DOCUMENT RESUME

ED 228 837 FL 013 582

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TITLE	The Intensive Use of Radio for Teaching English in Kenyan Rural Primary Schools. Exploring a Cost-Effective Application of Educational Technology.
INSTITUTION	Academy for Educational Development, Inc., Washington, D.C.
SPONS AGENCY	Agency for International Development (Dept. of State), Washington, D.C.
PUB DATE	Mar 83
CONTRACT	AID/DSPE-C-0051
NOTE	24p.; Paper presented at the UNESCO/BREDA International Seminar on the Use of Appropriate Technologies in Education (Nairobi, Kenya, March 21-26, 1983).
PUB TYPE	Speeches/Conference Papers (150) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Developing Nations; *Educational Radio; Elementary Education; *English (Second Language); *Instructional Innovation; Rural Schools; *Second Language Instruction; Teaching Methods
IDENTIFIERS	*Kenya; *Radio Language Arts Project (Kenya)

ABSTRACT

Instructional radio is a relatively low cost technology which can deliver effective educational programs to any school capable of receiving broadcasts, however remote the school might be. This paper explores the Radio Language Arts Project (RLAP), an application of instructional radio technology to the teaching of English as a foreign language. The advantages and disadvantages of the use of radio in education are noted, and successful realizations of radio's potential in Kenya and Nicaragua are described. The subject matter, English, is analyzed from the perspective of the Kenyan curriculum and the radio medium. The most significant instructional design principles used by the RLAP are enumerated. These are: more intensive use of radio and for longer periods, cost control, systematic instructional development, provision for distributed learning and immediate reinforcement, and the teacher/radio partnership. Finally, the formative and summative evaluation strategies for the RLAP are described and the project's implications are considered. (Author/AMH)

Academy for
Educational
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THE INTENSIVE USE OF RADIO FOR TEACHING ENGLISH IN KENYAN RURAL PRIMARY SCHOOLS

Exploring a Cost-Effective Application of Educational Technology

March 1983

A paper presented to the

UNESCO/BREDA International Seminar
on the Use of Appropriate Technologies in Education
Nairobi, Kenya, 21-26 March 1983

by

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The following report was prepared by the Academy for Educational Development under Contract No. AID/DSPE-C-0051, Rural Primary Schools Extension Project: Radio Language Arts, with the U.S. Agency for International Development.

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ABSTRACT

Instructional radio is a relatively low cost technology which can deliver effective educational programmes to any school capable of receiving broadcasts, however remote it might be. This paper explores the Radio Language Arts Project (RLAP), an application of instructional radio technology to the teaching of English as a foreign language. Radio's potential for education is described, and examples of successful realizations of this potential from Kenya and Nicaragua are noted. The subject matter, English, is analyzed from the perspective of the Kenyan curriculum and the radio medium. The most significant instructional design principles used by the RLAP are enumerated. Finally, the formative and summative evaluation strategies for the RLAP are described and the project's implications are considered.

AN OVERVIEW OF THE RADIO LANGUAGE ARTS PROJECT

The Radio Language Arts Project (RLAP) is a five-year research and development project. Its purpose is to develop, implement and test the effectiveness of an instructional system which uses radio intensively to teach English as a foreign language at the lower primary-school level (standards one to three).

The project is a joint venture between Kenya and the United States. The Kenyan executing agency is the Kenya Institute of Education, as authorized by the Ministry of Basic Education. The American executing agency is the Academy for Educational Development, under contract to the United States Agency for International Development.

Both qualitative and cost aspects of effectiveness will be examined by the RLAP. The project's end product will be a radio-based English-language series for standards one to three, complete with taped lessons (approximately 195 lessons of 30 minutes each for each school year,) appropriate tests, teacher training materials, and classroom observation and data-gathering procedures. Although the project has been designed for specific application in Kenya, it is expected that the model which emerges can be replicated, with modifications, in other Third World educational systems.

The general project design builds on Kenya's extensive experience with formal educational broadcasts to schools. It also draws on the results of several relevant projects in other countries, most particularly a radio-based primary-school mathematics project conducted between 1973 and 1978 in Nicaragua, Central America.

The RLAP envisions radio as an appropriate, cost-effective technology to reach the disadvantaged rural population for whom educational opportunities are frequently limited because of poor educational resources. For this reason, among others, English-language arts programmes are broadcast as part of the normal school curriculum during school hours. The daily thirty-minute lessons fill the regular English period in the school timetable. Radio is the major medium of instruction, but teachers have an important role during the broadcasts, in pre- and post-broadcast activities, and in complementary teacher-led lessons. The radio lessons are designed to assist teachers in the classroom, enhancing their effectiveness in teaching a difficult and important skill.

As of March, 1983, the RLAP is in its third year of operation in Kenya. The initial year was spent in establishing the project (including assembling the professional team, selecting schools, and finalizing the research design), analyzing the Kenyan English curriculum, and field testing a variety of methodologies for teaching English by radio. Regular broadcasts to thirty-one project schools in seven districts began with standard one in 1982. Standard two lessons are being broadcast to the same cohort of children in 1983, and standard three is scheduled for 1984. The achievements and costs of this method will be analyzed after the conclusion of the 1984 school year, based on the results of three years of broadcasting.

THE MEDIUM: INSTRUCTIONAL RADIO

Radio's Potential as an Appropriate Educational Technology

In 1973 Emile McAnany articulated five strategies for applying radio to development.[2] These continue to serve as a useful paradigm for alternative approaches to educational radio. They are:

1) open broadcasting, in which programmes of varying length are aired indiscriminately to a large radio audience;

2) instructional radio, in which specially prepared programmes are beamed to small, organized learning groups, usually in schools;

3) radio forums, in which programmes are prepared not only to educate but also to motivate decision groups to act and alter some aspect of the environment;

4) radio schools, which are non-formal but highly organized radio listening groups using support materials, trained monitors, and an established curriculum;

5) radio and animation, which promotes long-term trained discussion leaders able to use radio to increase the participation of community members in solving their own development problems.

