadcast utilization. The major emphasis was to determine to what extent the senior citizen, through visits and radio broadcasts, could be motivated to improve his cultural and educational aspirations. The programs were designed for retired teachers and business and

professional people. The reactions to the radio broadcasts were solicited in informal interviews with participants. Evaluative comments were not entirely favorable, although a series on music and a "talkback" series were well received. The project, in general, was found to have significant positive impact.

Edward and Peek (1970) investigated radio listening to reinforce operant responding. Four conjugate contingencies were used: contingent listening, contingent removal, free listening, and no listening. Results indicated that radio can act as an effective reinforcing event.

Comparisons of Radio with Other Media

In addition to studies evaluating radio's effectiveness as an instructional device, comparisons have been made of performance achieved with radio instruction and performance using traditional classroom or other media methods.

McLuhan (1964) discussed differences between TV and radio.

In a group of simulcasts of several media done in Toronto a few years back, . . . four randomized groups of university students were given the same information at the same time about the structure of preliterate languages. One group received it via radio, one from TV, one by lecture, and one read it. For all but the reader group, the information was passed along in straight verbal flow by the same speaker without discussion or questions or use of blackboard. Each group had half an hour exposure to the material. Each was asked to fill in the same quiz afterward. . . . The students performed better with TV - channeled information and with radio than they did with lecture and print - and the TV group stood well above the radio group.

Since nothing had been done to give special stress to any of these media, the experiment was repeated with other randomized groups. This time each medium was allowed full opportunity to do its stuff. For radio and TV, the material was dramatized with many auditory and visual features. The lecturer took full advantage of the blackboard and class discussion. The printed form was embellished with imaginative use of typography and page layout to stress each point in the lecture. All of these media had been stepped up to high intensity.

Television and radio once again showed results high above lecture and print. Unexpectedly to the testers, however, radio now stood significantly above television. It was a long time before the obvious reason declared itself, namely that TV is a cool, participant medium. When hotted up by dramatization, . . . it performs less well because there is less opportunity for participation. Radio is a hot medium. When given additional intensity, it performs better. . . .

A cool medium, whether the spoken word or the manuscript or TV leaves much more for the listener or user to do than a hot medium. If the medium is of high definition, participation is low. If the medium is of low intensity, the participation is high. . . . Because the low definition of TV insures a high degree of audience involvement, the most effective programs are those that present situations which consist of some process to be completed. . . .

William, Paul, and Ogilvie (1957) conducted a study on retention in relation to four different media. They presented the same abstract lecture simultaneously to a TV studio audience, on TV, on radio, and in print to four groups of college students matched for grade average. Each group took a thirty-minute multiple-choice examination immediately after the lecture and again eight months later. TV, radio, and reading ranked in that order of effectiveness and the order was unchanged eight months later. Those in the studio did no better than the reading group.

Gaskill (1933) conducted an experiment to determine the relative effectiveness of broadcasting and lecturing to college students. Two 21-minute talks were broadcast to two groups of sixty-five college students at one week intervals. For the first talk, Group A listened to the speaker at the studio and Group B listened by means of their own radio receiver on an individual basis. For the second talk, the groups exchanged positions. Three days after each of the two talks all of the subjects were given an objective examination. The same examinations were given to three classes of persons who did not hear the talks. Scores on the examinations indicated a small but significant superiority for the broadcasting group. Every individual had a higher score on the examination following a radio presentation than on the examination following a studio lecture.

Cook and Nemzek (1939) reported a study measuring the educational value of instructional radio programs for intermediate school pupils. 8th and 9th graders were taught using fifteen educational programs on local radio stations. Another group with similar characteristics was taught the same lessons but not permitted to listen to the broadcasts. From pre and post-test data the authors concluded that lessons taught by means of radio effect definite changes in pupils, and that the radio certainly should be used as an instructional device.

Miles (1940) investigated the effectiveness of radio programs as a supplement to classroom science teaching. Ten pairs of classes, five from the 5th grade and five from the 6th, were selected with each pair

approximately alike in intelligence, reading ability, age, and sex. The differences in mean gains of the radio and non-radio classes were examined by grade level and sex. The mean scores of the radio classes showed that a significant increase in information and a significant shift in attitudes occurred during the semester, and that the radio classes which spent the most time in utilizing the broadcasts were the only radio classes showing a gain in interests.

Barr, Ewbank, and McCormick (1942) reported the results of a Wisconsin research project in school broadcasting for grades 5 through 8. Objective findings yielded mixed results with few of the differences between radio and control groups statistically significant. Subjective data from questionnaires, letters, and interviews favored the radio lessons. Evidences of continued interest included increased enrollment, purchase of teacher's manuals, and requests for extension of radio facilities.

Rothney and Hansen (1947) reported a University of Wisconsin exploratory study conducted with 446 experimental and 403 control children to determine the effects of a radio program designed to teach children to recognize the basic value of the individual, to judge people by their own merits, and to overlook differences of race, religion and color. The data indicates that 97% of the pupils liked the broadcasts, 75% of the teachers thought that the program produced better pupil thinking and action, factors such as race, nationality, religion, or economic status were not important in the pupils' choice of the radio characters as friends, and that there were significant differences between

listening and non-listening groups of pupils in favorable attitudes toward members of groups other than those of which they were a part. The authors stated that measuring devices were crude and lacked subtlety. Also, there were no longitudinal data from which we might discover trends in the development of attitudes.

The effects of high frequency AM radio on learning of structural drills in Spanish were studied by Cook (1964). Personal receivers for each student were used. The broadcast consisted of Spanish drills and a limited amount of text material programmed in a stimulus-response pattern. Several measuring instruments were employed. The experimental group was given considerably more drill and did better on tests, however, there was no true control group since it received some of the experimental treatment.

Uslan (1965) used short wave radio broadcasts to teach geographic and related physical science concepts to 5th grade students. The experimental group achieved significantly higher post-test scores than a control group.

Garfinkel (1970) studied the effects of an enrichment oriented radio program in high school Spanish courses. His experimental groups consisted of students listening to the radio broadcast and students who listened to a tape of the broadcast. There was a control group which received neither audio input. The programs were broadcast for two semesters. Results of post-testing showed no significant differences

between the groups in listening comprehension and barely significant differences in attitude.

Banister (1970) compared the effectiveness of two American history courses for college students taught by different multimedia methods. For one group of students the instruction consisted of taped lessons accompanied by filmstrips, student response sheets, and seminars. The experimental group received thirty-minute FM broadcasts three evenings a week, which were supplemented by illustrated printed syllabi. The latter half of each program was devoted to a group discussion at which time the instructor would discuss the contents of the program while the students phoned in questions. Both groups had textbooks and other reading assignments.

Despite all efforts to publicize the course, initially only seven individuals enrolled for the radio course, and only five of these students completed the course. Evaluation instruments included three objective question tests, two mid-term tests, and one final test.

