PD-AAP-317

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: Interregional

4. DOCUMENT REVISION NUMBER: -

5. PROJECT NUMBER (7 digits): 936-5818

6. BUREAU/OFFICE: A. SYMBOL: ST/ED; B. CODE:

7. PROJECT TITLE (Maximum 40 characters): Radio Science

8. ESTIMATED FY OF PROJECT COMPLETION: 90

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 84; B. QUARTER 4 (Enter 1, 2, 3, or 4); C. FINAL FY 90

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 -)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL						
(GRANT)	(590)	( )	(590)	(8020)	( )	(8020)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1. Host USAID				1000		1000
OTHER U.S. 2.						
HOST COUNTRY	50		50	523		523
OTHER DONOR(S) USAIDs (at dissemi				4000		4000
nation sites) TOTALS	640		640	13543		13543

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 84 F. GRANT	E. 1ST FY 84 G. LOAN	H. 2ND FY 85 I. GRANT	H. 2ND FY 85 J. LOAN	K. 3RD FY 86 L. GRANT	K. 3RD FY 86 M. LOAN
(1) EH	EH	640		590		300		900	
(2)									
(3)									
(4)									
TOTALS									

A. APPROPRIATION	N. 4TH FY 87 O. GRANT	N. 4TH FY 87 P. LOAN	Q. 5TH FY 88 R. GRANT	Q. 5TH FY 88 S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)	1500		1600		8020	
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM 03 YY 87

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: David Sprague

TITLE: Acting Director, Office of Education

DATE SIGNED: MM 05 DD 08 YY 84

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 05 DD 08 YY 84

AID 1330-4 (3-76)

PROJECT PROPOSAL

RADIO SCIENCE

S&T/ED Jean H. Meadowcroft

May, 1984

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1. PROJECT BACKGROUND

1.1 Rationale for a Radio Science Project

The A.I.D. Education Policy Paper calls for in-depth reforms of education systems in Less Developed Countries (LDC's). The aim is to improve the efficiency and quality of these education systems, particularly at the primary school level. The Policy Paper urges that educational innovations such as instructional radio be used to support reforms.

A series of S&T/ED-sponsored instructional radio pilot projects responds to the need for mechanisms to provide inexpensive, widely available, effective primary schooling. Developing the use radio to quickly and economically overcome the lack of trained science teachers, Radio Science is the third, and last, part of a model radio-assisted curriculum for the primary school level. Radio Science responds to the needs strongly expressed by African educators to base their curriculum on science and technology and to make African primary schooling more efficient and effective.

The Radio Mathematics project, carried out in Nicaragua from 1974 to 1979, showed significant improvements in student learning of mathematics, at very low costs. Adaptation of these radio programs in Thailand, despite the cultural and language differences, also showed significantly improved learning. The Radio Language Arts education project, carried out in Kenya since 1979, is now producing significant gains in student learning. These radio education projects are reviewed in Section 5.1. The Radio Science project will follow on these programs which experimented successfully with systems design of instructional radio broadcasting as a means of increasing the quality of teaching at a low cost. The rigorous techniques developed in the earlier projects for producing tested radio education programs will provide the technical base for the Radio Science project.

The project purpose is to develop a tested model for using radio to provide effective primary science instruction at low cost. The project will use instructional broadcasting for primary school classes, with support by a science education resource center providing curriculum, materials and teacher orientation.

Achievement of the project purpose will be measured by two criteria:

1) that pupils receiving radio science education show statistically significant gains in learning compared to pupils in control classes, taught by teachers using customarily available teaching aids such as guides, materials, and textbooks; and

2) that the radio science education program recurrent costs are low, and its administration is manageable for LDC MOE's.

The sector goal for this, the radio mathematics and language arts radio education projects as well as the community based radio education project in the Dominican Republic, is to increase access to primary schooling while improving the efficiency and effectiveness of the education system.

Science education is critical to development, first and foremost for the science knowledge to be used in daily life, but also for the thinking skills to stimulate independent learning. The key is the application of scientific thinking in everyday experience, not only to learn to question "why" but also to have learned "why", and to use the new learning. Primary school science must stress the relation of science to daily life so that children will have the knowledge they need ultimately to improve their health and nutrition, to increase their crop yields, to conserve the soil and environment, to make, use, and maintain tools and other equipment for improving the quality of their lives.