The Radio Language Arts Project falls within the second of these strategies, instructional radio. Its goals correspond to the three primary educational functions of radio identified by Jamison and McAnany[3]: improving educational quality and relevance; lowering educational costs; and improving access to education, particularly in rural areas.

Instructional radio is by no means a new or untested educational technology. Jamison and McAnany cite three surveys supporting the conclusion that radio, particularly when appropriately supplemented by visual material, can teach effectively. Based on a series of examples compiled by Schramm[4], they state that "radio [in a formal setting], properly used, can teach as well as (or, in some cases, better than) traditional instruction."[5] Radio remains the more attractive option in cases where substantial importance is attached to subject areas (e.g., mathematics or a second language) in which teachers are relatively weak.

As with any educational technology, however, radio involves costs against which its potential must be measured. Some are incremental costs, representing the expenditure of resources which would not otherwise be used, and others are simply opportunity costs, representing resources used for radio instead of something else. In Kenya, for example, the incremental costs of developing and producing new instructional radio lessons must be borne by the Kenya Institute of Education's (K.I.E.) operating budget. These also represent opportunity costs, since the same funds could be used to support other instructional strategies (such as writing and producing textbooks). There are also costs involved in broadcasting on the Voice of Kenya (V.O.K.). Incremental costs are incurred because K.I.E. must pay the V.O.K. for air time and studio facilities. Opportunity costs occur because there is substantially more demand for radio time than can be met by the existing channels and schedule.

Advantages of instructional radio. These costs must be justified by the potential advantages of radio over alternative approaches. Fortunately, radio offers numerous benefits to balance this equation. In many Third World countries the relatively low cost of radio in comparison to other media (such as television and even print media, when printing and distribution costs are considered) has resulted in the wide distribution and use of radios. In addition to the general public, schools frequently have access to radio receivers. With the help of the World Bank, Kenya is in the process of ensuring that virtually every school in the nation has its own radio.

Maintenance is an issue which cannot be overlooked, but the servicing of simple radio receivers is far less difficult than that required for more complicated broadcast technologies. And, whereas television reception needs mains electricity, which is often unavailable in rural areas, radios can operate on batteries. Another advantage is that radio does not require the kind of expensive, cumbersome distribution system which so often leaves textbooks in cities instead of in rural schools. Instruc-

tion can be delivered, literally at the speed of light, anywhere there are radio receivers.

As an aural medium, radio can reach non-literate audiences. This is generally seen as an advantage in adult education, but it is equally valuable for the education of young children who cannot yet read. For them, radio can be used long before textbooks are practical. Although in some circumstances radio's aural nature is considered a disadvantage, it's advantages also are well validated in the literature, especially in the case of language instruction. Radio encourages listeners to focus their attention and use their imagination. This can be particularly beneficial for young children, especially when radio is complemented with effective visual media.

Another advantage of radio is the ease with which it can be combined with other instructional modes. Printed media or props can be used to add a visual component to a radio-based lesson without detracting from the aurally presented message. Well-designed radio instruction also can integrate classroom listeners into the programmes.

As a broadcast medium, radio requires centrally developed programming. For educational purposes, this allows a degree of control over content and pedagogy which cannot be achieved through textbooks or teacher training. In the case of foreign language instruction, for example, radio curriculum developers can have a direct influence over the quality of the language modeled and the methods of teaching that language to children. This advantage is particularly important where teachers are likely to be weak in the language and/or untrained in the methodologies which are now available for teaching foreign languages.

Disadvantages of instructional radio. Of course, there is no such thing as one perfect educational technology for all situations. Radio as an instructional medium also has several disadvantages. Start-up costs can be high, particularly for new, innovative series, and (as mentioned above) operating costs are a significant factor. Unless a country already has the necessary broadcasting infrastructure and sufficient radio receivers (along with the power lines or dry cell batteries necessary to run them), instructional radio will probably be prohibitively expensive to implement.

Broadcast radio is inherently a one-way medium, limiting the possibilities for responding to and reinforcing pupil responses in the classroom. A good teacher can evaluate and immediately react to a class's performance, but a radio teacher cannot be certain of what will be happening in the classroom when the lesson is broadcast. This is an important consideration in foreign language instruction, where there can be a variety of correct responses to a given stimulus (as opposed to mathematics, for example, where there is generally only one correct answer).

Radio lessons proceed at their own speed, independent of the listeners' response. This is a minor problem for bright chil-

dren, who may become bored if the radio lessons move too slowly to challenge them. It can be a much more significant difficulty for slower pupils. If the radio lessons are not carefully designed, these children could fall further and further behind the instructional pace.

There are some problems with using an exclusively aural medium. For example, foreign language instruction requires a visual component for teaching a variety of skills, from vocabulary comprehension to reading and writing. Printed materials can complement radio lessons to serve this function, but they create the need for a distribution system which would not be necessary otherwise. Television, on the other hand, can broadcast the visual as well as the aural message without relying on a physical distribution system (although it is highly unlikely that rural schools which have difficulty obtaining printed materials could take advantage of television).

Another disadvantage is that all too often, particularly in the earlier days of educational broadcasts, radio lessons have not been designed to take advantage of the medium's strengths and minimize its weaknesses. Instead, they simply mimic conventional classroom instruction. Little wonder that such lessons have not proven to be particularly effective.