This study, though limited by the small size of the population, demonstrated that radio broadcasts with printed illustrations and student response sheets was as effective as an on-campus multimedia program utilizing tapes, film-strips and student response sheets.

Taylor (1972) conducted a radio program devised to assist regular classroom teachers, in four elementary, three junior high, and three senior high schools, using a total of 274 students, to improve the

communication skills of the students. This investigation attempted to determine the motivational capability of the radio when used as a reinforcement stimulus in the classroom, and to determine whether or not radio could be utilized to improve communication skills.

All of the subjects were attending schools in deprived neighborhoods in Washington, D. C. The subjects were divided in an experimental group of 180 pupils and a control group of 94 pupils. The program consisted of broadcasting four different sound programs to the four grade levels. Results of a semantic differential scale administered to the experimental groups of students on variables of attitude and judgment toward the overall radio broadcast were summarized. Besides the scale, questionnaires, interviews, and classroom observation forms were completed.

The data suggested that the broadcasts generated an enormous amount of interest among students. There was an important variation among the groups characterized by a more intense involvement at the senior high level and less involvement at the primary level as the program proceeded.

Maximizing Effectiveness and Needed Research

Most of the history of radio research reflects little emphasis on maximizing a radio broadcast's impact. There is a need for careful study of what factors make some instructional radio programs effective, others mildly effective, and some outstanding.

Jay and Middleton (1941) discussed some of the problems encountered in developing a radio research laboratory. They criticized research on the psychological problems of radio because of poor laboratory conditions. A model of a radio laboratory designed to overcome some of these problems was presented.

Tyler (1937) suggested four major functional areas of research in classroom broadcasting. The first concerns the outcomes of classroom broadcasting and what we may expect to be accomplished. The second area involves the means of facilitating the outcomes to be achieved. Research in evaluation in relation to school broadcasting is the third field. The final area is that involving the coordination and selection of facilities for making effective use of radio. Several research studies are discussed, but lack of adequate data in all these fields, particularly in relation to evaluation, is retarding progress in school broadcasting. Unfortunately, in the ensuing thirty-six years, little has been done toward answering Tyler's questions.

Costs

One of the best reviews of the costs involved in an educational radio project is included in a book summarizing an extensive UNESCO project to study educational media worldwide (Schramm, Coombs, Kahnert, and Lyles, 1967). The review includes initial costs, relationships between costs and amount of use, unit costs, production costs, and examples of methods for reliably estimating expenditures. Estimates

for initial investment range from \$100,000 if existing facilities are limited to \$25,000 to \$50,000 if existing facilities can be extensively used. Comparable figures for educational television range from \$38,000 to \$8,000,000.

Unit costs for school broadcasts where radio provides a substantial part of the educational program can be as low as one to two cents per pupil-hour. This compares to five to fifteen cents per pupil-hour with television. Jamison and Klees (1973) reported cost data on eight different projects involving media. These include five television and three radio projects. The costs per student-hour for radio ranges from \$.0041 which is estimated for Indonesia, to \$.058 for Mexico. Radio forums in Togo (152 forums) cost thirty-two cents per listener-hour. With 1,000 forums, the cost for forums in Togo is estimated to drop to six cents per listener-hour. India with 2,000 forums spends nine cents per listener-hour. In Japan, where the average annual cost per secondary school pupil is about \$349, the cost of correspondence-plus-radio is estimated at \$91 per pupil per annum. Correspondence-plus-television is estimated at \$148 per pupil per annum.

Sovereign (1969) conducted a careful analysis of factors affecting costs of media uses in instructional settings.

Bourrett (1971) presented arguments in favor of radio over television as a low cost alternative for reaching rural areas. He cited the fact that installation and programming costs for television are three to five times that of radio.

Certainly there is agreement that radio costs considerably less than television and less than traditional classroom instruction. If the audience for the radio broadcasts is sufficiently large then the costs for development of the radio lessons can be spread over these listeners to get a low per person cost.

PROCEDURES

It is clear from the review of the literature that radio can be used effectively to teach a variety of subjects under a variety of circumstances in developed and developing countries. Radio has been successfully used not only to teach knowledge and information but also to increase various skills of the listeners. If one is to believe the trends in advertising, it is also true that radio can influence the decisions people make in obvious choice situations. While the literature seems to indicate the effectiveness of instructional radio, there is a lack of carefully controlled experimentation designed to examine the numerous variables involved in radio-delivered instruction. Thus, there is only scanty empirical evidence available to guide the development and implementation of radio-delivered instruction as a central system of education.

A series of research investigations is necessary if developing nations are to make full use of radio-delivered instruction in both formal and non-formal settings. The factors that contribute to an increased effectiveness of radio-delivered instruction need to be identified and analyzed in terms of relative costs and benefits. These include techniques for developing the content of the radio lesson, the use of different forms of supportive printed materials, the use of people as *presenters*, as monitors, or ^{as} discussion leaders, and other such factors. The series of investigations that are proposed do not seek to compare radio with traditional instruction or some alternate medium but rather seek to answer the question, "What can be done to maximize the effectiveness of radio-delivered instruction?"

In order to examine the potential of radio as an instructional medium it is necessary to classify various methods of use and then plan systematic investigations to determine the conditions under which the methods are effective.

The term traditional radio (TR) will be used to refer to radio presentations developed using techniques available prior to 1960. Programmed radio (PR) will be used to refer to radio broadcasts that are prepared according to the general empirical approach used in programmed instruction. This approach includes the use of behavioral objectives, use of overt/observable responses where necessary, and the tryout and revision of materials until they reach prior-specified goals.

Both TR and PR can be accompanied by instructional materials to be used in conjunction with the broadcasts. These materials could be textbooks, workbooks, diagrams, notetaking guides, or physical displays that are used to facilitate learning. The use of such accompanying material is called materials support (MS). It is not uncommon to find the use of materials support in radio projects, however, there is a lack of research data to support the use of materials or to indicate what type of material can best be used in teaching various skills, knowledge, or attitudes by radio.

Each of the four categories developed so far (TR, PR, TRMS, PRMS) can all have additional people support (PS) at the point of listening. There are numerous examples of the use of teachers, priests, or village leaders to monitor the radio broadcast, lead discussions, ask questions to reinforce

the points made in the broadcasts, and perform other instructional activities. Some research on traditional radio has indicated that PS is one of the more important variables contributing to the past success of TR. While all of these variations in the use of radio are interesting from a research point of view, some outcomes would be much more desirable than others for field application purposes. If it were true that traditional broadcasts without people or materials support were as effective as programmed radio with people and materials support, then costs could be reduced dramatically. Past experience and the existing research literature have cautioned us not to be optimistic - more successes have occurred with the more complicated and expensive applications.

Programmed radio has not, to our knowledge, been tested. Experience with programmed texts, programmed I-TV, and programmed multimedia presentations has indicated that the empirical development methodology has been effective in improving performance in all areas tested. Certainly there is reason to believe that these same principles will be effective in improving radio instruction.

