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ABSTRACT

Concerned primarily with interactive radio for instruction, this issue highlights radio projects in developing countries that have proven to be a successful tool for educational development. These include: (1) an experimental project designed to investigate the feasibility of using radio as a medium of instruction in the teaching of elementary school mathematics, used in Nicaragua from mid-1974 to early 1979; (2) the Radio Language Arts Project, a direct follow up to the Nicaraguan Radio Math Project for the purpose of applying and adapting the model to a different subject area in Kenya; and (3) Radio-assisted Community Basic Education (RADECO), which teaches the basic curricula of grades one through four through the exclusive use of radio to children in rural areas of the Dominican Republic. The descriptions of each of the projects (by J. Friend, P. R. Christensen and J. F. Helwig/J. Friend respectively) includes instructional design decisions, adaptation challenges, and curriculum choices. A follow up evaluation of all three radio projects is also included; this evaluation, by B. Searle, concludes that interactive radio is effective for the instruction of primary school subjects, and that both trained teachers and untrained classroom proctors can use radio lessons effectively. The newsletter also contains reviews of four books on the topic of radio and broadcasting plus two additional articles: "Radio Science: Completing the Interactive Radio Instruction Curriculum," by J. Meadowcroft, and "The Fourth R--(Interactive) Radio," by Philip Spain. (JB)

development communication report

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Longtime readers of DCR *will remember that the Clearinghouse was brought into being (as the Information Center on Instructional Technology) to assist the Office of Education of AID's Bureau for Science and Technology to disseminate information about the uses of communication technologies in formal education. While this initial focus has broadened to encompass many kinds of education, the Office of Education has continued to be a pace-setter in testing and validating the promise of educational technologies to improve the quality of education of rural school children throughout the developing world. Specifically, this has meant the adaptation of the theories of instructional design to radio, in increasingly complex subject areas, for primary curricula.*

In an attempt to bring our readers up to date with these developments, we have worked with the staff of the Office of Education to present a state-of-the-art review of what we are calling "interactive radio" for instruction. Evaluation results are coming in on two current interactive radio projects, and a new project, Radio Science, will be getting underway this year. The methodology and design of these projects is innovative and dynamic, and the successes they have realized should be considered by all who are concerned with providing equitable universal education.

Interactive Radio and Educational Development: an Overview

by Clifford H. Block

Instructional radio has been "reinvented," and now stands ready to serve as a powerful new tool for educational development. Today, it holds promise for alleviating some of the most pressing problems faced by educators throughout the world. Radio instruction can now, with assurance, be used to rapidly improve teaching quality, to increase educational access, and to introduce new subject matter.

This issue of *Development Communication Report* focuses on a decade of educational research, development, and evaluation of "interactive radio instruction;" a set of methods that is a major source of the revitalization of education through radio. When used with these methods, radio education is active, absorbing, and effective. The interactive radio approach has shown major student gains in nations as diverse as Kenya, Nicaragua, and Thailand, and in subjects as different as language and mathematics. A "community school" model is also in operation, in the Dominican Republic, teaching students late in their work day with radio classes organized by community aides.

This powerful new instructional tool is becoming available at a time when the search for improvement in primary education is gaining increased attention. While the developing nations have made enormous quantitative strides in providing educational access in the last two decades, both quality and efficiency have suffered. Failure, repetition, and dropout rates are astonishingly high, and most children fail to move beyond the first two or three grades. The skills of those who do go through the entire primary cycle are often below desired norms. And with population growth continuing, the prospects for improvement using conventional educational means are grim—in fact, educational conditions could well decline further.

The vigorous, systematic use of instructional radio now holds promise for breaking out of this cycle of decline. With this purpose in mind, the U.S. Agency for International Development (A.I.D.) started their program of develop-

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A Model for Interactive Radio Lessons: The Radio Mathematics Project

by Jamesine Friend

The Radio Mathematics Project was a highly experimental project designed to investigate the feasibility of using radio as a medium of instruction in the teaching of elementary school mathematics. The project, located in Nicaragua from mid-1974 to early 1979, was carried out by Stanford University under contract to the U.S. Agency for International Development. During its life, the project developed mathematics lessons for the first four years of elementary school. These lessons—daily radio broadcasts plus postbroadcast activities conducted by the classroom teachers—proved to be extremely successful in improving the students' mathematics achievement. Furthermore, the cost of widescale implementation of the materials was estimated to be well within Nicaragua's budget.

Radio Math's success can be attributed largely to the innovative style of the broadcast lessons, a style characterized as "interactive" in recognition of its mimicry of a conversation between students and teacher. The interactive lesson style is easily adapted to the teaching of many other subjects, and has been used, with minor modifications, to teach English as a second language (see the Radio Language Arts Project article in this issue), and initial reading (see the Radio-assisted Community Basic Education Project article in this issue). In all these settings, the lessons provide daily instruction, and are intended to *replace* rather than supplement existing instruction in the subject matter.

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In this issue . . .

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(**Radio Math** *continued from page 1*)

Lesson Style

Each lesson consists of two parts, a broadcast part and a nonbroadcast part conducted by the classroom teacher. These two are complementary, with content divided so as to take best advantage of strengths and weaknesses of both radio and classroom teachers.

The broadcast portion of the lesson carries the major burden of instruction, so that the lessons are successful even in classrooms where the teacher cannot fully support the radio-based instruction. The nonbroadcast activities are similar to what teachers are accustomed to using. In many schools in developing countries, teachers are overburdened; they may have far too many students, or they may have students in several grades. Furthermore, in many countries, there are not enough credentialed teachers, and even they may be poorly trained. For these reasons, teachers cannot consistently contribute to radio-based instruction in classrooms, and the success of these lessons will depend upon how well the radio can teach with less than optimal support.

The Radio Lessons

The interactive radio lessons are designed to provide direct instruction to the students. The radio teachers (usually two or three) explain concepts, provide examples, and guide the students in the completion of exercises. Instruction is done more by examples than by verbal explanations. Instruction has the flavor of guided discovery. Vocabulary is highly controlled so that explanations and examples are phrased in language suitable for the children's level of development. Technical vocabulary is used sparingly, and only after the concept to which it refers is well understood. Sentences are short and conversational, as befits an oral medium. Most of the time the actors speak directly to the children in the classroom, assuming the roles of teachers. Outside of short interludes of dramatization, the action takes place in what is presumably a classroom.

Most of the instruction is oral. Worksheets are sometimes used to supplement the lessons, but only to provide practice exercises, not to provide printed explanations. In the mathematics lessons, worksheets are used only in the first grade; in second, third, and fourth grades, students copy exercises into inexpensive exercise books. In the Radio Language Arts lessons and in the Radio-assisted Community Basic Education reading lessons, worksheets are used at all levels, because the subject material cannot be taught well without using printed material. Other supplementary materials, besides worksheets, are used sparingly. In the mathematics lessons for second grade, twelve small posters were prepared but otherwise only bottle caps, seeds, and stones were used as counting devices. There are two reasons for restricting the amount of supplementary teaching materials. One is that the *cost* of such materials may be quite high; daily, nonreusable worksheets can double the recurrent cost of using radio-assisted instruction. The second reason is related to *logistics:* delivering such materials to isolated schools is difficult in countries where communication and delivery systems are not well developed.

Teachers are not asked to spend much time or any money in the production or acquisition of materials. Other projects sometimes require these commitments from teachers. This may work for small-scale projects in which a great effort is made to promote teacher interest and participation, but it is unlikely to work on a large scale.

Active Student Participation

The students listening to the radio lessons are expected to participate actively, responding aloud to oral questions, circling pictures on their worksheets, writing in their notebooks, reading numbers from the blackboard, counting seeds or sticks, and so on. Appropriate pauses are provided for student responses so that students can complete their exercises as the radio lesson is going on. These student responses are frequent—one every 20 or 30 seconds—and are the most noticeable characteristic of interactive lessons. Indeed, we call this radio application "interactive" precisely because of these frequent responses that give the radio lesson the appearance of a rapid-fire dialogue between radio and the students.

After every student response, the radio gives the correct response so that the children can immediately compare their own responses with the correct one. This is an adaptation, for radio, of the principle that immediate reinforcement of responses promotes greater learning. Since radio is a mass medium, reinforcement cannot be individualized, so instead of the classroom teacher telling each student whether or not his/her response is correct, the answer is simply announced and the decision about correctness is left to the student. This adaptation of the immediate-reinforcement principle to group use was designed by the Radio Mathematics Project after several months of experimentation with various ways of handling reinforcement.

Interactive radio students are intensely involved in each broadcast lesson. Although each exercise in each lesson follows a fairly stereotyped form, the children do not become bored, partly because of this intense involvement, and partly because there are frequent changes of topic.

In the Radio Math lessons, as many as a dozen topics might be touched upon in any 30-minute session, with only two to three minutes of instruction in each topic. This "segmented structure" is not simply to prevent boredom or to accommodate the short attention span of young children; it applies an important pedagogical principle: distributed practice leads to greater long-term retention than does massed practice. If the total instructional time to be devoted to a specific teaching objective is 30 minutes, the most effective use of that time is in three-minute segments taught on ten different days, rather than in a single 30-minute lesson. Distributed practice is particularly suited to the teaching of "skill" subjects like arithmetic and reading.

Instructional Design

Segmented structure is characteristic of the radio lessons used in all three projects mentioned. It was originally an adaptation of the format used by the "Sesame Street" television program, though with some important differences. Because of the students' age and their lack of exposure to children's programs, it was not necessary to carefully integrate an element of entertainment into the radio lessons. Although the radio lessons include elements that are clearly for motivation or diversion, they are generally not integrated into the instructional segments. Nevertheless, it was found that some diversionary activities provided a few minutes of respite for the students from the intense mental effort required during the instructional segments. Songs and physical activities were found to be the most successful forms of diversion for them. Activities such as jokes, riddles, stories, or music for listening are unnecessary because the children find sufficient motivation in the high degree of participation required by these lessons.

Research-based Lessons

Radio Math's lessons are reinforced by rigorous research to validate their teaching effectiveness. Before being broadcast, the scripts and tapes are reviewed and revised by project producers. After a lesson is broadcast, a random subset of children are tested about specific results intended from the lesson's segments. If achievement is substandard, the faulty segment is redone and broadcast in its improved form some weeks later. This on-going formative evaluation is a basic, innovative characteristic of this radio model: validating the overall series of radio lessons as an effective teaching tool.

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Development Communication Report, published quarterly by the Clearinghouse on Development Communication, has a circulation of over 5,000. The newsletter is available free of charge to readers in the developing world, and at a charge of US $10.00 per year to readers in the industrialized countries.

A center for materials and information on important applications of communication technology to development problems. The Clearinghouse is operated by the Academy for Educational Development, a nonprofit planning organization, and supported by the Bureau for Science and Technology of the U.S. Agency for International Development as part of its program in educational technology and development communication.