The Experience of Instructional Radio in the Third World

With the exception of printed materials, particularly textbooks, radio is the educational medium with perhaps the longest record of service in the Third World. In fact, instructional radio may well be one area in which the South holds the lead over the North, since the developed countries, for the most part, have subordinated radio to more complicated educational technologies. Thus, instructional radio is an excellent candidate for technological cooperation among developing countries.

The breadth of such experiences with radio has been well documented. One excellent source of information is a series of case studies in the use of radio for education and development prepared by the World Bank in 1977.[6] Another is a set of profiles for particular projects prepared by the Clearinghouse on Development Communication.[7] This paper will confine itself to examining two cases which are particularly relevant to the Radio Language Arts Project: the general history of instructional radio in Kenya, and the particular experience of Nicaragua in teaching mathematics by radio.

Instructional radio in Kenya. The history of instructional radio in Kenya dates back to 1963, the year that the nation won its independence. In May of that year the Schools Broadcasting Service was taken over by the Ministry of Education. In 1976 it was absorbed in the Kenya Institute of Education as the Educational Media Services, with much wider responsibilities in the production of a variety of teaching aids including video

programmes, films, posters, charts and books, as well as radio programmes. Throughout this time the recording and broadcasting facilities of the Voice of Kenya have supported the schools broadcast system.

When radio programmes were first broadcast to schools in 1963 they were on the air for one hour a day. There were eight programmes for primary schools and four for secondary schools each week.[8] Over the years the broadcast time, the number and the range of programmes have gradually increased. The 1983 term one radio timetable for schools broadcasts includes fifty-nine instructional radio programmes (excluding repeats): thirty-one for primary schools from standards two through seven (including five Radio Language Arts Project broadcasts each week), twenty for secondary schools from forms one through six, and eight for teachers (including four for untrained teachers to support their in-service training course). Educational broadcasts are on the air through the V.O.K. for five hours and twenty minutes a day, Monday through Friday, eight weeks a school term, or a total of 640 hours per year of instructional radio.

Broadcasts to primary classes last fifteen to twenty minutes. They cover English, history, geography, music and movement, Kiswahili, health education and home science. There is also a program which answers letters from listeners. Secondary school broadcasts, twenty minutes each, cover biology, history, English literature, Christian religious education, English usage, creative writing, geography, agriculture and Kiswahili. Secondary students can also listen to a careers programme and a guest forum which assists them with their general paper on the A-level examination. There are three kinds of teacher training programmes. One focuses on methodologies for a specific subject (literature and mathematics in the first term of 1983), a second on areas of general interest ("You and Your Health"), and a third on support for in-service training (for example, broadcasts for untrained teachers).

Schools broadcasts are essentially supplementary in purpose, designed to help the teacher by offering one radio lesson per week to assist regular classroom instruction. They are supported by a range of printed material, including charts, teacher guides and pupil booklets. The Ministry of Basic Education supplies (or will supply) radios to all primary schools through the Kenya School Equipment Scheme, while secondary schools, responsible for their own equipment budgets, purchase their own radio receivers.

Another use of formal educational radio in Kenya has been to upgrade teachers in response to the great need for more trained teachers caused by rapidly rising school enrolments. Under the direction of the Correspondence Course Unit at the Institute for Adult Studies at the University of Nairobi, radio broadcasts supplement a correspondence-based instructional system to provide academic upgrading for classroom teachers. In addition to teaching parts of the syllabus, the programmes have served several other useful functions, including pacing and encouraging slower students, publicizing the correspondence course to potential

clients, and attracting an audience of casual listeners who can also be served by the medium.[9]

Radio Mathematics in Nicaragua. The Radio Mathematics Project was a joint venture of the Nicaraguan Ministry of Public Education and the U.S. Agency for International Development, through Stanford University's Institute for Mathematical Studies in the Social Sciences. It was an innovative effort to bring together two related technologies--radio and systematic instructional design--and to evaluate their effectiveness in teaching primary school mathematics.

Nicaragua faces the common problem of a scarcity of fully-qualified teachers, particularly in schools outside of major urban areas. In such settings, conventional primary-school curricula often do not serve the basic literacy and numeracy needs of rural students. The Radio Mathematics Project attempted to improve the quality of mathematics instruction with a curriculum focusing on basic skills in a context relevant to the rural children it served.

Radio Mathematics fell squarely within the instructional radio category of McAnany's paradigm. It functioned entirely within the formal primary-school system, following the existing Nicaraguan mathematics curriculum. Radio, the primary instructional vehicle, was used to broadcast daily thirty-minute lessons to children in the second, third, and fourth years of primary school. The lessons were supplemented by teacher-led post-broadcast activities.

By 1979, Radio Mathematics was clearly a success. It was serving 10,000 pupils in one quarter of the country's districts. The government planned to expand the use of the radio lessons to the entire country, and Nicaraguan professionals were in the process of developing a fourth year of programmes without assistance from Stanford. The revolution of July, 1979, changed the situation, as the new government chose not to continue with this approach. Since then, however, a number of other countries have investigated possible applications of this methodology to their own needs, most notably Thailand, which has developed a radio mathematics programme based on the Nicaraguan experience.[10]

The work in Nicaragua identified a number of principles concerning the effective use of instructional radio and related techniques of instructional design that have been applied to good advantage in the Radio Language Arts Project. These are discussed later in this paper. Radio Mathematics also proved that an appropriate use of radio could maximize the medium's advantages and minimize its disadvantages to produce a cost-effective educational technology.

Radio Mathematics lessons resulted in significant achievement gains for radio classes over non-radio classes (from forty percent to sixty-five percent mean post-test item scores). They also reduced the number of children failing to advance to the next level in primary school.[11] When pupils learn faster and

advance more regularly, educational costs go down. This trend can be accelerated by proper planning, particularly when the use of print materials is reduced (as it was in Radio Mathematics), thereby lowering production and distribution costs, and when the radio lessons continue in use over several years, thereby spreading development costs over time.