In considering the question of how to maximize the effectiveness of radio instruction, it is important to also examine the various types of learning that can result from instruction. Gagne (1971) has provided a useful classification of these different kinds of learning. He has divided the outcomes of learning into five domains: motor skills, intellectual skills, verbal information, attitudes and cognitive strategies. Recent research seems to indicate that different conditions influence learning in the five different domains. The necessary instructional

conditions for teaching knowledge or verbal information are different from the conditions for teaching intellectual skills. In the investigation of radio-delivered instruction, it will be necessary to examine the effectiveness of the radio in teaching in these different domains.

There are a number of other questions concerning the effectiveness of radio-delivered instruction that must be further investigated if the radio is to be fully used in developing countries. These questions concern such matters as the age of the listeners, their degree of literacy, the setting of the listeners (rural/urban - formal/non-formal), and certain cultural factors that may influence the acceptability of radio-delivered instruction. Obviously, these questions could only be investigated in field research studies conducted in developing countries.

In order to adequately investigate radio-delivered instruction two series of studies are proposed. The first phase consists of carefully controlled studies conducted in an English speaking developing country in the Caribbean under experimental conditions. The use of a country such as Jamaica would allow easy movement of persons to and from Florida State to assist in the research and for training purposes. The research should be conducted in a location that would allow sufficient rigor in controlling the experiment to maintain high internal validity. In addition, the setting and learners should be in a developing country to maintain necessary external validity of the experiments.

The second phase consists of the specific application of the most promising findings from the first phase of research. This second phase

would be field studies conducted in other developing countries in Latin America, Asia, and Africa. The following paragraphs discuss these two phases.

Phase I Research Design and Methodology

Phase I will be the basic tier of studies designed to investigate several dimensions of radio-delivered instruction under controlled experimental conditions. These studies would compare the effectiveness of traditional radio and programmed radio using combinations of materials, support and people support. These comparisons would be done for four different domains (motor skills, intellectual skills, information and attitudes), in several subject areas (mathematics, science, vital life skills) including non-academic topics. This basic design configuration is presented in Figure I.

The independent or manipulated variables in this phase are the instructional dimensions presented in Figure I. The dependent or measured variables include criterion measures of performance or amount of learning, time to reach criterion, attitudes, and transfer of learning. Several measurement techniques will be used to measure these dependent variables. Criterion-referenced test exercises will be constructed to measure the amount of immediate learning. A detailed listing of the independent and dependent variables is found in Appendix A. This appendix outlines the various dimensions of the variables influencing learning from audio media.

FIGURE 1
Basic Research Design

	No People Support			People Support Instructional			People Support Monitor		
	NMS	MS dev	MS pub	NMS	MS dev	MS pub	NMS	MS dev	MS pub
Traditional Radio									
Programmed Radio									

NMS - No materials support

MS dev - Specially developed materials support

MS pub - Published materials support (texts, etc.)

The intent in this research is not to compare an individual with other students in the study or with some reference group as in norm-referenced measurement, but rather to determine if the student has reached the specific objective that the radio broadcast was designed to teach. An adequate accounting will be done to determine the time and costs of providing instruction. Using this data, indicators of the relative cost-effectiveness of the instructional dimensions will be computed. In addition, unobtrusive measures, such as observational techniques, will be used to determine the degree of application of the learning (transfer of training) and attitudes towards learning from radio.

An additional area of interest to be explored in Phase I of the research is the topic of aptitude-treatment interactions. Measures of several aptitudes will be collected and analyzed to determine if there are ordinal or disordinal interactions of instructional dimensions and students' aptitude. Significant interactions, if found, would indicate that the various instructional dimensions (TR, PR, PS, MS) have a differential effectiveness for students of different aptitudes. This data would provide some criteria for the differential assignment of students to various types of radio-delivered instruction. The examination of aptitude-treatment interactions is not the primary intent of the studies being proposed but is of sufficient interest to be investigated.

As a result of the research in Phase I, many questions concerning radio-delivered instruction can be answered:

- Is PR more effective than TR?
- Can PR & TR be used to teach objectives in the various domains of learning?
- Can PR & TR be used to teach various subject matters?
- Does the use of materials support improve the effectiveness of PR and/or TR?
- What are the relative costs and benefits of the various combinations of PR, TR, MS, PS?
- Can the effectiveness of radio-delivered instruction be improved by a differential assignment of students to various treatment dimensions according to their aptitudes?
- What are the students attitudes towards radio-delivered instruction before and after being exposed to broadcasts?
- What combination of instructional dimensions (TR, PR, MS, PS) can best teach different types of learning tasks (subject areas and domains of learning) to students of varying aptitudes?
- Is there a difference in outcomes in PS if the person has a passive role (monitoring, distributing materials) or an active role (stimulating, discussion, questioning)?
- Is there a difference in outcomes if the broadcasts are presented to individuals or groups?

Phase I Studies

In order to examine the basic set of independent variables in Phase I. One of the proposed research project, a series of several studies will be necessary. This section describes each study which would be conducted.

Study one will investigate the use of programmed instruction principles in the design and development of radio lessons to determine the costs and effectiveness of this approach. In addition to this main treatment variable, several different options for supporting materials will be examined. These include the use of audio only with no supporting materials, with a specially developed outline and note taking guide, with a printed script, and with a pictorial representation of the radio program.

The content of the programs will be in the domains of information and intellectual skills in the subject areas of life skills and science. Six lessons in each of these subject areas will be developed for use in the research. The lessons will be presented via a tape recorder-loud speaker system to simulate actual radio broadcasts. It is not necessary to actually broadcast the lessons during these research studies since the tape system without stops or playback can adequately simulate radio broadcasts. Students will be selected and assigned at random to the various treatment groups. The dependent variable will be immediate post-test and retention scores on a criterion-referenced post-test measuring the attainment of the objectives the lessons were designed

to teach. Analysis of variance will be used to analyze the data.

The second study will investigate the use of programmed instruction principles and various roles for people support. The people support condition would include the use of a person to: a) monitor the student, b) provide orientation and objectives prior to the lessons, c) provide review and promote discussion following the lesson, and d) provide feedback and evaluation of the student's performance. The content of the programs will be in the domains of information and intellectual skills and in the subject areas of life skills and social studies. Six lessons will be used. Students assigned randomly to each treatment group in this study. The independent variables will be programmed vs. traditional preparation of scripts and the various types of people support. The dependent variable will be student learning as measured by a criterion-referenced post-test administered immediately following the lessons and after a retention interval.

Study three will extend the investigations of the first two studies to other subject areas and include the domain of motor skills as well as information and intellectual skills. This study will use the various materials support and people support conditions found most effective in the first two studies. Study three will require the preparation of more lessons using various combinations of materials support and people support with programmed and traditional script preparation. This study would also examine students' attitudes towards learning from audio media.