Readers are invited to submit typed manuscripts of no more than 1000 words.

The Radio Language Arts Project: Adapting the Radio Mathematics Model

by Philip R. Christensen

In 1979, the U.S. Agency for International Development approved a direct follow-up to the Nicaraguan Radio Math Project for the purpose of applying and adapting the findings to a different subject area—reading/language arts, and a different region—Africa. The result was the Radio Language Arts Project (RLAP) in Kenya, which was directed by the Academy for Educational Development in cooperation with the Kenya Institute of Education. Running from 1980 through 1985, the project's specific goal has been to teach English to rural Kenyan school children in standards (grades) one to three using an intensive, radio-based instructional system. Daily, half-hour radio lessons are broadcast throughout each school year, supported by the classroom teacher and limited print materials. They help children acquire the speaking, listening, reading, and writing skills necessary to function in a school system where all subjects are taught in English after standard three.

The project's broader goal has been to test the feasibility of adapting Radio Math's instructional system design principles to a new subject area. These principles can be divided into three main categories. First, project staff implement the curriculum methodically through systematic planning, distributed learning, and cyclical instruction. Second, they make effective use of the radio medium with techniques such as intensive broadcasting, interactive learning, immediate reinforcement, an engaging instructional pace, and maximizing the time devoted to the task. Third, they use other instructional modes to complement the radio, including the classroom teacher, printed materials, and readily available props.

Adaptation Challenges

Both mathematics and English depend on children learning to apply a complex set of formal rules to a variety of situations. Mathematics, however, is more predictable than language. In part, this is because linguistic rules and their application tend to be less regular than their mathematical counterparts. Furthermore, language is a combinational skill. A finite set of rules govern how to join elements on two levels—form and meaning—to produce an unlimited number of sentences.

The RLAP team first confronted this difference when preparing the instructional design document known as the scheme of work. We took far longer than expected to complete the first year's scheme because it was so difficult to articulate a language curriculum with the precision necessary for an effective, media-based instructional system. One problem is that English cannot be organized into the neat hierarchy of categories used by Radio Math. Another problem is that language's open-ended nature means that specifying a detailed objective for each linguistic behavior, would require an encyclopedia-length volume.

Instructional Design Decisions

We finally chose an instructional design that divided the syllabus' content into units called frames. Each frame represents approximately one week's instructional activities, organized around linguistic functions and notions (for example, personal emotions). For each of the four language skill areas (speaking, listening, reading, and writing), the frame specifies the necessary grammatical structures and suggests relevant words from the year's required vocabulary. (A separate record-keeping system tracks the use of vocabulary items in each lesson, identifying those that have been mastered and those requiring more work.) Rather than behavioral objectives, the frame uses competencies that describe expected student performance in open-ended terms. Finally, the frame suggests a setting that writers can employ as a vehicle for using the specified language.

Immediate reinforcement is another important instructional design principle we called upon. In our first year of radio English lessons, we provided immediate reinforcement similar to the Radio Math approach in which students respond to a question, and the radio teacher immediately follows with the correct response. It is for the student to determine whether or not his or her answer was correct. By the middle of standard two, however, we began to encounter difficulties in situations where more than one answer was admissible. In such cases, we chose to have the radio reinforce the children with at least one correct answer, and sometimes two or three alternatives. In actual practice, we found that children who responded incorrectly the first time did use the radio's model to correct themselves. Children who had given a different variation of the correct answer, however, often had learned the relevant rules and maintained their response choice regardless of the radio's alternative suggestion.

A related difficulty arose as we moved into standard three. By this point in the curriculum, children had to produce more complex and lengthy language. The basic format for oral interaction between the radio and the children began to lose its utility. What works well for simple questions and answers is less successful when the students may take 20 or 30 seconds to produce any one of a large variety of reasonable responses. We tried to minimize these situations during the broadcast lessons, directing teachers to have children practice more complicated interaction during the postbroadcast lessons.

Still another challenge was defining the accepted regional standard for pronunciation and grammar. In Kenya, students are learning a colonial language that retains its importance only in certain settings, such as schools. British English was the accepted school standard prior to independence, and each ethnic group in the country has adopted somewhat different English usage. We therefore selected British English as our standard for correct grammar and spelling. The English spoken by educated Kenyans (represented by our studio actors and Kenyan professional staff) became the standard for pronunciation. This approach admits substantial vari-

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The teacher assists students as they listen to, and work along with, the radio English instruction broadcasts in a RLAP classroom in Kenya. Photo courtesy of Philip A.S. Sedlak.

(**RLAP** *continued from page 3*)

ation into the language model we present to children, but the variation corresponds to the reality of Kenyan English.

There are, of course, other differences between mathematics and language besides regularity. Although both subjects are rule-based, students learn the rules in very different ways. Mathematics instruction generally explains the rules explicitly for children to apply in drill and practice. In English, children usually infer the rules (and their numerous exceptions) from exposure to the language itself, mastering the pieces of the entire matrix by a process of successive approximations. They learn to speak by speaking, to read by reading. Acquisition and practice blend together.

Teaching English in English

Another unique aspect of teaching a language by radio is that the subject matter is also the means of communication. In Nicaragua, the mathematics lessons were produced in the children's first language, Spanish. In Kenya, with over 40 vernacular languages, it would be impossible to produce mother-tongue versions for every lesson. From the very first RLAP broadcast then, children learned English in English, with occasional translation help from the teacher.

Among other implications, this places severe constraints on instructional design. What the writers can say and how they can say it must not exceed the bounds of the children's English abilities. For this reason, first-year RLAP programs seem simpler and, perhaps, less sophisticated than the early Radio Math lessons. On the other hand, teaching English in English means that lesson planners can control the quality of language modeled for the children, exposing students to good examples while they are learning.

Involving the Teacher

One of the most important modifications to the Radio Math model, dictated by many of these differences across subject areas, concerns the role of the teacher. While both Radio Math and Radio Language Arts have the teacher lead postbroadcast classes using prepared lesson plans, Radio Math tried to reduce the teacher's responsibilities during the broadcast to turning on the radio and carrying out certain specified activities.

While Radio Language Arts teachers also must perform management activities, they play an important instructional role during the radio English lessons. First, they provide mother-tongue translation when it is impossible for the radio to communicate something important purely in English. Second, they correct children when the radio cannot (after writing exercises, for example).

Another significant difference between Radio Math and Radio Language Arts involves the use of printed materials. After standard one, the Radio Math system used no printed materials for students. It depended only on teachers' notes and a few classroom posters. The radio English lessons, on the other hand, depend increasingly on printed materials as they move from standard one to standard three. This is necessary because children cannot learn to read without having something to read.

Rather than making the questionable assumption that adequate textbooks will be available in every classroom, we developed special RLAP worksheets. Brief, very simple in design, and requiring no color printing, they will be bound into reusable student booklets and distributed to schools that use the radio method. The cost of printing and distributing these materials is far less than the cost of textbooks.

In these ways and others, the Radio Language Arts Project has built a new structure on the foundation laid by Radio Math. The results of its efforts to teach English by radio are very encouraging, showing significant gains in speaking, listening, and reading skills as well as strikingly high levels of satisfaction from school staff and parents. Two independent evaluations carried out for the Kenya Ministry of Education, Science and Technology have confirmed these findings and recommended that the RLAP method be adopted throughout Kenya. The Kenya Institute of Education already has begun the review process necessary for national implementation of this instructional system.

The Radio Math and Radio Language Arts Projects have created innovative systems for teaching two important components of the primary school curriculum. Furthermore, the RLAP has proven that the success of mathematics by radio can be transferred to other subject areas. It is now quite reasonable to predict that, with creative and thoughtful application of the instructional design principles validated by these two projects, other subject areas, other grade levels, and other countries can benefit from intensive radio-based instructional systems. ■

Philip Christensen is the Field Coordinator for the RLAP in Kenya. He has also worked as an instructional systems designer for many years.

Video Applications for WID

Overseas Education Fund (OEF) International is seeking information on all types of uses of video (skills diagnosis, training, motivation) in Third World development projects. These examples will be presented for discussion at special workshops to be conducted by OEF and selected Third World women at the Nongovernment Organization (NGO) Forum, concurrent with the United Nations Conference on Women in Nairobi, Kenya, July 1985. Please send any information and descriptions of such uses of video to: Deborah Ziska, OEF International, 2101 L Street, N.W. #916, Washington, D.C. 20037, USA or call: 202/466-3430.

OEF International is a 40-year old private, non-profit organization whose training and technical assistance programs focus on enabling low-income women in developing countries to earn income, increase crop production, and organize for community development.

"Information is the only resource which grows richer when it is shared."

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Teaching Where There Are No Schools

by John F. Helwig and Jamesine Friend

In remote villages of the southwestern region of the Dominican Republic, children are receiving basic primary education by radio. The region is one with few qualified teachers and even fewer school buildings. The Radio-assisted Community Basic Education (RADECO) project aims to demonstrate that radio is an effective medium for instruction of children, and that it is cost effective.

The use of radio to reinforce and improve classroom teaching at the primary level has been tried and proven in radio education projects in Nicaragua and Kenya. In Nicaragua, mathematics lessons were developed and taught by radio to students attending regular primary school classrooms. In Kenya, where English is the language of instruction in all schools from the fourth grade through the university level, the radio English lessons are designed to help students develop a sound grasp of the English language. Both projects sought to demonstrate the educational and cost effectiveness of radio as a medium of instruction.

RADECO takes the experience of these two projects one step further: the basic curricula of grades one through four is taught exclusively by radio to children in rural areas where there are not yet formal schools. The project began in 1982, and is financed by the U.S. Agency for International Development. InterAmerica Research Associates provides project management and supervision, and the Dominican Secretariat of Education (SEEBAC) provides local staff.

Project promoter/supervisors assist in organizing an association of parents with children from seven to 14 years of age. The association makes available a "school"—usually a thatched-roof hut—and supplies batteries for the radio. A literate villager who has from six to nine grades of formal education, is recruited by the parents' association. This *radio auxiliar* is placed in charge of the RADECO "school". The community parents' association gives the *auxiliar* a small monthly stipend drawing from funds provided for this purpose by RADECO.

Each classroom is supplied with a radio, a small blackboard, and a limited supply of chalk and pencils. Each student is given a plywood clipboard to use as a portable desk. The language text is designed to fit on one-half of the clipboard and lies over the right page of the exercise book. In this way, children can more easily keep their lesson materials together in a crowded and often windswept classroom environment.

The success of interactive radio education, whether it is used to assist classroom teachers or as a substitute for classroom teachers, can be attributed largely to the innovative style of the broadcast lessons. The lessons are designed provide direct instruction to the students, while at the same time requiring them to respond orally to questions, or write answers, or solve problems on a worksheet.