The potential of radio The lessons of many years and many countries, including Kenya and Nicaragua, confirm the potential of radio as an appropriate, cost-effective educational technology. These results are even more interesting when compared to available alternatives.

A 1981 review of twenty-six system studies of the determinants of school achievement in developing countries, sponsored by the International Development Research Centre, found the most significant factors to be student traits, such as family socio-economic status and student health. These factors do not admit direct intervention by the formal school system. Teacher characteristics, such as certification, years of training, and years of experience, were not found to be particularly important factors. Textbook availability did prove to be significant, but the authors asked why it was not a stronger determinant than the evidence indicated.[12] Given the costs and difficulties of training teachers and producing textbooks in comparison to the relative level of benefits, the potential of alternative educational technologies such as instructional radio deserves careful consideration.

THE SUBJECT: ENGLISH AS A FOREIGN LANGUAGE

English in the Context of the Kenyan Curriculum

One of the challenges facing the Kenyan educational system is the existence of approximately forty different language varieties. The problem of supporting education in so many different languages has been solved by using the pupils' mother tongue or the language of their catchment area for teaching the first three years of school, and adopting English as the medium of instruction after the lower primary level. Kiswahili is taught as a subject from standard four. (English is the official language of Kenya, while Kiswahili is the national language.) All standardized leaving examinations, including the primary level examination, are administered in English. A child's English-language abilities, therefore, are critical to his or her success in the formal educational system.

During the course of a child's three years of lower primary English instruction, the syllabus indicates that he or she should master most of the major grammatical structures as well as approximately 1600 oral and 1200 reading vocabularly items. The purpose of this curriculum is to prepare children for standard four, when English is used as the medium of instruction.

In order to accomplish this goal, the national timetable devotes four hours per week to English in standards one and two, and three and a half hours per week in standard three. The syllabus is realized in a series of textbooks entitled The Progressive Peak English Course. There is a basic reader for each year, plus twelve supplementary readers used in standards two and three. Each standard also has a detailed course book for teachers.

The Progressive Peak English Course series was introduced nationally in 1976. Kenya is currently in the process of revising its entire primary curriculum under the auspices of the Primary Education Project (PEP). PEP proposes to alter somewhat the amount of time devoted to lower primary English, reducing it to two and a half hours per week in standards one and two (to allow a somewhat greater emphasis on teaching the vernacular languages) and raising it slightly to three hours and forty minutes in standard three. The Progressive Peak textbooks, however, will be retained.

Radio and Language Instruction[13]

Instructional radio has been used for language instruction in many different countries, using many different techniques, with differing degrees of success. Its most common use has been in the realm of adult literacy programmes. A UNESCO survey in 1969 reported forty countries using radio to combat illiteracy (twenty of which also were using television), and suggested that the utilization of broadcasting was increasing.[14] Reasons for adopting this technology include its power to reach isolated and inaccessible groups, its ability to extend beyond the walls of the conventional classroom, its simplicity of operation at the receiving end, and its popularity as an entertainment medium.

Attempts also have been made to use radio within the formal educational system for language instruction, with varying degrees of success. In the 1950's, for example, Thailand began to teach English with the help of radio, with the goals of upgrading education and extending equal educational opportunity to the entire country. Towards the end of the same decade, the Philippines began to use radio for classroom language instruction, and current efforts to put Pilipino on an equal footing with English within the educational system have fostered new interest in this medium. The Radio Project in Senegal used a radio series to help teach oral and written French to primary school children. Mexico's Radioprimaria system, designed in response to a shortage of teachers, broadcast lessons in several subject areas, including Spanish.

While this list is by no means comprehensive, study of these examples can highlight several important points. The use of radio for classroom-based language instruction is not nearly as common as radio use in non-formal education and adult literacy programmes. When instructional radio is used for formal language teaching, it is generally either a partner to other methodologies

or a subordinate technique used to enhance the effectiveness of the classroom teacher and/or printed materials. There are no descriptions in the literature of radio language instruction in which the broadcasts have been designed to serve as the sole means of instruction. Neither is there available very much systematic evaluation of the effectiveness of radio language instruction.

There is clear value, then, in a careful investigation of the potential of instructional radio to carry the primary burden of teaching English as a foreign language in a cost-effective manner. Its advantages are numerous. Its record of service, in Kenya and elsewhere in the Third World, is impressive. The subject area is an important one for the Kenyan national curriculum. This is the rationale behind the Radio Language Arts Project.

INSTRUCTIONAL DESIGN PRINCIPLES

It should be clear from the preceding discussion that instructional radio must be used properly in order to take advantage of its potential for teaching English as a foreign language. This requires careful attention to certain key principles of instructional design, not only in theory, but more importantly, in consistent practice. This section summarizes the most significant of the instructional design principles used by the Radio Language Arts Project, several of which are applications of approaches validated by the Radio Mathematics Project.

Intensive Use of Radio

The most common use of radio in language teaching has been to support other instructional strategies. This has been true in Kenya, where lower primary children have long benefitted from one fifteen-minute broadcast per week to support English lessons taught by classroom teachers with the Progressive Peak textbook series.

The most important question which the Radio Language Arts Project seeks to answer is whether a more intensive use of radio can be justified by improved pupil performance and reasonable, possibly reduced, costs. In comparison with other schools broadcasts in Kenya, RLAP radio English lessons, known by the series title English in Action, are longer (thirty minutes instead of fifteen), are more frequent (new lessons daily instead of weekly), cover more of the school year (broadcasts thirty-nine out of forty weeks instead of twenty-four out of forty), and begin earlier (at the first year of primary school instead of the second). Over the first three years of primary school (the focus of the RLAP and the period allotted to preparing children for English-medium instruction), RLAP children will listen to 292.5 hours of radio English lessons, compared to the twelve hours of new radio instruction children in conventional classrooms receive in the same period.