Study four will examine the treatment effects of the previous studies for learners who vary in several aptitudes or traits. This study will seek to determine if learners of different abilities learn better under different instructional conditions. A portion of this study will be the analysis of aptitude and treatment data from the previous three studies. The possible interactions will further be investigated by conducting additional studies if this is indicated. Regression analysis will be used for the aptitude-treatment interaction.

The fifth study will examine the effectiveness of various material and people support conditions used with programmed and traditional radio in the teaching of attitudes. The lessons used for this will be in the area of vital life skills with both adult and adolescent learners. This study will explore different strategies for teaching attitudes such as the use of models and reinforcing feedback to the learners. The rationale for this study is that the effective use and implementation of knowledge and skills requires an appropriate attitude or willingness on part of the person to apply the knowledge or skill. Since the person must choose to use what he has learned, this study of the ability of instructional radio to change attitudes is important.

In all of these studies cost data will be collected so that the cost-effectiveness of different treatment combinations can be determined. It may be that certain treatments, such as the use of specially developed materials, result in some performance increments but when viewed in

light of the cost-effectiveness analysis, the additional costs are much greater than the performance gains.

Phase II Research Design and Methodology

Once the basic tier of studies has been done in Phase I, hypotheses about instructional radio can be developed for research and field trials in other developing nations. Phase II of the research will be concerned with making specific applications of the most promising findings from the Phase I research and the literature review. Interest in participating in this project has been shown by the Governments of Ethiopia, Colombia, Panama, Korea, Brazil, Thailand, and Argentina. Scholars, participant trainees, and other officials from these countries who have attended the Florida State University have indicated strong interest in working cooperatively with the Center for Educational Technology in the pursuit of radio research and applications in their countries.

Additional variables to be investigated in the field settings would include:

Formal/Non-Formal: Can radio be equally effective in non-formal as well as formal settings? Are there different conditions that produce effectiveness in a formal and non-formal setting?

Age: What age groups respond best to what kinds of radio programs? Can radio be used as effectively with younger and older listeners by manipulating programming content?

Degree of Literacy: Do people who are not functionally literate learn adequately through the use of instructional radio? Is it economically feasible to offer programs for this population, or would it be more useful to concentrate on literates?

Rural/Urban: What differences in program design, if any, are necessary to accommodate both rural and urban populations?

Cultural Factors: Is radio a more acceptable means of instruction in some cultures than in others? Is acceptability determined by the kinds of programming available?

The studies in Phase Two would also apply and further examine the basic findings from the first phase of the research.

As a matter of research strategy, it is intended that those questions which have the greatest potential impact and which need the greatest experimental control will be studied in the most controllable environment. Those questions which can only be studied in field situations will, of course, be studied there.

Materials Development

In addition to conducting the proposed research in Phase II, CEI will develop a series of instructional materials on vital life skills for use in each of the developing countries. These skills include the topics of sanitation, food preparation, health care, etc. Once these lessons are developed they will be field tested and revised in each country before being used in the research. Rather than develop radio programs solely

for the purpose of answering the research questions, CET will develop and validate programs on vital life skills that could be used in each country.

These programs will be developed according to the principles of empirically developed instruction. These include the statement of objectives in performance terms, the development of scripts teaching these objectives, a consideration of the target audience in the development of scripts, field testing of these scripts, and revision based upon the analysis of the field test data. Appendix B presents a more detailed description of the model used for materials development. There is considerable evidence to suggest that when instructional materials are developed according to such a scheme, the materials are successful in promoting the desired learning in the target population. While the proposed research primarily explores the variables associated with the use of radios to deliver instruction, the development of a series of lessons on vital life skills in different developing countries is also an important goal. If it is possible, as most available evidence indicates, to develop validated instructional programs on vital life skills for selected developing countries in Africa, Asia, and Latin America, this project will have produced very useful and worthwhile products as well as the methodology for future development of validated lessons.

Lessons in other subject areas (mathematics, science, etc.) will be modified from existing instructional materials where possible to

reduce developmental costs. Many of the curriculum development projects in the United States have produced instructional materials in these subject areas that could serve as the basis for the radio lessons. Obviously extensive alteration may be necessary to use such material in this research in developing countries, however, excellent materials do exist that could form the basis for further development. Another source of material is the existing radio programs used in the developing countries. CET would prefer to use these materials and modify them to meet the requirements of the research design.

Selection of Participants

During the past several years CET has successfully established relationships with a number of agencies and people in developing countries who are concerned with educational development. The use of instructional radio has been discussed with key persons in several developing countries.

These persons generally agree that the use of radio for educational purposes has great potential in developing countries and that little is known about "how to do it" successfully. The topic of instructional radio is certainly not foreign to these countries as the survey of the literature revealed that radio is used in many developing countries to supplement both their formal and their non-formal educational systems.

What is missing is a firm research base to guide educators in developing instructional radio projects. Discussions with educators in developing countries consistently point out the lack of knowledge about

instructional radio. In order to close this knowledge gap, CET will involve several countries in the proposed research program. Since the first phase of studies requires a considerable amount of experimental control, one of the English speaking countries in the Caribbean would be ideal for a test site. The preliminary studies could be conducted under the supervision of researchers from CET in conjunction with appropriate counterpart personnel perhaps from the University of the West Indies or from the Association of Caribbean Universities.

During the first phase of research, research associates from other developing countries would be recruited to serve on the research team. Thus, those persons who would be involved in subsequent research in Phase II would be part of the working team in Phase I. Several persons from the countries that will participate in Phase II will then have the opportunity to work closely with CET researchers to further develop their research competencies to enable them to successfully carry out the research in their countries. CET will begin in the first year to strengthen the research capabilities existing in developing countries through such a structural work-training program.

The final decision on the specific countries that will participate will be made during the first year of the project. This will allow CET more time to explore the possibilities and potentials existing in developing countries, and their commitment to pursuing research on instructional radio. The countries selected would likely include Argentina, Brazil,

Colombia, Ethiopia, Korea, and Thailand. Persons from these countries have expressed a desire to participate in such research. Rather than make final selection of the countries to participate in the second phase at this time, CET prefers to make the decision after the first year of operation. This will allow more time to identify the agencies and personnel in developing countries that could assist in and benefit from the project.

Within each country selected, the specific sample of listeners will be drawn using stratified sampling techniques to insure representation from all subgroups. In the formal school sampling, whole classrooms will be selected at random from a listing of possible classrooms. Assignment to experimental treatment conditions will be completely random within strata. For the non-formal sample, volunteers will be used and randomly assigned to experimental treatment conditions.

In all cases, CET will seek to utilize existing resources for instructional radio rather than establish a radio station solely for the purposes of the research. There are existing facilities and on-going instructional radio programs in developing countries that would be ideal for conducting the research. Many persons connected with such programs have indicated a desire to cooperatively engage in this type of research.

Data Analysis

The data collected in the proposed studies will be recorded on specially designed forms at each test site and sent to CET for keypunching.