The Curriculum

There are four phases of activity in the RADECO project: script writing, radio production, evaluation, and supervision (or outreach). The curriculum is developed and lessons are written and then recorded for broadcast. Each daily radio lesson is one hour long and is divided into approximately one-half hour of mathematics and one-half hour of language. Social and general science subject matter is woven into these lessons as well. The mathematics lessons are based on those developed by the Nicaragua Radio Mathematics Project, which have been adapted to the official Dominican curriculum and adjusted for cultural and linguistic variations. Language used in the southwest region of the Dominican Republic, children's books, and the official curriculum were all carefully analyzed and used to develop this master plan.

Scripts are written to use two or more actor/teachers. Dialogues between the actors are developed to explain concepts, provide examples, and guide the students in the completion of exercises. Sentences are short and conversational, and designed to invoke interaction. Most of the utterances are directed to the children, although for didactic purposes, there may be occasional comments between the radio actors.

The radio lessons are based on the guided discovery method. Because examples are used to convey general principles, and students actively participate even in illustrative examples, the lessons sometimes convey the impression that they are comprised entirely of drill-and-practice material with no explanations. To the contrary, exercises are carefully planned sequences of examples designed to lead students to deduce the principles involved.

Worksheets are provided to supplement the lessons or are used as practice sheets. In the mathematics lessons, worksheets are only used at the first-grade level. Children must copy exercises into their own notebooks at the second- through fourth-grade levels. Worksheets are used with the language lessons at the first-grade level, but a text is being prepared for the second-, third- and fourth-grade levels. When it is completed, it is expected that two children will share a text. Each page will contain the material for one daily lesson. The student will do the required written work in his or her own notebook.

Students are expected to participate in the radio lessons by responding aloud to the radio teacher's questions or by following commands. They are expected to respond quickly and often—a total of 60 to 90 responses per 30-

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On File at ERIC

Recent entries in the ERIC (Educational Resources Information Center) files concerned with educational radio include two reports on teaching English by radio in Kenya, an evaluation of a two-way radio project in Australia, a manual for planning radio campaigns, and a guide for evaluating broadcast radio and television educational programs. All five are available on microfiche and in paper copy from the ERIC Document Reproduction Service (EDRS), P.O. Box 190, Arlington, Virginia 22210, U.S.A. Be sure to include the ED number and payment in U.S. funds for the price listed plus shipping.

- Onganga, Obiero O. *An Evaluation of the Effectiveness of Radio Programmes in Teaching English Language to Class Six Pupils in Primary Schools in South Nyanza-Kenya. African Studies in Curriculum Development & Evaluation, No. 46.* 1982. 81pp. (ED 235 788)

(This evaluation did not encompass the Radio Language Arts Project in Kenya referred to elsewhere in this issue)

The effectiveness and efficiency of Kenyan educational radio programs for teaching English in standard 6 classes were assessed in a research project which was undertaken as part of a training program jointly organized by the African Curriculum Organization, the Kenya Institute of Education, the University of Nairobi, and the German Agency for Technical Cooperation. Additional study objectives were to determine the extent of radio program use and to examine the problems associated with such use. Teachers of standard 6 classes in 50 schools in the South Nyanza District who used the English language programs were asked to participate by responding to a questionnaire, and by being observed during the presentation of a radio lesson. Data were gathered on such items as content coverage, relevance to pupil workbook, language level, enjoyment and interest, radio reception, dialog quality, support materials, distribution of audio equipment, and the classroom teacher's part in the program presentation. Results indicate that classroom teachers leave the majority of teaching to the radio teacher, when they should be creating an environment to help students use radio instruction effectively and developing their own supplementary materials. It is recommended that programs be designed to stimulate exploratory and critical attitudes and to suggest projects. Appendices include the questionnaire for teachers and the researcher's evaluation scheme, as well as sample exercises for use with radio lessons. Available from EDRS in microfiche for 97¢ or in paper copy for $7.40.

- Imhoof, Maurice and others. *English by Radio: Implications for Non-Formal Language Education. Occasional Paper #12.* 1984. 49pp. (ED 243 470)

A five-year research and development program, known as the Radio Language Arts Proj-

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ect (RLAP), was conducted in Kenya to develop, implement, and test the effectiveness of an instructional system that uses radio to teach English as a foreign language in the first three grades of primary school. The initial project year was spent in establishing and field testing the RLAP program. Beginning in 1982, daily 30-minute English lessons were broadcast to grade 1 students in 31 project schools located in seven districts. Grade 2 lessons were broadcast to the same group of children in 1983, and grade 3 lessons in 1984. Radio was the major medium of instruction, but teachers had an important role during the broadcasts, as well as in pre-and postbroadcast activities. Based on initial results from a standard achievement test and on results from a questionnaire distributed to teachers and headmasters after the first year of broadcasting, it was found that students showed substantial achievement gains and that the program was very well received by school personnel. This report discusses the use of instructional radio in various Third World countries. It also describes the effectiveness of radio in classroom language teaching, using RLAP as a case study, and suggests some implications of the RLAP instructional radio methodology for nonformal language education. An 11-item bibliography and background information on the authors are provided. Available from EDRS in microfiche for 97¢ or in paper copy for $3.90.

- Conboy, Ian. *Two-Way Radio in Schools (or, The Loneliness of the Long Distance Learner). An Evaluation of a High Frequency Short Wave, Two-Way Radio Trial*. 1983. 97pp. (ED 238 634)

The Country Education Project in Victoria, Australia, tested the use of two-way radios to bring educational resources to isolated children studying correspondence courses in small rural high schools and to increase interaction among rural schools. Eight rural Victoria schools and the Secondary Correspondence School in Melbourne used two-way, high-frequency short wave radio transceivers for 18 months. Data were collected from log books, observation, interviews, and questionnaires completed by 11 rural teachers, 22 Correspondence School teacher/supervisors, and 38 students. The Correspondence School teachers used the system an average of 25 to 30 times per month for curriculum meetings and tutorial sessions averaging 15 to 30 minutes in length. The subjects taught most frequently by radio were French, legal studies, art, politics, and Italian. Students used the system for formal subject meetings and for informal socializing. Rural teachers sometimes used the radio for meetings with neighboring schools. All users were enthusiastic about the radio system and felt it improved subject understanding. Although it increased their workload, teachers felt the system allowed more in-depth treatment of some subjects and better motivation, and diagnostic and remedial work. Respondents noted problems with reception, scheduling, and the lack of accompanying visual information, but most participating schools have purchased the cost effective equipment. Available from EDRS in microfiche for 97¢ or in paper copy for $7.40.

- Crowley, David and others. *Radio Learning Group Manual. How to Run a Radio Learning Campaign. 2nd and Revised Edition*. 1981. 187pp. (ED 237 282)

The Third World countries of Botswana and Tanzania have used Radio Learning Group (RLG) campaigns effectively to get a limited amount of important information to a very large group of people at the same time. During campaigns voluntary participants, who are organized in groups of five to 20, meet twice a week for about five weeks to listen to radio broadcasts about topics of national importance, and to study supporting printed materials with the aid of a group leader. The group feeds questions and comments back to the government. Intended for organizers, teachers, administrators, and students of adult education, this manual explains in detail the ten steps of organizing a campaign; the development of materials coordinated to the radio broadcasts; the field work essential to a successful RLG campaign; the training necessary for personnel at the national, district and town, village and ward, and group leader levels; and the evaluation of the campaign. Short sections provide suggestions for starting with experiments and pilot programs, following up with action, and consulting about the projects. Appendices include examples and flow charts from RLG campaigns in Botswana and a brief bibliography. Small black and white cartoon characters guide the user through the manual. Available from EDRS in microfiche for 97¢ or in paper copy for $14.40.

- Smith, James A. *A Guide for Evaluation of Broadcast Radio and Television in the Delivery of Informal Education: A Graduate Project*. 1982. 75pp. (ED 243 448)

This guide focuses on appropriate techniques for the evaluation of electronic media educational programs. Such evaluation helps to provide the educator with the feedback that is missing whenever there is no direct contact with students, and also with information on the relative worth of an educational program. This four-part guide prepared as a graduate project at the University of Alaska includes: (1) a statement of purpose and a description of radio and television as educational delivery systems with emphasis on their use in programs for farmers by the Cooperative Extension Service in the United States; (2) a brief review of evaluation systems as applied to education, with a discussion of some of the evaluation models that may be applied to electronic media educational delivery, and a recap of several evaluations of educational television; (3) a practical approach to the evaluation of electronic media delivery of extension programs with a detailed discussion of each of the phases of evaluation, plus a section on implementing the evaluation; and (4) a summary of evaluation as applied to electronic media with a checklist to serve as a guide to the evaluator. Appendices contain sample forms and examples of evaluation reports. Thirty-six references are listed. Available from EDRS in microfiche for 97¢ or in paper copy for $5.65.■

Barbara B. Minor, Publications Coordinator, ERIC Clearinghouse on Information Resources, School of Education, Syracuse University, Syracuse, New York 13210 USA.

Rural Communication Award

The International Programme for the Development of Communication (IPDC) recently announced the award of the first US$20,000 IPDC-Unesco Prize for Rural Communication to the Kheda Project, a rural television project in India. The project provided 400 villages in the Kheda district with equipment enabling villagers to produce programs on local issues, health, and agricultural matters.

The Prize will be awarded every two years. Its purpose is to recognize meritorious and innovative activities by individuals or groups of persons to improve communications, chiefly in the developing countries. Qualification criteria are that entrants be nationals of member states of Unesco or organizations with headquarters in such states; and that they have distinguished themselves by "one or more outstanding initiatives to promote the development of rural communication." Newspapers, films, radio, television, traditional or folk medium, and multimedia programs will be considered.

Nominations should be submitted to the Chairman of the Intergovernmental Council of IPDC by the governments of the member states of Unesco. For more information write to: IPDC, Unesco, 7, place de Fontenoy, 75007 Paris, France.

Development Communication Monograph Available

The Clearinghouse is making available a publication of its parent organization, the Academy for Educational Development, that reviews the way in which the field of development communication has grown and anticipates its future role. *Beyond the Flipchart* will be useful to anyone looking for a clear discussion of how media have been applied to education, agriculture, health, population, and other development sectors, and how the techniques of social marketing are being integrated into successful development communication programs.

This 40-page monograph is available, prepaid, from the Clearinghouse for US$5.00 (multiple copies US$3.00). Readers in developing countries may request it without charge.

Radio Science: Completing the Interactive Radio Instruction Curriculum

by Jean Meadowcroft

Through science we attempt to discover and explain matters through disciplined inquiry. Science education is critical to a country's development both because it trains people how to use this knowledge to improve daily life, and it stimulates thinking skills which lead to independent learning. Widespread scientific and technological knowledge among people of a country is a necessary requirement for development.