This means that RLAP children are exposed to instructional radio for learning English almost twenty-five times as long as their counterparts in control classrooms. With this much time available, it becomes possible to assign a leading pedagogic role to radio. Rather than just supplementing textbooks and teachers, the radio lessons can carry a large share of the instructional burden.

Cost Control

The inherent costs of developing and broadcasting radio lessons have already been mentioned. It is important to ensure that no additional costs are unnecessarily associated with the methodology if the total package is to remain economical. Furthermore, special projects such as the RLAP too often depend on resources (human and time, as well as material) which cannot be supported by normal operating budgets. In such cases, of course, no matter how impressive the results, the new methodologies can never be properly implemented.

The RLAP seeks to meet this challenge by minimizing two particularly significant costs: printed materials and teacher training. Recognizing the expense, difficulties, and uncertainties associated with printing and distributing materials, the RLAP depends as little as possible on the print medium. A brief guide to each lesson is prepared for the teacher. These can eventually be collected in a simple booklet which can be distributed separately or with other teacher's notes for other schools broadcasts.

Language teaching, of course, benefits substantially from visual perception. Wherever possible, the English in Action lessons ask the teacher to write or draw on the blackboard, prepare simple visual aids, or locate easily obtainable props. Few assumptions are made about textbook availability, although recommendations are given for how teachers should take advantage of those English textbooks which the school can supply.

In standard two, for example, teachers are given guidelines for using the Progressive Peak books during non-radio English periods, but the radio English lessons themselves do not depend on these books. Instead, pupil worksheets are prepared as necessary to accompany the radio lessons (an average of one worksheet per week). These use typewritten text and simple, black-and-white line drawings, primarily to support reading work. During the project's pilot phase the worksheets are being continuously developed in conjunction with the lesson scripts and distributed (with the teacher's notes) to project schools every fortnight. For national implementation, however, the worksheets can also be compiled as inexpensive booklets which would be less costly to print than conventional textbooks.

Formal teacher training has been limited to a one-day workshop at the beginning of the year. The workshop introduces

teachers to the radio and the lessons, and explains how they can work effectively with this method. Many teachers have asked for longer training, but the costs would preclude national implementation of such a programme. Instead, the radio lessons themselves are designed to give the teacher as much guidance and help as possible. The radio characters frequently give the teacher suggestions and request his or her help in various ways. The teacher's notes for each lesson also suggest the most effective ways to work with the radio. There is even the possibility of developing a radio-based in-service training program which could reduce or even eliminate the need for an initial workshop.

Systematic Instructional Development

The Radio Language Arts Project integrates two appropriate educational technologies. The first, radio, has already been explored in some depth in this paper. The second is a technology in the original sense of the word (which comes from the Greek tekhnologia for "systematic treatment"). It is systematic instructional development.

The RLAP is not a curriculum development project in the strict sense. It does not seek to determine what should be taught, since it follows the guidelines in the Kenyan Primary English Syllabus. Instead, it seeks to determine how the existing curriculum can best be taught with the help of radio. In order to accomplish this, the syllabus must be translated into effective instruction which systematically imparts to pupils the objectives specified by the curriculum. This is the process of instructional development.

The process begins with the writing of a "Scheme of Work" which translates the syllabus into a step by step sequence of language competencies, patterns, and vocabulary. Each step (called a "frame") focuses on the four basic skill areas (listening, speaking, reading, and writing), identifies links to existing material (such as the Progressive Peak readers) for possible follow-up use, and suggests a theme which can unify the lessons (for example, "at the shops"). Frames are designed and ordered following the best available principles of language teaching.[15]

Each frame is translated into a series of lesson plans that guide the script-writing. The lessons are divided into segments, ranging in length from thirty seconds to several minutes. Multiple segments, in turn, are combined into instructional blocks, each assigned to a specific skill area. The organization of the lessons is constant. In standard two, for example, every lesson begins with a speaking/listening block which runs for six minutes following the musical opening and concentrates on maintenance of previously taught patterns and vocabulary. The content of each segment varies from day to day, as specified in relation to the frame by the script plan.

The instructional writers draft segments by following the script plans. They refer to the relevant frame in the Scheme of Work for the content and objectives which the segment must teach. The draft segments are then combined into a working script, which is reviewed for congruence with the specifications in the Scheme of Work, for cultural appropriateness, and for production suitability.

Once the script has been approved, support materials (teacher's notes and pupil worksheets) are written and distributed to project classrooms. Formative evaluation instruments (discussed later in more detail) are prepared in order to check on whether the part of the curriculum under consideration was, in fact, mastered by the pupils. Formative evaluation results feed back into the script planning process, closing the loop. The entire process is designed to promote effective learning, with maximum efficiency, of precisely what is required by the syllabus.

Distributed Learning

Psychologists have long known that skills need to be practised regularly to be maintained effectively, and that learning spread over time (distributed learning) is more effective than learning concentrated in only one period (mass learning).[16] However, instructional designers generally have paid only lip service to the implications of this principle. By far the most common mode of instructional organization, whether by classroom teachers or mediated learning packages, is the "topic"—one lesson devoted to one subject.

The challenge of instructional efficiency addressed by the Radio Language Arts Project requires the application in practice of the distributed learning principle. This is one reason for the segmented script organization described in the previous section. Rather than devoting one English in Action programme to a single topic or objective, each programme consists of several segments teaching or maintaining different skills and competencies. A given competency, on the other hand, will be taught over several consecutive lessons. Then, after a period of several weeks, it will be maintained over several more lessons.