All analyses will be conducted by CET. The primary statistical techniques will be analysis of variance, covariance analysis, and multi-variant analysis of variance. In some instances in which the assumptions underlying these parametric techniques cannot be met, nonparametric analyses will be performed. For that portion of the research examining the relationship between various treatment conditions and aptitudes of listeners, regression analysis will be used. In this technique, regression equations are computed for each treatment condition (independent variable) relating aptitudes to the dependent variable. Any significant difference in the equations' beta weights indicates that persons who differ in those aptitudes have differences in the measured variables when assigned to different instructional treatment conditions.

Time Requirements

The total research program will require five years to complete. This proposal is a request for funding of Phase I of the two phase program. It is estimated that Phase I can be completed in a twenty-one month time period. The following is a listing of the major tasks to be completed in the first twenty-one months and the estimated time of the completion.

Summary Schedule of Phase I Activities

- | | |
|-----------------|---|
| <u>Year One</u> | 1. Exploration of possible sites for Phase I of the project (1st-3rd month) |
| | 2. Selection of the site (4th month) |

3. Establishment of ties with host institutions and discussions of the research (4th-6th month)
4. Completion of working plan (4th-7th month)
5. Completion of any necessary formal training (5th-8th month)
6. Development of instructional programs (7th-13th month)
7. Seminars for foreign research associates (8th-10th month)
- Year Two 8. Tryout and revisions (13th-14th month)
9. Testing and development of radio delivery logistics (13th-14th month)
10. Conduct studies (15th-19th month)
11. Seminars and experience for foreign research associates (17th-19th month)
12. Collect and analyze data (20th-21st month)
13. Prepare research reports (21st month)

This listing presents a summary of the planned schedule of activities for the first phase of the project. This schedule is a reasonable initial estimate. A PERT network is being developed for use by the project manager to guide in the operation of the project should the necessary funds be received.

The third through fifth years of the project are Phase II. The research will be conducted during these years in selected developing countries.

Summary Schedule of Phase II Activities

- | | |
|------------------------------|---|
| <u>Prior to
3rd Year</u> | 1. Selection of countries, institutions and personnel. |
| | 2. Participation of selecter personnel in Phase I as participant/observers. |
| | 3. Development of work plans for each country. |
| <u>3rd Year</u> | 4. Refinement of research designs and working plans. |
| | 5. Assembly and training of necessary LDC staff |
| | 6. Development of lessons. |
| <u>4th Year</u> | 7. Tryout and revision of lessons. |
| | 8. Conduct research studies. |
| <u>5th Year</u> | 9. Completion of studies. |
| | 10. Analysis of data. |
| | 11. Preparation of research reports and handbook for users. |
| | 12. Implementation of findings and transfer of control to LDC's. |

During Phase II, CET will work cooperatively with personnel in the selected developing countries to conduct a series of research studies in each country to determine the most effective and efficient manner to utilize radios for educational purposes.

Anticipated Products

There will be many products from the proposed research program

that will be useful to developing countries. The knowledge obtained from the research will be one of the most important products. Research reports will be prepared on each study to completely describe the research. In addition to these reports a handbook will be prepared for educators on how to effectively use educational/instructional radio. This handbook or guide will summarize and interpret research findings, translating these into specific operating practices based on the research. The orientation of the guide will be towards the needs of management level officials in developing countries.

The guide will deal with specific uses of radio in formal educational settings. School uses, specific applications of radio to regular school programs, including variations of people and software support of radio programming, will be included. Case studies based on real applications will be digested and reported with an eye toward specific transfer of an approach from one country to another. Anticipated problems will be discussed and variations on solutions of these problems will be discussed.

Applications of radio to non-formal settings will be a principal thrust of the guide. This area probably represents the greatest opportunity to gain benefits from the characteristics of radio. Case studies of the use of radio in non-formal settings will be digested and interpreted with the hope that the information will enable users to transfer program ideas from one country to another. Problems in the use of radio in non-formal settings will be discussed in the hope that the information will enable users to avoid similar results.

The research conducted and the literature reviewed will be interpreted in the light of operational and program development needs. Generally, empirical development procedures will be followed if the interim review provides sufficient evidence to justify the approach.

It is anticipated that by the time the research project is completed, the comparison of alternative delivery systems on a cost-benefit or cost-effectiveness basis will be possible. At the moment it appears that the use of radio with supplemental printed materials may be the only cost-feasible instructional approach available to many developing nations. More importantly, there is little existing evidence to suggest that this would be a second-rate solution. On the contrary, radio appears to have the advantage over classroom instruction and television in some important applications. Unfortunately, the amount and quality of research to support this conclusion is inadequate -- at the moment, the conclusion is only reasoned speculation.

In addition to the research reports and handbook on how to use radio, a set of validated lessons on vital life skills will have been produced and used in several developing countries. This will be valuable in two ways. First, the lessons themselves will be of use to persons in Africa, Asia, and Latin America. Second, the methodology by which instructional materials can be developed for use in different cultures will be of value in and of itself. The developmental procedure is described in Appendix B.

If materials can be developed that can be used elsewhere with minor alterations and modifications, this certainly would be of benefit.

One other end product is equally important. During the operation of the research project CET will continually seek to strengthen the research capability of the developing countries. This will be done through formal training where necessary, the extensive use of seminars conducted on site, and the practical experience the foreign research associates will gain by sharing the responsibility for conducting the research. Other persons will be involved very early in the project and hopefully they will be able to be full partners during the second phase. Following the termination of the project, a trained cadre of researchers will exist in each country who would be able to conduct additional research as they deemed necessary.

PERSONNEL

In order to successfully conduct the research described herein, a project staff with many complementing abilities must be assembled and orchestrated. Dr. Robert Morgan, Director of the Center for Educational Technology, will serve as the principal investigator and have the responsibility for operational decision making. In addition to being the Director of CET, he also serves as a Professor in the College of Education. Dr. Morgan has had extensive experience in directing research and development activities in private industry, federal government, universities, and in foreign countries. Most recently, Dr. Morgan spent a year in Korea establishing a team of Koreans to conduct a large scale reform of their educational system. Dr. Morgan has served as consultant and advisor to officials in many Latin American countries and in Africa. Dr. Morgan's vita is included in Appendix C.

Dr. Wallace Hannum, Research Associate at the Center for Educational Technology and Assistant Professor in the College of Education, will serve as the project director for this project. Dr. Hannum has experience in conducting research activities in public school systems and universities. He has directed innovative educational development projects and has worked with Latin American educators in designing research projects to reduce the unit costs of education. His academic training includes work in psychology, educational administration, and educational research. (See Appendix C for Vita.)

Other members of the research staff include Dr. Gail Rayner, Research Associate at the Center for Educational Technology, who will have responsibility for the materials development aspect of the project. Dr. Rayner has developed training programs and instructional materials for several educational technology workshops. She has supervised numerous students from Latin America and Thailand in the development of instructional materials. (See Vita in Appendix C.)