In many primary schools, particularly in less developed countries, science is poorly taught. Teachers often do not have sufficient knowledge of science. They are limited as well by inadequate school facilities and teaching materials, and in some cases, the idea that science is too complex and sophisticated. Consequently, science teaching often relies too heavily on facts, and is presented in a way that makes it difficult for students to use it in their daily lives.

The interactive radio model is expected to change this. It will be used to produce and present science in the classroom in a way that will make students listen, learn, and think about the natural world around them.

Science Education: A Background

In the 1960s and 1970s, two A.I.D.-supported African programs made significant progress in developing science curricula and materials. These were the African Primary Science Program (APSP), and the Science Education Project for Africa (SEPA). APSP redesigned science education so students would understand their environment better, and introduced an experimental, discovery approach to teaching science. By 1970, APSP had established science centers in seven African countries, and had developed teachers' guides and science books. SEPA trained science educators and helped to build networks among 13 nations, established two science education centers, and published numerous teaching guides and sourcebooks for teaching science. Organizations, including the World Bank, UNESCO, the British Council, and Peace Corps have endeavored to improve science education, particularly through teacher training and providing science equipment. These efforts improved science education, but more effective means of delivering science education to the classroom is still needed.

Radio Education

The interactive radio instruction model has proven to be effective, efficient, and inexpensive, as demonstrated in the Mathematics, Language Arts, and Community Basic Education projects; and its adaptability confirmed as shown in the Thai Math project. Other articles in this edition of *DCR* show how this model is more effective and efficient than traditional teacher and textbook models in achieving improved student learning. Once programs are developed, it also is inexpensive. Recurrent costs for radio mathematics in Nicaragua, and in the Dominican Republic, are projected to be less than US$1 per student per year. In the forthcoming Instructional Radio Dissemination project, packages of combined mathematics and science instruction are planned. Adaptable to many countries with only slight changes, these packages will be even less expensive to operate on a recurrent cost basis.

Radio Science, then, will consolidate and build upon previous science education projects and apply the interactive radio model to deliver improved science education widely, rapidly, and directly to teachers and students in the classroom.

Project Description

Activities have just begun in the Radio Science project. The contractor, the Education Development Center, Inc., will be responsible for its development over the next five years. As with some of the previous interactive radio projects, the purpose of this project is to develop and test four grades of instructional programs for primary school students. Its success will be measured by two criteria:

- That pupils receiving radio science education show significant gains in learning when compared to control classes of pupils taught by customary methods.
- That the recurrent costs are low, and administration of the radio programs is manageable for Ministries of Education in less developed countries.

There will be four areas of project activities: instructional programs, orientation and institutionalization, evaluation and research, and dissemination.

Instructional Programs: Project staff and host country educators will prepare a course of study based on the national primary school science curriculum. They also will develop low-cost, locally produced instructional aids. The science curriculum will be adapted to the interactive radio format, and be produced—one grade each year over a four-year period. Initially, at least twenty schools will receive these radio science programs, receiving twenty- to thirty-minute radio lessons several times a week. It is anticipated that by the end of the five-year project there will be over one hundred participating schools.

Orientation and Institutionalization. Initially, there will be a month-long workshop for national staff and project technical specialists, with follow-up workshops each year. This will help to build a common base of knowledge among international and national educators, science specialists, and other staff, and build a team among them. The international staff will present the interactive radio methodology and science education studies; the host country staff will provide information on local schools, national science curriculum, the local environment and ecology. This team will pool its knowledge to produce lessons based on universal science concepts which will be applicable to many different rural environments.

Before broadcasts begin, brief workshops will be given to show teachers how to use the radio science programs. Ministry of Education district supervisors, school directors, and other officials will be included in the workshops to inform them about the project, and to build a local constituency to support it. During the school year, there also will be weekly broadcasts for the teachers offering suggestions on how to use the programs.

Radio Science staff and Ministry of Education officials will hold semi-annual meetings. This will help to build a local network of educators who understand the project and can continue the radio programs after the project is completed.

These efforts are expected to result in the establishment or strengthening of already-established Ministry of Education centers for radio education and for science education resources.

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Extension Strategies and Goals Conference

The Agricultural Extension and Rural Development Centre (AERDC) of the University of Reading in England is holding an international conference from Sept. 15-21, 1985 as part of its 20th anniversary celebrations. The title of the conference is "Investing in Rural Extension: Strategies and Goals." For the past 20 years AERDC has been involved in post graduate training, in-service training courses at AERDC and abroad, and has participated in consultancies and development projects around the world. Participation in the conference will be limited to 150. Please contact G. E. Jones, AERDC, The University of Reading, London Road, Reading RG1 5AQ, England, for information and applications.

Attention Educational Planners

If your ministry would like to consider adding an interactive radio component to its activities, the Clearinghouse will be pleased to provide you with illustrations, pamphlets, teacher's guides, sample tapes, a film or video on the Radio Math Project, and a forthcoming film on the Radio Language Arts Project to assist you in the planning process.

A Communicator's Checklist

1 Broadcasting in Education: An Evaluation, by Anthony Bates (London, Constable and Company, 1984), 272pp.

For many, the link between broadcasting and education is an assumption. On the face of it, this assumption seems sturdy enough. You can put the best teachers on the air. You can assure the same curriculum over a broad area. You can save money compared with alternative strategies. You can provide in-service training to teachers by broadcasting excellent lessons. You can provide equal education to all.

Evaluating this assumption is what Bates does in this book; and as anyone who has been involved in educational broadcasting knows, the assumption proves less sturdy than may have been hoped. Bates provides a sober tour of the educational-broadcasting "busyness," evaluating as he goes with a keen eye sharpened by his years as an educational broadcaster and consultant in the developing world. Bates provides the reader with a thorough acquaintance with the struggles of the educational broadcasting world, in both developed and developing countries. He puts the usual assumptions to the test, to find out what really counts in a successful application of broadcasting to education. Bates cites some projects that have demonstrated desired results and, from these, offers guidelines to the reader:

1. Successful broadcasts are fun to watch or listen to. Bates points to "Sesame Street" and the British series "On the Move."
2. Successful broadcasts are expensive. The shows have to be done well, and good results cannot be attained cheaply. Poorly designed and poorly produced broadcasts have caused some people to doubt whether educational broadcasting has any learning value.
3. Successful broadcasts are integrated into broadcasting and education structures. Broadcasters and educators must both be involved; neither can rely on his/her own expertise. Bates d. ..'s a common reluctance among broadcasters to accept feedback from educators who hesitate to produce broadcasts in collaboration with non-broadcasters. The same thing can be said of many educators; they "know what good teaching is" and they are wary of collaboration with broadcasters.
4. Successful broadcasts have specific objectives built around a curriculum designed for the target audience.
5. Successful broadcasts use pretesting and formative evaluation. This is the area where assumptions are rigorously tested. Methods for an educational broadcast initially flow out of the dom, experience, and judgment of the col- orative educator/broadcaster team. It is these methods that are tested, prior to and during the series. Having specific measurable objectives beforehand is the prerequisite for pre..sting and formative evaluation. Bates notes, "Systematic pretesting of programmes is still strongly resisted by many producers and broadcasting managements; it adds to costs, slows up the rate of production, and requires a different form of production scheduling. Above all, it challenges the professional assumptions of producers." The Nicaragua Radio Math Project and the Kenya Radio Language Arts Project are two examples of the full and fruitful incorporation of pretesting and formative evaluation into the production schedule.
6. Successful broadcasts are not received in isolation. That is, people do not learn much when they watch or listen alone. The excitement generated by an engaging program is multiplied many fold by the presence and involvement of others. In a developing country classroom, the enthusiasm generated by a group provides learning support to each child—whose surroundings may otherwise offer very little reinforcement to educational ideals.
7. Successful broadcasts are well marketed. The target group is alerted to the broadcast, prepared for the broadcast, and disposed to receive the broadcast. Once the series starts, the broadcasts themselves are the prime marketing mechanism, to hold and to attract a wider audience. In the formal education setting of developing countries, the crucial "marketing" is done among education officials and classroom teachers.
8. Successful broadcasts have maximum exposure. This means adequate air time at appropriate hours, lots of programs, and some repetition. For educational results to be measurable, more than a one-shot enrichment broadcast is necessary.

To achieve excellence in educational broadcasting, the very best from broadcasting must combine with the very best from education. What Bates contributes is a thorough appreciation of how difficult that achievement is, and a distillation of useful lessons, so that the difficulties of the past not be repeated. He makes clear that the link between broadcasting and education cannot be assumed, but can be achieved by a focus on results and a willingness to evaluate all assumptions, in terms of those desired results. ■

Reviewed by Peter Spain, a researcher and writer, currently with U.S.A.I.D.'s Bureau of Science and Technology/Office of Education.

Available for £7.50 from Constable & Co., Ltd., 10 Orange St., London WC2H 7EG, U.K.

2 Organizing Educational Broadcasting, by D. Hawkridge and J. Robinson. (Beckenham Kent, England, Croom Helm Ltd., 1983), 302 pp.

This is an eminently readable book, almost totally free of statistics and the jargon one often encounters in writings on organization and policy analysis. The authors draw on 12 case studies and their personal experience and knowledge to build a lucid, systematic discussion of issues that appear to be germane to educational broadcasting today. The case studies, together with an update on some of the original case studies by Jack Lyle, comprise the latter half of the book.

Beyond a short introductory chapter there are seven other sections, ranging from the context of educational broadcasting to finance. All are informative; some are more thoroughly grounded in empirical case material than others, hence more comprehensively elaborated. The discussion of the context of educational broadcasting is one of the best I have seen of a vastly complex set of factors, rendered plain by clear writing in the service of well-organized thought. The chapters on forms of governance and autonomous production and distribution, and on utilization, are also outstanding. But all chapters will reward a careful reading.

The authors have attempted to draw lessons from very disparate situations which have been reported and evaluated differently from each other. I was left with a sense that their concluding guidelines for practice in each chapter were sometimes more clearly related to the issues and questions they raised, and perhaps to their personal experience, than to the empirical information in the case studies. The fault lies in paucity of comparative data, not in the cogency of the discussion.

The book is well-worth reading. I recommend it to anyone involved in development communications, and especially to those embarking on educational broadcasting projects. ■

Reviewed by Paul Spector, president of the Institute for International Research in McLean, Virginia. He has supervised more than 60 overseas development projects, several of which have included work in broadcasting.

Available for £12.95 from Croom Helm Ltd., Providence House, Burrell Row, Beckenham, Kent BR3 1AT, U.K.

3 The Radio Programme: An AIBD Manual for Media Trainers, edited by Howard Gough. (Kuala Lumpur, Malaysia, Asia-Pacific Institute for Broadcasting Development, 1982), 247pp.

No one can deny that the very best way to learn anything is to DO it, and certainly in the area of radio production, no amount of book learning can ever replace actual hands-on experience, so perhaps it would be fair to classify this AIBD manual as a *reminder* book rather than a training manual.