In addition to promising to improve learning, this approach enhances the ability of the radio lessons to involve pupils. The relatively short attention span of lower primary children is much better served by only a few minutes of concentration on one topic. Their interest can be maintained more effectively through the presentation of a variety of material and through the quicker pace such variety promotes.

Active Learning

Children learn better when they are actively involved in the learning process. Radio, as a one-way broadcast medium, tends to encourage passivity among listeners unless careful steps are

taken to promote active response. This is a central instructional design principle of the Radio Language Arts Project.

The first key to success in this area is getting children to accept the radio as a window into another world, whose characters can communicate with the pupils in the classroom. The primary instructional objectives of the first standard one lessons centered on this task. Children learned to respond directly to commands and questions from the radio characters during carefully timed pauses in the broadcasts. Because those characters, in turn, seemed to reply to the children, a sense of two-way communication was created. By standard two this sense has become a strong foundation for the instructional message. With no hint of self-consciousness, pupils ask and answer questions of the radio characters, sing songs with them, play games with them, and travel with them in the realm of imagination to a variety of locales where functional English can be acquired and practiced.

Once this two-way relationship is established, it is possible for the radio to effectively stimulate pupil participation. Writers try not to let more than fifteen to twenty seconds lapse (sometimes more, often less) without requiring some sort of response from the children. The exact type of response depends on the instructional objectives being treated. For example, pupils could be asked to answer a question, ask a question, repeat a pattern, work through a transformation drill, read a sentence, find a word, write a phrase from dictation, copy a sentence from the blackboard, sing a song, or play a short game requiring physical activity.

All of these techniques, and many others, involve children actively in each radio lesson. In this manner, the children's attention is firmly held, they are better able to acquire new skills, and they are likely to retain those skills more successfully. One result is that teachers and headmasters frequently comment on how much the children enjoy and are interested in the English in Action lessons.

Immediate Reinforcement

An important lesson for education from psychology is that learning is enhanced by immediate feedback to the learner. This is another area where the one-way nature of broadcast media can cause problems unless appropriate care is taken.

The Radio Language Arts Project lessons are designed to serve teachers who may be weak in English, as well as those with good English skills. Therefore, each segment must be planned so that the pupils will benefit from everything that the classroom teacher can contribute, but will not suffer if this contribution is limited. For this reason, the radio gives pupils correct answers to problems as often as possible.

The open-ended nature of language makes this far more difficult to implement for English than, for example, mathematics. In

the case of reading exercises, the problems are minimal. If the child has been asked to read something, the radio can repeat it correctly. If a comprehension question has been asked, the radio can model an appropriate answer. In the case of writing, on the other hand, it is very difficult for the radio to provide effective reinforcement. The pupil's attention can be drawn to a model of the correct response, but his or her actual written work can neither be judged nor corrected by the radio. This remains the teacher's responsibility.

Oral language falls between these two poles. In the first year of broadcasts it was fairly simple to anticipate the correct response to a question, since the language available was relatively limited. However, as the children's English ability increases, so does the difficulty of reinforcing correct responses. For example, there can be several good answers to the question, "Where is Juma's book?" Appropriate responses include, "It is on the table," "It's on the table," "On the table," "It's over there," etc. Fortunately, classroom observations suggest that the pupils are not confused by hearing the radio offer one correct answer after they have given a different one. Sometimes they will change their next answer to follow the radio's model, and sometimes they will continue with their own chosen pattern. This allows the continued use during the broadcast of the important instructional technique of immediate reinforcement.

The Teacher/Radio Partnership

The basic role of the English in Action radio lessons is to enhance the classroom teacher's effectiveness. This is accomplished by bringing into rural classrooms instructional techniques which might not otherwise be available: systematic coverage of the curriculum, a strong model of correct English, sophisticated pedagogy, maximum exposure to the target language, and lessons which can capture children's attention and motivate them.

As the pupils' English improves, it becomes neither realistic nor efficient to expect the radio to be able to teach everything. It can carry a major instructional burden, but the greater the teacher's contribution, the more the children will benefit.

This partnership between teacher and radio is an important instructional design principle for the Radio Language Arts Project. It is implemented in two ways. First, in the process of preparing the Scheme of Work for each year a careful analysis is made of every objective to determine the most efficient way to teach it. Some objectives are assigned primarily to the teacher's area of responsibility, with the radio offering support. Lesson plans are prepared by RLAP staff for such areas, so that these objectives can be covered systematically, too.

A good example of this is writing practice. Only two minutes out of thirty in each standard two English in Action lesson is devoted to writing. This time is used to introduce the children to new skills (such as writing from dictation). Practising

these skills, on the other hand, is left to non-radio class periods under the teacher's guidance. Devoting half of the radio lesson to writing practice, with dead air in the background while children execute tasks for which the radio can give little useful feedback, would be inefficient and ineffective.

Second, teacher's notes are prepared for every radio lesson to provide teachers with a clear picture of what will be covered and how they can work effectively with the radio. These notes summarize the content of the lesson, outline the preparation required, and give specific suggestions about what the teacher should do during the broadcast. The broadcasts themselves contain guidance for the teacher whenever necessary, to supplement the most important points in the teacher's notes. The in-service training workshop emphasizes how the teacher can help make the broadcasts more effective, but, more importantly, it emphasizes how the radio can enhance the teachers' effectiveness.