In addition to the personnel devoting their major portion of time to this project, several research advisors will be used to assist in shaping the direction of the project. These advisors include Dr. Robert M. Gagné, Dr. Robert K. Branson, and Dr. David E. Platts. Dr. Gagné is a distinguished educational psychologist with considerable experience as a researcher. Dr. Branson has managed a number of educational technology projects and served as a consultant to universities and industries. Dr. Platts is the Director of WFSU-FM and has considerable experience in the design and management of educational radio systems.

Additional assistance and guidance for the operation of the proposed project will come from a group of international consultants assembled for this project. This includes the following persons:

Khoo Eng Choo, Deputy Director, SEAMEO, Thailand

Young Dug Lee, Director, Korean Educational
Development Institute, Korea

Enrique Nardelli, President, Latin American
Association of Radiophonic Schools.

Joao Oliveira, Director, PRONTEL, Ministry
of Education, Brazil

Bernardo Restrepo, Profesor, University of
Antioquia, Colombia

Haile Yesus, Vice Minister of Education, Ethiopia

Fr. Salcedo, Director, ACPO, Colombia

The following staff organization chart (figure 2) shows how the personnel will be utilized for this project. There are six categories of personnel for this project. The research advisors will be selected from the faculty of Florida State University and will provide guidance on basic research design and methodology.

The international consultants will be a very distinguished group of educators who will assemble three times during the first twenty-one months of the project. The consultants will provide guidance and assistance throughout the operation of the project. Furthermore, they will be instrumental in the selection of foreign research associates and in coordination of the research effort in the developing countries. The international consultants will be compensated at a rate of \$50 for each day and paid travel expenses.

The foreign research associates will be selected during the first of the project and will actively participate in the phase one research. The group of foreign research associates will assemble on site for two time periods each one being three months. They will participate

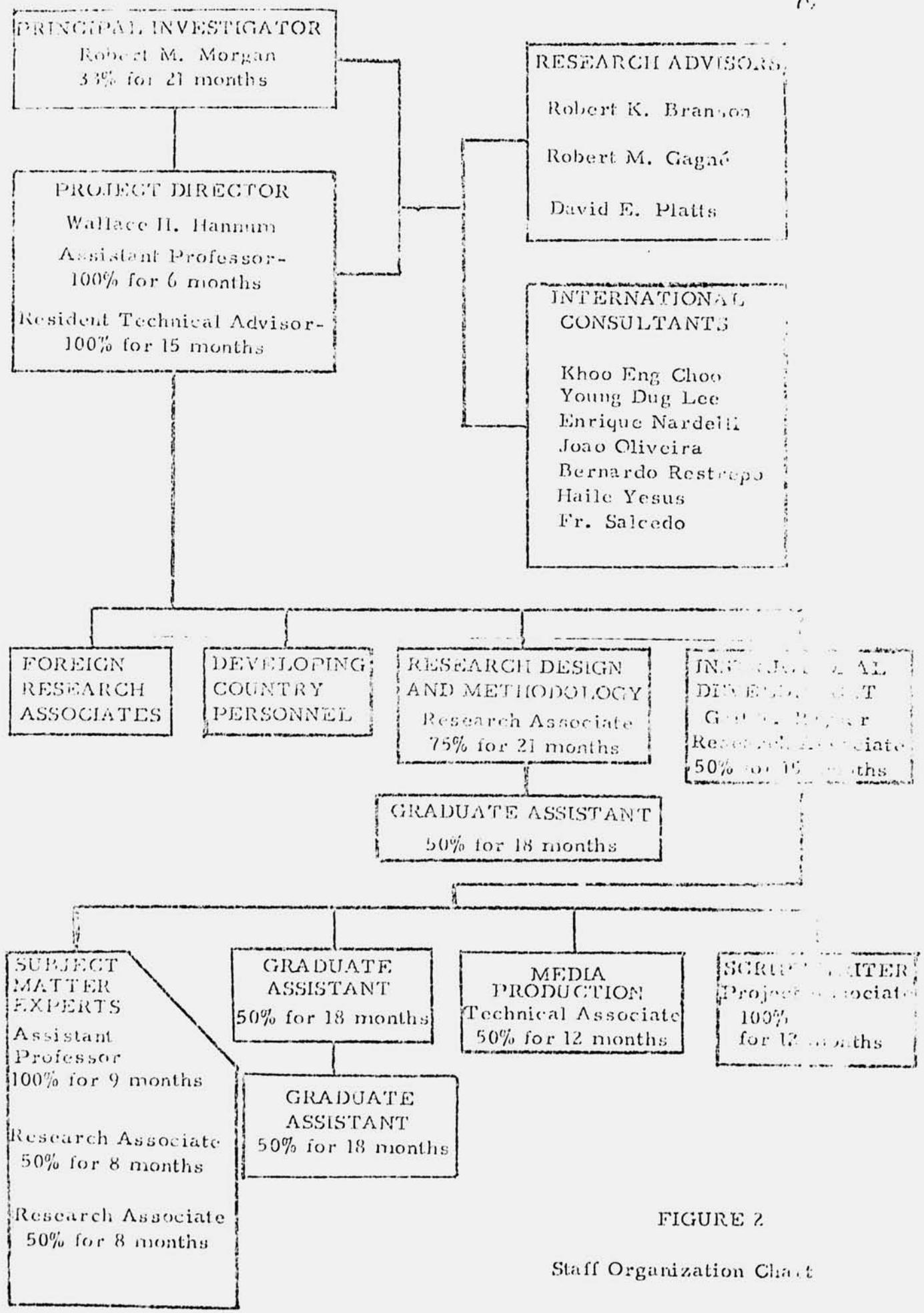


FIGURE 2

Staff Organization Chart

initially in the planning and coordination of the research and in the development of instructional materials for the research.

During the first time period CET personnel will conduct formal and informal training programs for the research associates on an individual and group basis as needed. These research associates would come back to the site of the research and help in actually conducting the studies. After the conclusion of the phase one the foreign research associates would return to their countries and would have responsibility for conducting the phase two research with CET assistance. These research associates would be paid for all expenses, per diem, and travel but would not receive a salary from the project since their assignment to this project would be related to their work.

Another category of personnel is composed of those persons in the developing country that would interact with persons working on the project during phase one. These people would most likely be from the Ministry of Education or the University of the West Indies. It is not anticipated that these persons would spend a large portion of time on activities related solely to this project. Project personnel would probably interact with appropriate developing country persons throughout the duration of the research, but those persons would not be paid a salary from the project.

There are two categories of persons attached to CET that would work on this project. One of these categories includes a research

associate and graduate assistants who would work with the project director on the design and methodology for the research. This category would have responsibility for all matters pertaining to the research. The other category of CET support is that of instructional development. Persons in this category would have the responsibility for the design, development, and production of the instructional lessons including the scripts and supporting materials. This group would include three subject matter experts to assist in the development of the vital life skills material and other areas. Also included in this category would be a person to assist in the writing of scripts and a person to prepare the audio tapes and graphics for accompanying materials.