In under 250 pages, the book attempts to cover every aspect of radio planning, production, on-air techniques and editing procedures. The editor freely admits that it only skims the surface of many subject areas, suggesting, for example that "sections on basic skills and formats are more comprehensive (than the section on news), though still summarized."

As a summary, however, the book is excellent, and is obviously compiled by broadcasters with a great deal of combined knowledge and experience. All the basic knowledge is there, from reminders on the importance of researching the audience BEFORE making a program, to information on the best types of microphone to use for an interview; from notes on control room procedures, to illustrated information on how to splice tape.

It is probable, however, that the novice producer, using this book as a teacher, might run into some problems. Frequently, the book will give good advice, such as "There are several ways of turning pages of scripts silently," without answering the question 'how?' Examples are frustratingly lacking in several places where the trainee would most like to have them, although other sections are equipped with very helpful examples. While the manual acknowledges that its "notes are intended for use in the training of generalist producers," and adds that "For the training of specialists, trainers should refer to specialized reference texts," it is somewhat tantalizing to be presented with excellent examples in some areas and be denied them in others.

The general layout of the book presents some difficulties, too. The "notes have been placed in four categories and printed in ink of four different colors," which is essentially a good idea. The difficulty arises from the fact that unless the reader keeps referring back to the Table of Contents, there is no way of knowing what each color indicates. Since none of the notes fall precisely into any one category, it would have been preferable to have a running head on the pages indicating that specific notes were on. "Planning" or "Production," etc.

Similarly, the use of boxes throughout the text is inconsistent. Where they are used to separate pictures from text, their aim is clear enough, but when they are used to isolate various bits of print, they are confusing. Sometimes the box is used with the heading "CHECK" to enclose questions for the consideration and knowledge testing of the reader; at other times, questions are enclosed within a box without the heading "CHECK." Sometimes a chapter begins by putting all examples of correct procedure into boxes, and then suddenly switches to the inclusion of incorrect procedure in the boxed format as well. Sometimes examples are italicized; sometimes they are not. Readers eventually find their way through these inconsistencies, but the book would have gained a great deal by better overall planning and editing.

Nevertheless, this is a book that should be in the possession of every radio broadcaster who aspires to do quality broadcasting, and it should be in constant use. For the beginner, it would be best used as a supplement to a very good teacher. For everyone else, it should be required reading—on a regular basis—for every radio producer with less than 20 years experience. The book's chief contribution to broadcasting literature is that it serves as an excellent checklist of all the things that a producer of quality programs should and should not do. If every radio producer currently putting programs on the air would follow the rules set down in this manual, the standard of radio production throughout the world would undoubtedly rise.■

Reviewed by Esta de Fossard, a Senior Communications Officer at the Academy for Educational Development. She has done radio education consulting in Africa, Asia, and Latin America.

Available to readers in the Asia-Pacific region for US$8.00, elsewhere for US$10.00 from Asia-Pacific Institute for Broadcasting Development, P.O. Box 1137, Pantai Bahru Post, Kuala Lumpur, Malaysia.

4 Telecommunications: Issues and Choices for Society, by Jerry Salvaggio (New York, Longman, Inc., 1983), 182 pp.

This collection of essays reviews some of the opportunities and many of the policy problems posed by advances in telecommunications. Many of the problems are posed in terms of protection of privacy, minimizing the problems of surveillance, and promoting freedom and opportunity. With few exceptions, the new media are not tied to developing nations in this volume. More seriously, the discussions are neither linked to the history of the media (except for Schiller's essay), nor to the social structures in which these media are being developed and implemented.

Unfortunately, the theoretical base for studying telecommunications rather than mass media is very weak. As a result, it is somewhat awkward discussing the "new media" as it is not entirely clear, aside from the physical infrastructure, what is being talked about. Are telecommunications media somehow distinct from other problems of technological development and transfer, or do they simply represent one category? Do these media promote new social activities or functions, or do they permit existing functions to be performed in new ways? This collection tackles the transformations in telecommunications from a number of approaches with varying degrees of success.

Herbert Schiller presents a critical view of the media in terms of their relationships to power and privilege. He makes clear that the media are not available to most of the world's population, and more importantly, are tied to the military and intelligence communities which exercise dominance over the majority. While the critique is strong, the solutions are not. This is an inherent problem of radical critiques as guides to policy—they provide important insights but leave us in a difficult position, attempting to take specific actions to create change.

From a totally different perspective, Daniel Bell attempts to tie media use to social context. Bell writes that "The revolution in telecommunications makes possible both an intense degree of centralization of power, if the society decides to use it in that way, and large decentralization because of the multiplicity, diversity and cheapness of the modes of communication." Bell lauds innovation and minimal public regulation as a means of allowing individuals to create new communities through innovation.

Bell's views are important as they have been influential in developing the notion that technology can lead social change, while also indicating the major instrumental problems to using technology which might present its adaptation or disrupt the existing social structure. While much of Bell's writing provides important insights into technologies' potentials, it ignores the major structural constraints on the use of media in creating new communities, or in preserving the monopoly on power of existing communities. There is no discussion of how to bring the majority of the population of the U.S., let alone the rest of the world, into the new technology, particularly given the requirements for education, knowledge about the intricacies of information search, and most importantly, the economic and political resources to use the information.

Joe Pelton provides a mixture of technological boosterism and caution, with the emphasis on the latter. Pelton discusses the creation of worldwide environments shared via communications. Unfortunately, it is not always clear what this means. What *exactly* does it mean for 1,000,000,000 people to watch the same television program? Does it foster universality? Or can global communications actually fractionalize constituencies?

The policy discussions in the book are generally not very strong. Far too much emphasis is placed on public policy, without a good historical analysis of how telecommunications has developed. This is not to downplay the importance of government-sponsored research and development. However, one does get the sense, particularly in the chapter about Japan, that the concern with public policy is often excessive or misdirected.

Public policy is important in terms of social concerns about telecommunications technologies, particularly their affects on privacy, but in a broader sense than generally presented in this volume (excluding chapters by Schiller and Slack). It is hard to avoid the cliché that technologies per se do not infringe on privacy—

(continued on page 10)

(**Overview** *continued from page 1*)
ment—not simply to do educational radio a little bit better, but to make possible a set of new strategies for educational development. With these strategies, well-crafted daily radio lessons provide sturdy support for teachers in the basic school subjects, teaching the core of each subject. They also reach out to areas where fully-trained teachers are not available and to adults in their homes.

Design Research

To this end, A.I.D. has invested a substantial effort for over a decade in the development and testing of the programs, to which educators and governments in cooperating countries have added immeasurably. The objective has been to design a method of educational improvement that is effective, easy to manage on a large scale, and affordable. Now that most of the research and development has been done (work in science education continues,) those goals have been met, and adoption of the techniques supports one of the lowest-cost interventions available in the entire world of education.

Adoption can involve varying levels of local adaptation. Some nations may wish, initially at least, to use the actual radio tapes for the entire four- to five-year primary school curricula in mathematics, English, or Spanish language training (and later in science). These are available through A.I.D. Others will want to revise the tapes, either in the local language or to introduce local examples; for these nations, the scripts, supporting written materials, and the underlying instructional designs are available. Still others may wish to apply the instructional principles developed through these projects to create entirely new instructional series.

The cost of adaptation will vary greatly depending upon the approach that is taken. For simple use of the available tapes, and the provision of classroom radios, a recent analysis in an African nation shows that per-student costs would be no more than 40 cents per year over the current system. Even these costs can be decreased with reduced student failure and repetition. Furthermore, the community school model, as exemplified in the Dominican Republic, is much less expensive than traditional schooling.

Project Acceptance and Expansion

Teacher attitudes toward this new approach, unlike with some other technologies, have been enthusiastically favorable—in large part because of the enlivening effect on the students themselves. Achievement scores have shown a 25 to 50 percent improvement over regular classes. But even more gratifying has been the delight of children as they participate in these lively, engaging classes.

There also is a great potential for expanded adult education through interactive radio instruction. In countries where these programs have been broadcast, thousands of adults have come regular listeners. If combined with newspaper supplements or distribution of associated written materials, adult literacy and numeracy might be greatly improved.

There are other very good models for radio use as well, as exemplified by the radiophonic schools in Latin America, and other pioneering programs carried out in Africa and Asia. The techniques of interactive radio build on this work, then add to it new educational methods developed both from cognitive psychology and from the communication arts. An example is the Children's Television Workshop which created "Sesame Street." In addition, measuring the effectiveness of teaching is fundamental to the interactive radio methodology, which offers the potential for continued improved teaching in the future.

The evidence is now in from numerous interactive radio experiments and pilot projects. They have laid a foundation for a renaissance in classroom radio use by meeting fundamental education needs. The incorporation of these approaches into the mainstream of education is the next step, and we look to the *DCR* readership as partners in this effort.

Clifford H. Block is the Associate Director for Development Communications, Bureau for Science and Technology, Office of Education, A.I.D., Washington. He has directed the implementation of interactive radio projects throughout the developing world.

Communication Conference in People's Republic of China

The First International Communication Conference will be held in Shanghai, China between August 4-10. The human and social contexts of communication will be explored. Future research in the areas of mass media, intercultural/international communication, and speech communication will also be discussed. Interested Americans and Europeans contact: Fred Casmir, Division of Communication, Pepperdine Univ., Seaver College, Malibu, CA 90265. Pacific Basin persons contact: Dr. Malcom Pettigrove, Canberra College of Advanced Education, School of Liberal Studies, P.O. Box 1, Belconnen, A.C.T., Australia, 2616.

Martha Stuart

The Clearinghouse joins others in the field of international communications in mourning the recent death of Martha Stuart. We applauded Ms. Stuart in her efforts to make video technology available to villagers so they could speak on their own behalf, and are pleased to learn that her daughter will continue to provide this valuable service.

(**Telecom** *continued from page 9*)
private and public agencies do. Technologies are often developed by agencies which lack a strong commitment to privacy or individual freedom, leaving those who have such commitments to attempt to alter the technologies' implementation or use. As Schiller correctly notes, it is vital to examine how communications technologies are tied to the existing social order to determine how they are being used within that order. Concerns about privacy and freedom are important, but they should not be excessively focused on media anymore than concerns about crime should focus on controlling the trade in burglary tools. Starting with a political commitment to freedom and to individual and collective opportunity, with an operative notion of what these mean, is the strongest approach to analyzing and developing public policy in the media.

For developing nations, much of this discussion is academic as public policy is largely concerned with developing a basic infrastructure for services which are largely assumed in the industrial nations. However, given the large capital requirements, market development, and structural changes which will be necessary for a developing nation to move quickly into the new "information" society, far stronger commitments to public policy creation and implementation will be needed than has been seen in the U.S. and many of the other industrial states. And, as has been discussed in much of the literature on communications and development, this commitment must extend to the overall problems of equity and opportunity in development, not simply to the introduction of media into a social context which, through its rigidities, inhibits economic and social development. ■

Reviewed by Douglas Goldschmidt, a telecommunications economist now working independently in New York. He was the former associate director of the Rural Satellite Program at the Academy for Educational Development.