Yet science often is poorly taught. Teachers who themselves have insufficient knowledge of science typically give their students collections of theories and facts to be memorized and reproduced at exams. This makes science unrelated to daily life experiences, and too theoretical to be well understood by school children. For example, in recent research on sixth grade students' achievement in Costa Rica, an educationally sophisticated nation, scores in two areas of science averaged only 5 and 18 percent compared to 43 percent in social studies and 41 percent in arithmetic (Kreimer, 1983).

There is already some experience in the use of radio and television for teaching science lessons to children. A story is created, using a cast of characters and their adventures, to convey the science content and to explain how it is related to children's experience. To take an example, an

Indian boy complains to his father about the sun's heat; his father tells him a story about the day the sun never rose --the cold, the plants' failing to grow. After the story, the radio science teacher suggests questions for the children and their classroom teacher to talk about and activities for them to do: identifying how the sun is used to grow crops, to dry the harvest, to light the pages of the books the children read. Stories are an age old means of teaching; radio is a modern media, especially well suited to conveying concepts such as science to children in classrooms. This is but one of many techniques that can be used to build a comprehensive radio curriculum.

Why choose instructional radio to improve science education? As for any innovation, the initial costs of a pilot project for developing the radio assisted curriculum by formative evaluation techniques are substantial. For example, we can contrast the ultimate use of radio with the strategy of providing standard textbooks. The provision of textbooks indeed is a useful intervention, but textbooks have not been tested for effectiveness and efficiency in producing learning by the students whose school and environment may be quite different from those presented in the textbook. Two studies in mathematics education confirm that systems-designed radio mathematics instruction produce significantly greater gains in student learning than textbooks. The first, in Nicaragua, showed that over a full school year students using textbooks learned more than control groups with few or no books, but that students receiving radio-mathematics instruction showed far greater gains (Jamison, et al, 1981) The second, in Thailand "... measured student achievement in the group of schools using the radio programmes and compared the results with a similar group of control schools using regular mathematics texts .... [T]he experimental schools did better than the control schools in every region in all three years.... [Also], the radio programmes are helping to close the gap between the regions, or in other words, promote regional equity in the Thai primary education system." (Galda, 1984:42).

Additional teacher training is another alternative to radio. But it is costly, time consuming, and variable in effectiveness at the classroom level, according to the abilities of the teacher. Radio assisted instruction is effective because it can be designed to bring into every classroom high quality instruction tested to produce learning.

Radio-assisted instruction is an efficient and low cost educational strategy as it can reach large audiences after the pilot development stage. The developmental stage is undeniably costly, due to high inputs of technical expertise for the subject to be taught, for instructional radio, and for evaluation, as well as to the extensive work done in curriculum development, formative and summative evaluation and subsequent revision of materials. This stage, then, requires support by an international donor such as A.I.D.

The costs of adaptation for other nations are lower. They vary according to the amount of adaptation required in the subject matter itself, in language, and possibly in curricular design to fit national education plans. For a universal subject such as mathematics, little or no adaptation may be required for a nation using the same language. An informal effort using the Nicaraguan radio mathematics programs on cassettes in Colombian schools showed the students rapidly adapted to learning from the tapes, and learned well. Adaptation of the radio mathematics programs for community education centers in Dominican Republic has involved re-recording with Dominican voices and music and reducing the length to fit the community education format (Galda, personal communication, 1984). Costs for the Thai adaptation to a very different language and culture were higher. For instruction closely tied to language, such as reading, adaptation of programs could approach developmental costs, since reading instruction must be tailored to the linguistic structure of each language or dialect.

Once instructional radio programs have been developed or adapted, recurrent costs are extremely low. For Nicaragua, this was projected at $.88 per student-year (Wells and Klees, 1978: 234). A recent projection for the Dominican Republic was $.71 per student year. These costs include replacement of radios and batteries, supplies of teacher guides and student materials, radio broadcast time and tape maintenance, teacher training, as well as administrative support.

S&T investigation of radio and science education projects, including an extensive consultant report in 1983, showed no organized methodologies tested for effectiveness in teaching children science through radio. The review documented significant curriculum development efforts in science education for African schools (section 5.1), efforts that had fallen short in reaching into classrooms because they imposed

unrealistic demands on the skills of teachers. The point of Radio Science is to consolidate and build on these science curriculum developments, and to use radio to deliver improved science education widely and rapidly.