RESEARCH DESIGN

The Radio Language Arts Project's research design gives equal weight to two discrete strategies, one for formative evaluation, the other for summative evaluation. This balance attempts to redress problems common to the research designs of other instructional radio projects. On the one hand, some projects have had little or no formative evaluation, making it difficult to correct weaknesses which remain unidentified until the final, summative evaluation (when it may be too late to do anything about them). On the other hand, many projects have had no effective summative evaluation at all, making it difficult to document and analyze lessons learned with any confidence.

The RLAP research design uses a sample of thirty-one schools drawn from seven Kenyan districts. In light of the mission to reach rural children, these schools were chosen to represent Kenya's rural population, limited only by the necessity of project staff's being able to reach the schools for educational treatment and evaluation. Finite resources also precluded working everywhere in the nation. Given the obvious importance of mother tongue as a variable in learning English as a foreign language, districts were selected which represent approximately seventy percent of the Kenyan population linguistically. Given the importance of academic quality, schools were chosen by means of a stratified random sample on the basis of performance on the standardized primary school leaving examination, which ensured equal attention being paid to high, medium, and low scoring schools.[17]

These thirty-one project schools are divided into two subsets. For summative evaluation purposes, twenty-one schools are designated as pilot (i.e., experimental) schools. Pilot schools are visited only once a year by professional staff, for the sake of post-testing, and once a fortnight by a driver to deliver and collect print materials. This minimizes the possibility of any Hawthorne effect artificially improving results.

For formative evaluation purposes, the remaining ten schools (matched on the basis of academic performance to ten of the pilot schools) are designated as observation schools. Formative evaluation data are collected from these schools several times each week. Because of the resulting intervention effects, observation schools are excluded from the summative evaluation sample.

Formative Evaluation

Not only has the RLAP given equal weight to formative and summative evaluation, but it also has applied a technique developed by the Radio Mathematics Project which makes formative evaluation an integral part of the instructional development process.

Conventional instructional development, particularly for educational media, follows a four-step procedure. Materials are developed, tried out in the field, revised on the basis of field test results, and, finally, fully implemented. This can be termed the revision model. It is a thorough, well-validated methodology, but it is also expensive and time-consuming. If one wishes to develop a new radio lesson for virtually every day of the school year while minimizing costs at the same time, the revision model is impractical.

Radio Mathematics developed an alternative formative evaluation model based on the feedback system used in industry to control continuous processes. Industrial applications of this approach involve the continuous monitoring of output, with any deviation from desired outcomes causing an automatic compensatory adjustment of the input parameters. Its educational application calls for the ongoing assessment of lesson effectiveness, with corrections being made (i.e., material being retaught) in future lessons as necessary.[18]

As applied in the RLAP, this system is labeled the feedforward revision system to underscore its emphasis on improving instruction through changes to future lessons. A team of two observers (professionals from the field seconded to the project on a part-time basis) is assigned to each of the ten observation schools. They observe three lessons each week, completing a protocol developed by project staff which focuses attention on the instructional methodology (teacher performance, pupil participation, common mistakes, etc.). They also talk to teachers, eliciting their comments and suggestions. To these reports are added observations by the RLAP professional staff members, each of whom observes once a week. Every Friday the observers administer an achievement test, also developed by project staff, which focuses on objectives that have been introduced or maintained during the week.

Formative evaluation data are compiled, analyzed, and summarized by the RLAP research specialist, who then presents the results to his colleagues. Problems are identified and decisions

are made about correcting them. In some cases a specific problem (for example, an objective which was not mastered) will be solved by writing a limited number of segments to correct it (the objective will be taught again using a different instructional methodology). In other cases a general concern will be raised (for example, children have difficulty locating a specified section on worksheets), resulting in a new instructional design principle which will be applied throughout future lessons (perhaps a new worksheet format, and/or more time and cues given in the radio lesson to help children find the proper place).

When serious problems arise, of course, decisions are made to change lessons which have already been recorded. A segment which is observed to fail completely, leaving pupils confused and not participating, would evoke such a decision. But the emphasis of the feedforward formative evaluation process is on revisions to future materials. This requires that the instructional design principles on which materials are based be carefully validated to ensure that problems are the exception rather than the rule.

Before regular broadcasts began, the RLAP spent more than a year developing pilot radio lessons based on tentative principles about the most effective use of radio for teaching English as a foreign language, testing those lessons in classrooms, evaluating the results, revising the design principles, developing new lessons based on the revised principles, and so on. The result was a reasonable certainty that the English in Action lessons would be generally successful without an unacceptably high level of revision. In practice, this has proven to be the case. The radio lessons work well, and those problems identified by formative evaluation have been corrected without undue difficulty.

Summative Evaluation

The basic choice for the summative evaluation design was between matching control and experimental schools, administering a post-test in both sets of schools simultaneously at the end of each broadcast year, and using the same set of schools for both control and experimental purposes, administering a post-test one year to children who have not been exposed to the treatment and the next year to children in the same classroom who have been exposed to the treatment. The second, lapped-year, research design was chosen.

This approach has two major advantages. The paucity of reliable data on school, teacher, and pupil quality make any attempt to construct a comparable set of control and experimental schools an uncertain one. By controlling the teacher variable as much as possible (i.e., by trying to keep the same teacher in the classroom from one year to the next), and by guarding against any untoward changes in the pupil cohort from one year to the next (for example, by avoiding schools in areas where significant changes in the socio-economic and educational profiles of entering pupils from one year to the next are likely), the lapped-year design should ensure a closer match between control and experi-

mental groups at the same schools than would be the case if two different sets of schools were used.

Second, the lapped-year design completely avoids the problem of contamination of control schools. Control groups are tested before the broadcasts to their standard begin, so there is no chance that they could be exposed to it unintentially. Were a matched set of control and experimental schools used, it is possible that children in the control schools might listen to the radio lessons, too, thereby contaminating the results. Indeed, there are indications of widespread listening to English in Action lessons among non-project schools, and it may well have proven impossible to keep the control sample free of such interference.