Available for US$24.95 (cloth cover) from Longman, Inc., College Division, 1560 Broadway, New York, NY 10036 USA.

Call for Papers

The Eighth Annual Forum of the Pacific Telecommunications Council will be held from January 12-15, 1986, in Honolulu, Hawaii. Three sub-themes to the Conference theme, "Evolution of the Digital Pacific," will be considered: 1) current telecommunications developments in the Pacific; 2) future developments including computer-communication convergence, artificial intelligence; and 3) training and education needs, and programs relevant to current and future needs. One-page outlines of proposed papers are requested by June 15, 1985. For more information contact: PTC '86, 1110 University Avenue, #308, Honolulu, Hawaii 96826, USA. Phone: (808) 941-3789, Telex: 7430550PTC.

Evaluations of Three Interactive Radio Projects

by Barbara Searle

A characteristic feature of the radio instruction projects funded by the U.S. Agency for International Development is the inclusion of significant funds for evaluation. As a result, we have substantial information about the implementation and impact of one completed project, Radio Math, and emerging documentation for two on-going projects, Radio Language Arts and Radio-assisted Community Basic Education (RADECO). The evidence gathered to date allows us to draw several firm conclusions about the use and effectiveness of interactive radio instruction.

- Students can and do learn primary-school subjects when taught by interactive radio. Often they learn more than students studying without radio lessons.
- Trained teachers and untrained classroom proctors can use radio lessons effectively with little training or special assistance.
- Interactive radio lessons are seen as useful by teachers and proctors and are used voluntarily, provided that the quality of radio reception is acceptable.
- The cost per student per year to deliver radio lessons—after curriculum-development work is completed—is modest since few supplementary learning materials are required.
- In a grade-one classroom comparison with textbook use, interactive radio has been shown to be significantly more effective in raising student achievement.

Other findings seem to be emerging from these projects as they progress. The first is that the instructional method is robust. That is, the instructional principles first developed for teaching mathematics in Nicaragua (see the article on Radio Math in this issue) work for other subjects, and in other cultural settings.

A second tentative conclusion concerns group instruction. It is generally accepted that group lessons cannot adapt to individual differences among students. Evidence from Nicaragua suggests that interactive radio lessons improve the achievement levels of slower students, as compared with the performance of similar students in non-radio classrooms. Two explanations for this are: the carefully crafted instructional messages are more effective with slower students than usual teacher instruction; and teachers, freed from the necessity of teaching the faster students, can devote more time to those with difficulties.

Another tentative finding is that students from rural schools show greater achievement gains than students from urban schools, thus narrowing the gap that exists between the two groups.

Evaluation Design Problems

Evaluating the effectiveness of instructional programs is complicated by several issues. No two instructional programs have the same objectives, use the same teaching strategies, or cover the same material. Thus, in designing a test to compare student achievement on two instructional programs, great care must be taken to make it fair to both groups. Also, in developing countries, experimental programs are likely to reflect not only how much the students learn, but also how often they attend, how likely they are to drop out, and how experienced they are with taking tests. There is usually substantial turnover during the school year, so it is often difficult to interpret test scores, and particularly to conclude that students in one program learn more than those in the other program. Higher scores mean that those who took the test learned more of what was *tested*.

> ***". . . instructional principles first developed to teach math in Nicaragua . . . work for other subjects, and in other cultural settings."***

A final concern is that control groups be tested before the lessons become available. When radio programs are broadcast openly, there is considerable likelihood that people (both in and out of school) other than the experimental group will listen to them. But this time lapse opens the way for events other than the instructional program to cause differences between the two groups. (The Nicaraguan revolution was one such unexpected event.)

Radio Math

A brief survey follows of evaluation results from the three interactive radio projects: Radio Math, Radio Language Arts, and RADECO.

For five years, the Radio Math project in Nicaragua developed interactive radio lessons for primary-grade levels one through four. The effectiveness of the instructional programs was assessed by comparing achievement levels of radio classes with similar classes taught in the usual way. Considerable care was taken to avoid the pitfalls noted above. Score differences indicate that grade one lessons were most successful in raising student achievement. For several reasons grade four results are less sturdy, among these is that lessons were evaluated during the first year of the revolution, while the control group was tested the previous year.

Many other questions regarding student achievement were investigated during the Radio Math evaluation. Among them were:

1. How does performance compare on topics that were taught and on those that were not taught by radio lessons? For all four grades, experimental students did much better than control students on topics taught by radio. For grades one and two, experimental students did somewhat better even on topics *not* taught by radio. The results demonstrate that, at least for primary mathematics, interactive radio was more effective than the usual teaching methods, and students were not disadvantaged because some topics left out of the radio lessons.

2. How does interactive radio compare with other teaching aids in raising student achievement? Achievement gains from radio lessons and in textbook classrooms were compared in a special experiment run with grade-one classrooms. The results showed control classes with 44.3 percent correct; textbook classes with 48.7 percent correct; and radio classes *62.1 percent correct*. Thus, at least in this situation, interactive radio was shown to be far more powerful than textbooks, which the World Bank has in the past identified as the single most effective tool in raising student achievement in the developing world.

3. Are achievement gains found for students of all ability levels? It is significant that even though group instruction potentially holds back the fastest students, the top third of experimental students still scored higher than the top third of control students. Also, the lowest third of students at the two grade levels tested made significant gains.

Other studies showed that teachers liked using the lessons and that the broadcasts also appealed to, and were listened to, by the community at large. On the other hand, despite the achievement gains, use of radio lessons was found to have no impact on school promotion rates (which are teacher-determined) and little effect on attendance and dropout rates.

Radio Language Arts

The Radio Language Arts project teaches English as a second language to lower-primary students (standards one through three) in Kenya. The program teaches both oral and text-based skills, following the official Kenyan curriculum.

Achievement at the standard one level is measured by tests of oral and reading comprehension. As in Radio Math, the control classes are tested the year before broadcasting begins to avoid contamination of the results. Control classes are in the same schools as experimental classes. In addition to testing achievement, the project is collecting data on teacher and community attitudes toward the program, and data on student attendance, repetition, and dropout.

Test results show that students using radio lessons perform substantially better than control students on the listening tests and somewhat better on the reading tests. The effectiveness of the interactive radio method is once again confirmed by test results showing that even with

(continued on page 12)

(**Results** *continued from page 11*)
less instruction in reading than the control group, the radio students score higher.

Preliminary survey results indicate that headmasters, teachers, and parents are pleased with the program, testifying to the greater fluency in English of the students who are using radio lessons regularly.

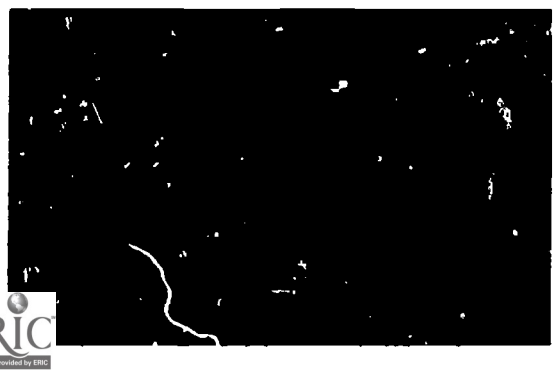
RADECO

RADECO is taking interactive radio out of the classroom and introducing it to the community, testing the hypothesis that the instructional method is sufficiently robust to be used by proctors drawn from the community, and without specialized training. The experiment is being run in rural areas of the Dominican Republic where there are no schools, or where children must work during regular school hours. The goal of RADECO is to teach the children who attend its classes as much as they would have learned in basic skills had they gone to regular schools. Therefore, the comparison group for evaluation purposes is first-grade students in schools in areas similar to those covered by RADECO.

The results of the first-year evaluation show a substantial difference between the experimental and comparison groups, in favor of the experimental group. However, the posttest was administered to all students via radio and, in retrospect, the project staff thought this might have given the radio group a significant advantage. Nevertheless, the outcome of a reanalysis still favors the radio student. Interpreting these results most conservatively, it seems clear that students studying by radio are learning at least as much as students going to school in these rural areas of the Dominican Republic.

The results from the RADECO project are the most powerful demonstration to date that the instructional method used in these interactive radio programs is capable of providing effective instruction in basic skills, whether or not a trained teacher is present, and without significant investment in accessory instructional materials. ■

Barbara Searle is with the World Bank in the East Asia & Pacific Education Division. She was the director of the Nicaraguan Radio Math Project, and was affiliated with the Institute of Mathematical Studies in the Social Sciences at Stanford University.



Estimated Recurrent Costs for
First-Grade Radio Math in Thailand

Assumptions:
- Only future recurrent costs are considered
- Programs are used in 30,693 schools with 45,413 first-grade classes totaling 1,081,733 students
- Every first-grade section in a school currently has a radio
- Nonreusable workbooks are given to all students
- Radios last about 5 years; batteries last for about 100 hours
- All teachers are given manuals which last an average of 2 years
- 34% of all schools have electricity
- Radios will be used 6 hours per day among several classes. Only ½ hour will be 1st-grade math, so only 1/12 of cost attributable to Radio Math
- Teacher orientation is part of regular ministry costs

Costs per student per year (US$)

		Per Student
Student Costs:		
workbooks		.35
Classroom Costs for 24 Students:		
teacher manual	.44	
radio (annualized including maintenance)	.85*	
power (batteries)	.32	
program revision	.02	
	$1.63	.07
Transmission Costs		.01
Program Costs:		
administrative personnel		.01
	Total:	$0.44

*Radios used for 11 other programs

Project Evaluation and Microcomputer Courses Planned

The University of Minnesota is offering several development-related courses in the coming months. "Microcomputer acquisition and uses in development," will be held August 19-Sept. 6, 1985 and Oct. 12-Nov. 1, 1985. This course is designed to guide individuals and organizations in developing areas of the world to plan, acquire, implement, and manage a microcomputer system. No prior computer experience is necessary.

The "Development Project Evaluation Seminar," Sept. 16-27, 1985, will focus on how to make project evaluations useful, practical, and accurate. A step-by-step approach will be taken in looking at project evaluation techniques from conceptionalization to applying findings for program improvement and policy decision making. For more information and registration materials for both courses contact: Fred Hoefer, 405 Coffey Hall, Univ. of Minnesota, 1420 Eckles Ave., St. Paul, MN 55108, USA, Telex/TWX: 298421 UM COL AG.

(**RADECO** *ontinued from page 5*)
minute lesson. Correct answers are given immediately by the radio teacher, applying the principle of immediate reinforcement. It is left to the students to determine whether or not their own answers were correct.