Also included in the personnel section is a secretary and a clerk-typist to provide the necessary support to the project staff. It is assumed that some secretarial support and facilities can be made available in the developing country. Thus no funds are in the budget for this purpose.

Further information on the capabilities and personnel of the Center for Educational Technology can be found in the Capability Statement that is attached as Appendix D.

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Appendix A

Dimensions of Research on Learning from Audio Media

Production Variables

KEY - programmed vs. traditional preparation of audio scripts:

This key variable concerns the use of instructional development principles most often associated with the programmed instruction movement. These include a clear specification of the terminal performance of the learner in behavioral terms, the development of scripts that contain the instructional conditions and events that will most likely produce the desired learning, the active engagement of the student in listening to the scripts by the use of questions or orienting stimuli; and the tryout and revision of the script with students selected from the targeted group until the script produces the desired learning.

Minor
Variables -

1. presentation of performance objectives
2. use of test like events (mathemagenic behaviors) to increase learning
3. amount of repetition of information necessary for learning and retention

4. various formats (lecture-dramatic)
5. use of different response modes
6. revision based on student data .

Materials Support Variables

KEY - specially developed vs. published materials

This variable includes a wide range of possibilities for the design and use of material to support the radio lesson. The two broad categories are the use of materials specially developed for each lesson and the use of published materials that are available.

Minor
Variables -

1. use of content outline
2. use of advanced organizers
3. use of performance objectives
4. amount of prose possible without distraction from audio
5. note taking guides
6. response modes
7. use of published materials
 - a) maps - charts
 - b) prose
8. how to select published material
9. the use of materials to support and reinforce audio lessons, or to supplement and provide additional information, for visual discrimination or visual identification

10. use of information mapping techniques
(Horn) to organize the accompanying
materials

Content Variables

I. Subject Matters

KEY - use of audio media in science, math, health, etc.

It may be that radio is particularly well suited for teaching some subject areas and not as effective for other subject areas.

II. Domains of Learning

KEY - effectiveness of audio media for information, intellectual skills, motor skills, attitudes

Available research indicates that there are different instructional conditions and events necessary for the learning in different domains of learning. The research will examine the question of the effectiveness of radio in teaching in the different domains.

Minor
Variables-

1. recall of prerequisite skills
2. entry requirements
3. sequencing
4. necessary conditions (people, materials, "hands-on") for different domains

People Support Variables

KEY - is people support necessary; if so, then what kind and role

The research will explore many possibilities for the use of supporting people ranging from a monitor who doesn't perform any instructional function to the active involvement of an instructional person at each stage.

Minor
Variables-

1. active instructional role vs. monitor vs. none
2. within active
 - a) for orientation prior to lesson
 - b) for demonstration during lesson
 - c) for demonstration after lesson
 - d) for review (summary)
 - e) to promote discussion
 - f) to evaluate student performance
3. the use of peers, teacher aides, teachers, village leaders, and others as the supporting person.

Learner Attributes

KEY - Interaction of instructional conditions and learner attributes.

Another variable of concern is the individual differences of the learners that may influence the learning from radio.

Possible
Variables-

1. listening comprehension
2. general intelligence
3. motivation (inner vs. outer direction)
4. initial learning vs. relearning
5. level of academic training
6. listening fatigue
7. attention span
8. literate - preliterate
9. age

Instructional Strategies

KEY - Investigate various instructional strategies

There are various instructional strategies that could be examined in conjunction with instructional radio.

1. stand alone audio
2. amount of necessary support
3. adaptive models
4. student control
5. diagnostic & prescription procedures
6. group vs. individual listening
7. listen only vs. listen with guided performance
8. rule - example relationships
9. provision for feedback of student performance
10. spaced reviews
11. mastery models

Stimulus Properties

KEY - for what instructional tasks is audio stimulus not appropriate

Some persons have suggested that radio is effective as television for the learning of all tasks except those involving motion. In this area a range of tasks will be examined to determine what tasks cannot be taught by an audio stimulus and what supplementary materials can correct this.

1. supplement with
 - a) real object
 - b) pictorial
 - c) symbolic
2. necessity for motion
 - a) real motion
 - b) simulated motion

Response Characteristics

KEY - what type of student response is necessary

This variable concerns the various provisions that could be made for the active involvement and responding of students.

1. no responding
2. covert response to questions during
covert response to questions after
3. overt response to questions during
overt response to questions after
4. papers and pencil/simulation/real object
5. how much practice (responding) is necessary
6. knowledge of results (feedback) from
materials
7. amount of cuing and prompting
8. stimulus fading

Measurement Problems

KEY - how to adequately measure dependent variables; also, what are the important dependent variables

1. use of criterion referenced rather than norm referenced testing
2. relevant practice practice prior to measured performance
3. criterion problem (what constitutes adequate performance)
4. type of performance
 - a) paper and pencil
 - b) plan of action
 - c) simulated or role play
 - d) real world
5. correspondence of test performance to real world performance
6. criterion level (how much error to allow)
7. sequential testing
8. computer based testing

Hardware Factors

- Broadcast:
1. costs
 2. maintenance (personnel, parts, etc.)
 3. quality of signal
 4. FM vs. AM
 5. distribution of signal
 6. antenna placement
 7. large transmitter or series of smaller ones
 8. microwave networks
 9. availability and quality of electric service
 10. matching of transmitter and terrain
- Reception:
1. costs
 2. maintenance requirements
 3. battery life

Administrative Factors

1. cost effectiveness of various possibilities
2. individual vs. group listening
3. space requirements
4. personnel requirements
5. what types of learner management are necessary
6. scheduling of equipment usage
7. distribution system for software
8. how many? (hardware and software) for given number of persons
9. maintenance procedures
10. supervision of lesson development
11. program scheduling (what is best time of day for various audiences)

Retention Problem

KEY - how to insure adequate retention of the lessons

1. determining what level of retention is required
2. use of hard copy materials for storing information
3. use of retrieval cues
4. use of compressed speech for relearning
5. use of overlearning and initial mastery
6. use of spaced reviews