The summative evaluation strategy for one classroom (the basic unit of analysis) is summarized in the following chart.

Year	Radio Classrooms (experimental)	Control Classrooms (control)
1981		School A Classroom 1 Teacher X Pupil cohort alpha
1982	School A Classroom 1 Teacher X Pupil cohort beta	School A Classroom 2 Teacher Y Pupil cohort alpha
1983	School A Classroom 2 Teacher Y Pupil cohort beta	School A Classroom 3 Teacher Z Pupil cohort alpha
1984	School A Classroom 3 Teacher Z Pupil cohort beta	

In November, 1981, pupils in the alpha cohort in classroom one (standard one) of this school (school A), having been taught for a year by teacher X without the radio English lessons, were given a post-test based on the Kenyan syllabus. Results from this test provided a pupil achievement record for the control group. In November, 1982, the same test was administered to pupils in the beta cohort. These children had spent a year in the same classroom (classroom one) with the same teacher (teacher X), but with the radio English lesson treatment. Their test results provided a pupil achievement record for the experimental group. The amount of time devoted to English each week was held constant from 1981 to 1982. A comparison of results between the control

and experimental groups could then be used to evaluate the effectiveness of this use of instructional radio.

The same pattern will be followed during 1983 and 1984. The same set of schools will continue to be used for both control and experimental purposes. Pupil achievement and other variables will be measured in one year for control purposes and in the subsequent year, after treatment, for experimental purposes. The same control and experimental cohorts of children will be followed because the RLAP is interested in cumulative results (i.e., the effects of three years of radio-based instruction versus three years of conventional instruction). Supplementary data will be collected through instruments such as surveys of teacher and headmaster attitudes.

Finally, a cost-effectiveness analysis will be undertaken to consider at least two interrelated areas. First, the costs of delivering radio-based English instruction will be compared to the costs of delivering conventional instruction. In Kenya, this conventional instruction is at present print-oriented, with a common text and supplementary materials for each standard, including brief, supplementary radio broadcasts beginning in standard two. Second, the costs of radio-based instruction will be compared to pupil performance, which could be studied in relation to student retention at the standard level, poor achievement, drop-out rates, and budget levels.

As of March, 1983, the summative evaluation data for 1981 (control) and 1982 (experimental) standard one classes are in the final stages of analysis. Although results are not yet available, indications from the formative evaluation system are that the first year's programme have been successful, with encouraging pupil achievement and very positive reactions from the project schools.

CONCLUSION

If the final results of the Radio Language Arts Project are positive (as preliminary indications are showing), their implications will go beyond confirming radio's proven role as an appropriate educational technology. They will focus attention on the virtually untapped potential of this medium to assume a primary role in the formal instructional process, improving student achievement in a cost-effective manner that can benefit rural schools as easily as urban schools. Furthermore, they will suggest that the accomplishments of Radio Mathematics in Nicaragua are generalizeable to other subject areas and other countries. The three years of RLAP radio English lessons will be added to the four years of radio mathematics lessons as a resource available to any country interested in adapting them for its own use. And the knowledge gained in developing those lessons will be available to professionals who wish to extend this methodology to other subjects and other academic levels.

FOOTNOTES

1. Dr. Philip R. Christensen is the Field Coordinator and Chief of Party of the Radio Language Arts Project. Dr. Ephantus M. Mugiri is Chief Programme Coordinator at the Kenya Institute of Education. The authors are grateful to Dr. Maurice Imhoof, RLAP Project Director, and to the professional staff of the RLAP (David Edgerton, Kurt Hein, Mary Karue, John Muitungu, Margaret Ojuando, Greg Owino and Philip Sedlak), for their many helpful suggestions about this paper.

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6. Peter L. Spain, Dean T. Jamison, and Emile G. McAnany, eds., Radio for Education and Development: Case Studies (World Bank Staff Working Paper No. 266), 2 vols. (Washington, D.C.: The World Bank, 1977).

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8. Gathoni L. Kirika Munuthi, "A Descriptive Study of the Role of Radio and Television in the Educational System of Kenya" (M.A. thesis, San Francisco State University, 1981), pp. 170-184.

9. Peter E. Kinyanjui, "In-Service Training for Teachers through Radio and Correspondence in Kenya," in Radio for Education and Development, eds. Spain, Jamison, and McAnany, pp. 152-170.

10. Pattama Sang-Jan, "Media and the Teaching of Mathematics in Thailand," Media Asia 9 (1982): 203-205.

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12. Ernesto Schiefelbein and John Simmons, The Determinants of School Achievement: A Review of the Research for Developing Countries (Ottawa: International Development Research Centre, 1981).

13. An explanation of the theory of language teaching goes beyond the scope of this paper. For an excellent treatment of the subject in the specific context of educational radio, the reader is referred to Imhoof's position paper (Maurice Imhoof, Reading by Radio: A Position Paper on the Use of Radio in Teaching Reading Skills for Educational Development [Washington, D.C.: Academy for Educational Development, 1981]).

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17. Maurice Imhoof, Selecting Project Schools, Academy for Educational Development Field Notes no. 1 (Washington, D.C., 1982).

18. For details about the use of this formative evaluation model in the Radio Mathematics Project, see Jamesine Friend, "A Historical View of the Radio Mathematics Project's Use of Formative Evaluation," in Radio Mathematics in Nicaragua, eds. Friend, Searle, and Suppes.

NOTE: Publications of the Academy for Educational Development and the Clearinghouse on Development Communications may be obtained from the Academy for Educational Development, 1414 22nd Street N.W., Washington, D.C. 20037, U.S.A.