The RADECO lessons are not all work and no play. A method for incorporating diversionary activities first used by the Nicaragua Radio Mathematics Project has been adapted to RADECO's needs. Several segments of the one-hour lesson are devoted solely to entertainment. The most successfully used forms of entertainment are songs and physical activities. Children's songs and patriotic anthems are taught and sung frequently. In-place exercises offer the children an opportunity to stand up and stretch their bodies. Sophisticated motivational techniques are unnecessary since the children are fully absorbed in responding to the radio instructors. There are, however, many musical cues that alert the children to what they should do next—pick up their pencils, turn over their worksheets, or put down their clipboards.

The *radio auxiliares* conduct 20- to 30-minute postbroadcast activities following each daily broadcast. In these sessions, children review vocabulary and do math exercises which the *auxiliares* copy onto the blackboard from guides prepared for them. The lessons are broadcast

Cost Estimates

Estimated Recurrent Costs to Disseminate Radio English Lessons to all First-Grade Classrooms in Kenya

Assumptions:
- Only future recurrent costs are considered
- Programs are used in 11,966 schools with first-grade classes totaling 890,000 students
- Every first-grade section in a school will have a radio (12,000 now in schools; 10,250 to be added for full implementation)
- Reusable worksheets are provided to every student
- Radios last about 5 years; three sets of batteries per year are required
- Three 30-minute programs are broadcast daily throughout the school year
- An existing radio channel is available and has been boosted, at no cost to the project, to reach the entire population

Costs per student per year (US$)

		Per Student
Student Costs:		
worksheets		.06
Classroom Costs for 40 Students:		
teacher's manual	.15	
radio (annualized)	7.00*	
radio maintenance	2.50*	
power (batteries)	2.81	
teacher training	.03	
	$12.49	.31
Transmission Costs		.02
Program Costs:		
administrative personnel		.01
	Total:	$0.40

*Costs of 10,250 new radios for full implementation, used exclusively for English lessons

in the late afternoon, a time when the children have finished their daily tasks. Most of the children work on coffee farms, in sugarcane fields, or family cottage industries which characterize this region. Some of the children are offspring of Haitian immigrants, and speak Creole. The RADECO programs use Spanish, the Dominican national language, and include lessons to help Creole speakers master Spanish. The RADECO program not only fulfills an educational goal, but a social one as well by teaching children of immigrants Dominican culture and history.

Evaluation Phase

Both formative and summative evaluation is undertaken in the RADECO project. Approximately ten of the "schools" are randomly selected as experimental or "formative evaluation" schools. Project evaluators visit each "school" once a week to observe student behavior and record their learning progress. They return another day in the week to administer a short test covering the material taught during the previous five schooldays. This information helps the curriculum writers decide what subject matter to discontinue because students have adequately assimilated it, and what subject matter to continue focusing on because they are having trouble with it. Students are tested at the beginning and end of the school year in all RADECO schools. Similar testing is also undertaken in regular schools in the southwest region of the Dominican Republic. Summative evaluation is then able to provide comparative data from RADECO and regular SEEBAC schools, showing how RADECO students compare in academic achievement to regular school students.

Broadcasts of RADECO lessons were initiated in February 1983 to over 400 students in 20 schools within a radius of 50 kilometers of the city of Barahona. Children in these schools will complete the third grade in late 1985. In November 1984 the project was expanded to include over 1000 students in 45 "schools" in a 100 kilometer radius of Barahona.

John Helwig has worked as an educational development specialist since 1963 for USAID in all of the Central American countries, Venezuela, and the Dominican Republic. He has worked in educational planning, teacher training, university teaching, out-of-school educational programs, distance education, and radio education.

Jamesine Friend was the Overseas Director of the Radio Mathematics Project in Nicaragua.

The Fourth R—(Interactive) Radio

by Peter Spain

The classroom is typical of those in developing countries. Dirt floor, mud-brick walls, no lights. The shuttered windows keep out weather and light. On this day, the windows on one side are kept closed to cut a chilly wind. The benches are rudimentary, as are the few teaching materials and the chalkboard. Into the small, dark room are crowded 42 pupils.

Not so typical is the radio receiver the teacher is adjusting. While radio has been used in a limited number of developing-country settings for twenty years, its impact has not been overwhelming. Improvements in learning have occurred, but not to the degree that educators in developing countries have rushed to adopt radio. Early hopes pinned on radio for great leaps forward in educational efficiency have faded, and radio has taken its place on the shelf along with many other good-but-not-revolutionary educational innovations.

This radio classroom is not like any the observer has seen before. When the program starts, a rapid-fire dialogue between the radio and the children begins, punctuated by music and little dramas, with regular pauses for the children to answer and receive immediate reinforcement for their answers. The students are following the adventures of a boy, a girl, and their family. They are singing songs, and responding orally, physically, and in writing to the incessant, engaging pace of the radio. They are involved, they are enthusiastic, and they see immediate results from their work.

This is a classroom in the U.S. Agency for International Development (A.I.D.)-sponsored Radio Language Arts Project (RLAP), now completing its third year of broadcasts in Kenya.

Most exciting to any observer is the enthusiasm and involvement of the children. They exhibit an animation and an activity level that gives promise of increased learning and that bears witness to a lesson they have already taken to heart—that learning can be fun. This is in striking contrast to many developing-country classrooms, where rote learning prevails and passivity is the daily bread of children. (Even in other developing-country radio classrooms, children are expected to listen to the "master teacher" on the radio, who teaches in the same mode as a classroom teacher, though perhaps with more creativity and imagination. Still, for children, the message is: if you want to learn—listen. Passivity prevails, and the difference can be seen on the faces of the children.)

A second exciting aspect of the RLAP is the creative use of radio. What is happening in this Kenyan classroom had never been tried even in the developed world. In developed countries, where radio is part of the background noise of life, the assumption has been that you could

(continued on page 14)

(**Fourth R** *continued from page 13*)

not teach effectively with radio. A supplement, yes, but not the main vehicle of instruction. Consequently, in the developed world, radio was never enlisted into the educational system as RLAP has been in Kenya. What is going on here belies the old belief that radio cannot carry the burden of classroom instruction.

Radio Transformed by Interaction

What marks the RLAP is *interaction*. The program draws in the children as active participants in a cleverly designed, pedagogically sound dialogue that faithfully covers the Kenyan language curriculum for standard three (the third primary grade). In its agreement with the Kenya Ministry of Education, Science and Technology, the RLAP has committed itself to assume the main instructional responsibility for teaching the language curriculum.

The teachers work in concert with the program, guided by special teachers' guides that have been prepared and distributed by RLAP. The teachers call on individual children, as cued by the radio. They oversee the childrens' written responses on their worksheets. In the course of the broadcast, teachers monitor the childrens' papers more closely than they normally could if they were doing the teaching unaided. While the radio instructs the entire class, the teachers walk up and down the aisles, offering individual supervision as needed.

Interactive radio represents a quantum jump in the use of radio for instruction, an innovation that has transformed radio, the dowdy step-child of the information age, into an exciting educational tool that makes a quantifiable difference.

RLAP was built on the experience of a mid-1970s A.I.D.-funded project that developed the interactive radio technique to teach mathematics in primary schools in Nicaragua. Radio Math's achievement was to dispel the many doubts among educators and broadcasters that "you can't teach mathematics by radio." Neither A.I.D nor the project contractor, Stanford University's Institute for Mathematical Studies in the Social Sciences had been sure that you could either, but the value of trying was clear. A.I.D. had long had a seminal role in developing new ways of applying media to meet education and development needs. The pressing need for better quality education and greater access to schools had not proved amenable to traditional solutions. Once Radio Math's interactive method produced consistently superior results among children in the radio classes versus the children in conventional classes, the next research task was to adapt it to other primary subjects.

Rising from the ashes, skeptics this time warned that "you can't teach language by radio." Mathematics, with its logical structure and quantitative nature could be taught by radio, but less quantitative subjects such as language could not. RLAP succeeded by adapting the interactive nature of Radio Math, and further refining its formative evaluation technique. The challenge is to involve the children in a conversation with the radio, which demands precision timing and rigorous observation of how children respond to radio prompts.

Measuring for Success

Through trials and observations, repeated pretesting and classroom monitoring, creativity and expertise in instructional design, RLAP designers have reached the precision required in effective interactive radio. It is this precision that results in the enthusiastic involvement of entire classrooms of children.

An assessment carried out in collaboration with the Center for Applied Linguistics has shown that RLAP children have consistently learned more than the children attending conventional schools. The Center's assessment has provided evidence similar to that found in Radio Math—namely, that superior learning is consistently and significantly associated with radio teaching.

Formative evaluation is built into the project design to get improved learning results. Project designers do not wait until the end of the school year to see if their programs are working. Test results are of little help to the project after instructions have ended. Once the broadcasts are produced with the desired level of precision, once the children are involved and responding, the formative evaluation process begins. Evaluators immediately begin to question how much the children are learning and if they understand the curriculum as it is delivered to them in this new form.

Adaptation

The Radio Math and Radio Language Arts Projects have produced packages of educational material that can be adapted to the primary curriculum in other regions or countries. Thailand has introduced Radio Math, and a number of other countries have taken the first steps to introduce Radio Language Arts, Radio Math, or both.

When television was introduced in developed countries, many people predicted the demise of radio. But radio adapted, found new ways to work and new roles to fill, and is flourishing today. Had we stopped to reflect on radio's resourceful adaptation then, when pushed by TV, we might have asked earlier: "what can radio do if pushed by the educational demands of the developing countries?" Because of cost considerations, television and other communication technologies are not likely to supersede radio in these countries for some time. This innovative use of radio should, therefore, serve the developing world for many years.

In the dim light of that rural Kenyan classroom the case for what interactive radio can do is made best—nothing compares to the enthusiasm, the zest for learning that has been tapped in the otherwise all-too-typical rural schoolroom. ■

Peter Spain is currently working with A.I.D. to introduce and expand the use of interactive radio in schools in developing countries. He has been a researcher and writer in the development communication field for 15 years and has worked in Asia, Africa, and Latin America.

International Training Opportunities at Colorado State University

The International Training Programs at Colorado State University offers a wide selection of nondegree training opportunities for mid-career foreign nationals. Also available are regular Summer short courses for both degree and nondegree students. Courses are offered in engineering, agriculture, forestry, and natural resources. For registration information contact: Dr. J. Oxley, Office of International Training Programs, 314 Aylesworth Hall, NE, Colorado State Univ., Fort Collins, Colorado 80523, U.S.A. Phone: (303) 491-7892. Telex/TWX: 9109309011 CSU CID FTCN, Attn: Intl. Training.

Please note in the article "Spreading Good Ideas: Adapting Illustrated Materials" in the Winter *DCR* #48, the Overseas Development Administration (O.D.A.) of London, England should have been included as a major supporter of the PIACT/PATH program. O.D.A. has been a pioneer in supporting the development of family planning materials for illiterate populations in Africa and Asia.