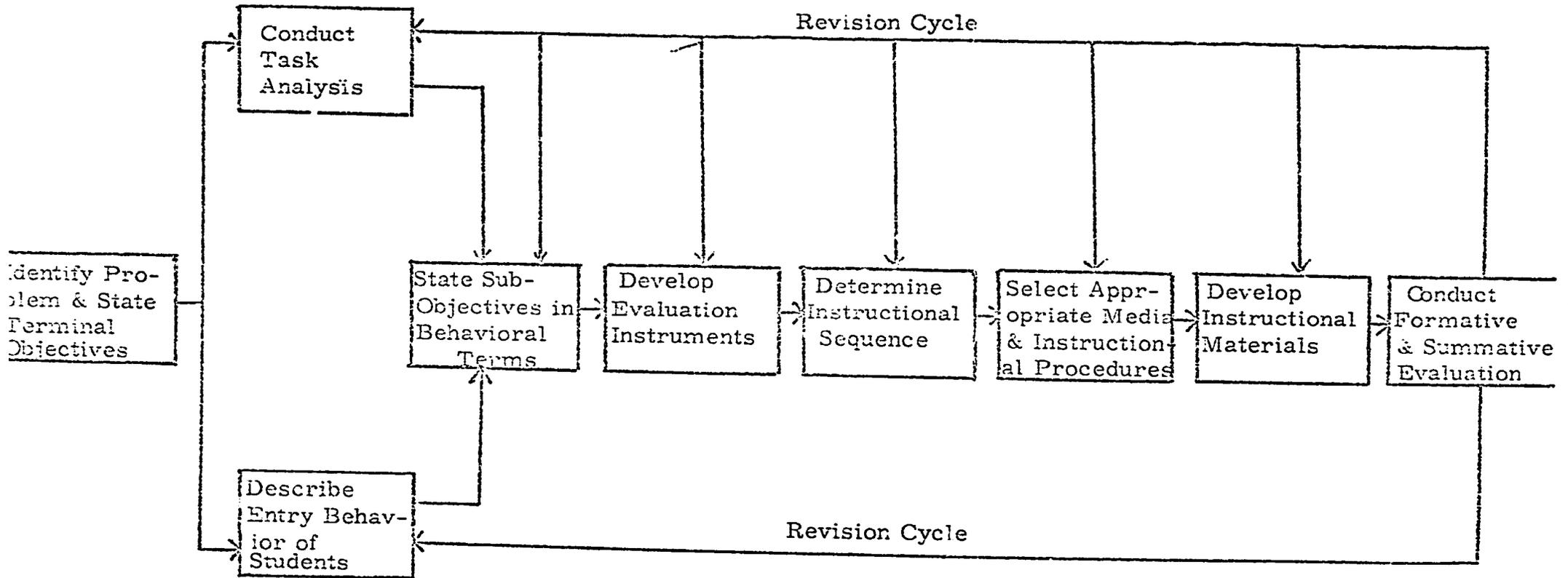


Figure 1. -- (From Dick, Merrill, and O'Neil, Systems approach model for development of instructional materials.)

APPENDIX B

Instructional Materials Design Model

Figure 1 is a scientific representation of a systems approach model which describes the step-by-step procedures that may be followed to assure a maximally effective instructional program. This model has been successfully used in the development of instructional materials for a variety of media and numerous different subject areas and levels.

The first step in the model is to clearly and unambiguously identify the instructional problem for which materials are to be designed. Rather than simply identify the content area which is to be taught, it is necessary to clearly indicate what the terminal skills and attitudes of the learner are to be. From this information one can proceed to task-analyze these skills in order to identify the subordinate skills that are required to learn and perform the terminal objective of the task. Often the first attempt at task analysis results in a listing of the topics which are to be covered in a content area. However, subsequent passes should result in a description of the kinds of sub-behavior which a student must be able to perform and the types ordered relationships which exist between the sub-behaviors. Taken together, these skills represent the tasks to be taught by the total instructional system.

As may be seen in Figure 1, the next step in the model is to identify the entry skills of the students. This step requires the curriculum designer to consider not only the task which is to be taught, but the

characteristics of the learners who are involved. Too often in the past, the real skills of the learner have been overlooked in the sense that too much has been expected of him upon entering the learning task; i. e., assumptions were made that he had skills which in fact he did not have. One must also consider the social situation in which the learner is found, his lack of motivation and interest, and potential pay-offs for participating in the learning activity. All of these behavioral characteristics should be considered in addition to the learner's general level of academic aptitudes.

The fourth step in the model is the development of performance objectives. This is done on the basis of the results of the task analysis and the analysis of the entry skills of the students. It is at this point that the designer must clearly state the types of skills that his instruction is designed to achieve. The book by Bob Mager on behavioral objectives has become almost a classic in this area. Mager states that, if behavioral objectives are to be of real worth, they must indicate the conditions under which the performance will take place, e. g., "while standing at a blackboard," or "without the use of a slide ruler" they must indicate what the performance is, e. g., "list the planets in our solar system" and they must indicate the minimum level of acceptable performance. This criterion is usually expressed in terms of a percent-correct figure, or perhaps a time limit. Any of you who have ever worked with this model may agree that the formation of behavioral objectives is probably the most difficult task within the entire sequence. But, if this task is performed satisfactorily,

it greatly facilitates the rest of the process.

The next step in the model suggests that prior to the development of any instruction, the designer must construct a variety of evaluation instruments which are directly related to the performance objectives. By thus tying the performance objectives and the evaluation instruments directly together, the designer is required to show the relationship between the evaluation which he will utilize and the performance which he is looking for and empirically demonstrate the effectiveness of the instructional program in helping the student to achieve the desired terminal skills. Therefore, he should not be limited to simple paper and pencil evaluation devices, but rather should design evaluations which are consistent with the skills and attitudes which are desired.

The sequence of instruction is considered in the sixth step of the model. The most effective sequence for presenting the instructional materials is determined by utilizing the ordered relationships between the subskills revealed by the task analysis procedure. For example, if the subskills are hierarchically related to each other, it is important that the instruction be designed to build one skill upon another until the terminal performance is achieved.

In the seventh step, consideration is given to the kinds of learning events and conditions that are required and then it is possible to select the type of media and instructional procedures which should be utilized in order to maximally insure the achievement of each objective.

The subobjectives of the course, the entry skills of the students, the appropriate sequence of instruction, and the appropriate media and instructional procedures are used in the eighth step to develop the actual instructional materials.

The final step in the model is to evaluate the instructional program. After the initial design of the material, a formative evaluation is conducted wherein a student from the target population goes through the materials in the presence of the instructional designer. The student is asked to point out any troublesome areas in the program and revisions are then made based on the student feedback. The term formative is meant to imply what the arrows on the chart indicate -- that feedback from the evaluation of the instruction can be and should be utilized to improve and repeatedly improve, not just the instruction, but also to bring into question any of the preceding steps in the process. The most obvious gap which is often detected is the students' lack of certain entry skills. If this is the case, the question must then be asked whether this lacking skill should be included in this instruction, or should students be denied access to these materials until they have achieved the prerequisite skills. The point is, in order to maximize the effectiveness of the instructional materials, they must be evaluated with respect to the behavioral objectives of the instruction, and that this evaluation information should be utilized in recycling through the development process.

Several additional one-to-one or small group tryouts with corresponding revisions may be necessary before the program becomes truly effective. A field or summative evaluation may then be conducted. This evaluation should approximate as nearly as possible the actual setting in which the material will be used. The results of the summative evaluation are then used to document the effectiveness of the final product.