(**Radio Math** *continued from page 1*)

In summary, a series of design considerations underlies the Radio Mathematics Project lessons:

- Children learn best when they actively participate in the learning process.
- Immediate reinforcement of responses enhances learning.
- Distributed practice is more effective than massed practice.
- Explanations and examples must be appropriate to the level of development of the student.
- Supplementary materials should be held to a minimum in order to reduce costs and to minimize delivery problems.
- Teacher training should be kept to a minimum so as to reduce costs.
- Teachers should not be required to spend more time in preparation than they would if not using radio lessons.
- Teachers, schools, and students should not be required to purchase more supplies than they would otherwise.
- Content of the lessons should not be threatening to the teachers.
- Content of nonbroadcast activities should be well within the teaching abilities of the teachers.
- If possible, the lessons should be appropriate for use by adults and by children who cannot attend school, but who can listen to the broadcast lessons.
- Formative evaluation can validate teaching effectiveness. ■

Jamesine Friend has worked in education for 20 years. She was the Overseas Director of the Radio Mathematics Project in Nicaragua.

(**Science** *continued from page 7*)

Evaluation and Research. Formative evaluation of the radio programs will provide continuous feedback on student learning to guide the development of future programs. It provides feedback both on the lesson formats being used, and on student mastery of concepts being taught. In Radio Science, formative evaluation will also systematically gather information from teachers, school directors, students, and where possible, parents on their attitudes toward and suggestions about the radio programs. This data will indicate ways of improving the format and content of the lessons, and of more fully integrating science into daily life. Summative evaluation will determine yearly learning gains by students when compared to the control group. We expect that Radio Science, like the other radio projects, will result in increased student learning gains, and also narrow the gap between rural and urban student achievement.

There will be three small-scale research studies done in conjunction with the project that will further explore science education in developing countries. The first study will be a diagnostic assessment of primary school science and curricula in the host country and in the region, in order to suggest the optimum grades in which to use radio science programs. The first grade in primary school concentrates on reading and mathematics. Since many students must also make a transition from their mother tongue to the national language, the radio science programs may be targeted for the higher primary levels. Second, a small research study in cooperation with national educators and scientists will aim to learn more about the ethnoscientific concepts children have, how children learn school-taught science, how much they retain, and how they apply science education to their daily lives. The third study will experiment with the use of newer technologies, such as low-cost electronic devices, to better understand the process of science learning.

Dissemination. In its second year, the project will begin publishing occasional papers on project findings. Later, two conferences will be held at the project site. Furthermore, informational materials, including a film or video, and packets of sample project materials will be developed and distributed to Ministries of Education in other developing countries. We expect these efforts to result in other nations using the Radio Science programs.

With the Radio Science project, the Interactive Radio Instructional Curriculum is complete. An Instructional Radio Dissemination project will offer information and technical assistance for the establishment of programs in mathematics, language arts, science, and basic community education programs in at least four other sites. ■

Jean Meadowcroft designed and is currently the Project Officer of the Radio Science Project. She is an Assistant Education Development Officer at the Office of Education, A.I.D. Washington.

(**Thai Math** *continued from page 16*)

The BSPP mathematics lessons include a 25-minute radio broadcast and a 15-minute post-broadcast session led by the classroom teacher. For this session the teachers use a manual provided by the BSPP which gives a complete set of instructions for activities to follow the broadcast.

The Radio Broadcast

The part of the mathematics lesson covered by the radio is mostly in the form of a dialogue between the "radio teacher" or other radio characters, and the students in the classroom. Some of the activities during the radio programs are oral, with the entire group of students answering the radio teacher together. Other activities are written, with each student writing in his notebook or BSPP-supplied worksheet according to directions given by the radio teacher. A third kind of activity requires physical participation by the student, such as manipulating objects according to directions from the radio.

At the time of the radio programs the teacher is freed from the usual activity of standing in front of the class to lecture and write on the board, as the radio is doing the teaching during this period. This gives the teacher a unique opportunity to observe the students and help those who are having problems. If a teacher has to teach more than one grade, as happens in a few rural schools, then he may spend part of the radio time teaching another class. The teacher should also be listening to the programs, paying special attention to the teaching methods used. During the postbroadcast session, many of the techniques used in the radio program can be applied.

Each program is divided into segments of between one to five minutes. Some segments are purely mathematics instruction while others have entertainment to help motivate and relax the students. Much of the entertainment is aimed at promoting learning through songs and physical exercises.

Useful Tool

The BSPP mathematics lessons are a very useful tool designed to make the teachers' job easier at the same time as helping them teach mathematics more effectively. The programs are very easy to use, requiring no more than one day of special training. The radio programs and the postbroadcast sessions cover the entire mathematics curriculum from the Ministry of Education. The first-grade programs require individual student workbooks provided by CET, as well as a teacher's manual: the higher grades need no preprinted student material, only a teacher's manual and regular student notebooks.

All lessons were designed following a few basic principles of good primary school teaching. Chief among these principles are:

1. Students learn best when they are actively involved in the learning process. In the radio lessons there is very little explanation, with most of the teaching done in the form of a dialogue.
2. Students learn a topic best when the learning is distributed over a longer period of time. Instead of teaching the various topics in blocks or chapters, the BSPP lessons often teach several topics at the same time, but learning each topic may require as long as the entire school year.
3. Primary school students need great amounts of practice to reinforce the basic learning process. Because the radio lessons are organized to use broadcast time effectively, it is possible to include much more practice and review than is usually done by the classroom teacher.
4. Learning must take place in small increments. The teaching of each topic in the BSPP lessons has been well planned so that each step follows logically from the previous steps and there are no gaps that would lead students to make faulty generalizations.
5. Materials must be tried out and the results observed in the classroom. Extensive classroom observation of BSPP programs has guided the direction in which the programs have been developed.
6. Students learn best when instruction is related to everyday life. BSPP lessons are based on concrete experiences and there are many examples and problems illustrating practical application of the mathematical skills and concepts that the students are learning.

Experiment Results

To date, there have been two kinds of evaluation of this experiment. One has measured student achievement in the group of schools using the radio programs and has compared the results with a similar group of control schools using regular mathematics texts.

Results show that BSPP experimental schools did better than the control schools in every region in all three years. Also, the difference between experimental and control schools was greater in the northeast than in Bangkok. This means that the radio programs are helping to promote regional equity in the Thai primary education system.

The results from teacher questionnaires have also been very positive. Teachers and headmasters are enthusiastic about the BSPP programs. Apart from praising the fact that the programs teach mathematics effectively and they are easy to use, they have also mentioned a number of other benefits. The programs promote discipline and punctuality in both students and teachers—the programs must start at a given time and students and teachers must organize themselves accordingly. In the northeast, teachers also say that the programs help students to speak and understand standard Thai. All teachers agree that the programs improve students' mental agility and self confidence. ■

Klaus Galda is currently the director of the Radio Science Project. He was the field director of the Radio Math Project in Nicaragua and consulted for UNESCO in the Thailand Fifth World Bank Education Project, and for the RADECO Project in the Dominican Republic.

Learning Math by Radio

by Klaus Galda

This article appeared in a somewhat longer version in the British Council's journal Media in Education and Development *(Vol. 17, No. 3, March 1984). It is reprinted here by permission of George Grimmett, Editor. This project is an example of an adaptation of the Radio Mathematics Project initially used in Nicaragua. The Institute for Mathematical Studies in the Social Sciences at Stanford University worked with Thai education officials to adapt this program to the Thai culture and to the official Thai curriculum. Some changes were necessary to reflect the differences in the official Thai curriculum. The change in cultural setting did not create a big problem, and Thai children responded very well to the dialogue approach used in presenting the mathematics lessons over the radio.*

During the past half a century Thailand's educational system has undergone great changes and made tremendous progress towards the goal of universal education. There is free access to schooling for all Thai children, especially at the primary school level, regardless of their social or economic status. Within the past 20 years a massive school building program has also provided generally adequate physical school facilities at the primary level and the student-teacher ratio in Thailand is one of the lowest in the developing world.

In spite of these wonderful accomplishments certain problems persist. Perhaps two of the greatest are the lack of training among a large number of primary school teachers, and the problem of serious regional inequities in the schools. These problems are not unrelated as, on the whole, the more favored regions also get the best trained teachers. Many educational innovations, new curricula and new materials have had disappointingly little success in improving the quality of Thai primary education, mainly because of the inability of most teachers to use these innovations as they were intended.

As far as regional inequity is concerned, a set of studies carried out by the National Education Commission in the 1970's demonstrates that in most school subjects, and especially in the key areas of Thai language and mathematics, achievement levels in the northeast are only about half those in the more developed regions of Bangkok and the central plain. There is no evidence that this gap has been significantly narrowed in the past ten years. Of course educational reforms could only hope to decrease the inequity, not to eliminate it.

It is clear to most educators that the introduction of new materials on their own will only serve to increase the disparities, since the already better trained teachers will know how to use new materials more effectively. On the other hand a massive in-service training course for hundreds of thousands of primary school teachers would be very expensive, almost impossible to administer, and probably take too much time away from the teachers. So it seems that an ideal solution for the two problems would be an approach which would work equally well in all classrooms and train the teachers indirectly over a long period while they are actually teaching.

Fifth Education Project

During the late 1970s, the Ministry of Education together with the World Bank planned the Fifth Education Project for Thailand. One of the main objectives of this was to strengthen the educational radio system. One of the outcomes will be a network of 11 radio transmitters, covering virtually the entire country, exclusively dedicated to educational programming. Specifically in the case of primary school education, it was felt that educational radio could be an important tool to help solve the problems of inadequate teacher training and regional inequity discussed above.

With these considerations the Centre for Educational Technology (CET), a division of the Department of Nonformal Education, launched the Basic Skills Pilot Project (BSPP) in 1980. The BSPP was to develop an extensive set of radio programs, as well as accompanying printed material, to help overcome student learning deficiencies in the two basic subject areas of mathematics and Thai language. By serving as a pedagogical model for the teacher, the programs would also help to train untrained teachers without taking them away from their usual classroom duties and without making additional demands on them. This article will describe the mathematics programs developed under the BSPP.

Initially the BSPP was set up as an experimental project in early 1980. The first set of programs, 160 lessons for second-grade mathematics, was broadcast from May 1980 in two geographical regions. One radio station in Bangkok broadcast the programs for Bangkok and outlying areas, while the other station in Maha Sarakham, broadcast to schools in two northeastern provinces. The two regions chosen represent the extremes in Thailand, with the first region having generally the most favored schools and the second region having the least favored.

In 1981 the first-grade programs were developed and broadcast to the same schools. In 1983 the project expanded and broadcast programs for grades one, two and three to about 50 experimental schools in five provinces. Beginning in late 1983 CET distributed radio receivers to all public schools in Thailand and the programs were available for use in all primary schools in 1984.

(continued on page 15).

Development Communication Report

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