- It will compensate for the teachers' lack of science knowledge and will provide support systems for teachers, through the radio science lessons themselves, broadcasts especially for teachers, teacher workshops, and participation by host country science educators in developing methods and materials;

- Lessons and instructional materials will reflect children's daily experience and include post broadcasting activities for children to apply science lessons at school and at home;

- Rigorous formative and summative evaluation not only will test student learning, but will gather information on student, teacher, and parent attitudes and concerns about the radio science programs;

- Further progress will be made on local production of low-cost teaching materials. Some materials may be collected by teachers and students, but the project will work with government and private sector entities to achieve mass production at low cost;

- The project will be based in a Ministry of Education's Curriculum Division, and will seek MOE approval for official adoption of the final radio science programs. This will ensure its use throughout the national education system and its inclusion in pre-service and in-service teacher training programs.

1.2 Internal and External Efficiency in African Schooling

Problems in internal and external efficiency of education in Africa demonstrate the critical need to focus attention on improving education at the primary school level. From 1960 to 1980, African nations made great strides in increasing school enrollments and completion rates, and

decreasing repetition and drop out at the primary level. But a study based on UNESCO data concluded "... African children attaining primary school entry age have a relatively small chance of attaining some secondary education". (UNESCO, 1983b: p. 31) The majority of African students who leave school after the primary level may find that their schooling has little application to their daily lives. The gap between school and the village is great; even school completers "... are often ill-equipped or poorly motivated to make a contribution to their economy and their country's development..." (Barnes, 1982a: 31).

Thus, the 1982 Harare Conference of Ministers of Education concluded that "... in their first ten years of schooling, all these pupils should receive training based on a common core curriculum that is predominantly scientific and technological ... [with] practical work ... and application of the scientific and technological concepts explained by the teacher and by specialists drawn from the local community [so that] concepts are thus assimilated because they are used to solve day to day problems." (UNESCO,1982a:63-64).

1.3 In sum, the Radio Science project responds to:

- Progress by APSP and SEPA in training science educators, establishing science curriculum centers, and developing science education materials;
- The stated need for greater progress in delivering primary school science education that is practical, applicable to daily life, and directed to economic development requirements;
- Successful experience using tested, instructional radio systems to improve teaching and learning of primary school mathematics and language arts, at very low cost;
- The concentration of African pupils in primary school.

2. PROJECT DESCRIPTION

2.1 Project Phases and Program

To accomplish the project purpose, the project will be implemented in two overlapping phases -- first, developing a primary school radio science education program in one country, and later, disseminating the science education program and evaluation findings to three other LDCs.

Phase I

Over a five-year period in one African country, the project will:

- establish a Science Education Resource Center (SERC) in the curriculum division of the Ministry of Education;
- develop and produce science curriculum, lessons, and materials for grades 1-7, divided into four levels for broadcasting purposes;
- deliver these to rural school classrooms through radio broadcasts and teachers trained by SERC;
- carry out formative evaluation and summative evaluation to assess and revise the science education program, and to measure student learning of science.

Phase II

In the second year, the project will begin to bring educators from other nations to learn the methodologies of producing, testing, and refining the instructional radio programs, developed in this and other S&T/ED projects.

In years three through five of the project, the project will expand information dissemination to African and other countries through a network of radio and science educators, and educational planners.

By the sixth year, dissemination sites for projects adapting the radio science programs to national language and

curriculum will be distributed through AID's regional divisions: Asia, Near East, and Latin America. The project will support efforts to achieve implementation of the complete primary school radio curriculum in mathematics, science, and English as a second language in at least one dissemination site.

2.2 Program Description

The Ministry of Education will establish a Science Education Resource Center (SERC) in the MOE Curriculum Division, with a staff of national science curriculum specialists, assisted by a team of U. S. advisors in science education, curriculum, instructional materials, instructional radio, and evaluation. The Ministry of Education will also delegate radio education specialists to the project and assign time for the broadcasts on a radio station. Project funds will also support employment of additional local staff required during the intensive development stage of the project.

Pilot instructional radio programming will begin in one region, with at least 20 non-urban schools, located within one day's roundtrip journey from the SERC. Some schools should be relatively isolated, to provide a test of radio science under difficult conditions.

To achieve the project purpose, the following tasks will be carried out:

- prepare a detailed implementation plan for development and broadcasting of the science program, evaluation, and dissemination, based on experience from the Nicaragua Radio Mathematics and Kenya Language Arts projects. The plan will include ways for SERC to use nearby school classes to try out lesson ideas. These science classes can become models where other teachers may come to observe, and where videotapes or slides can be filmed for training project teachers;

- assess existing primary school science curricula and materials available both in the nation and in the region for possible adaptation (to avoid having to develop all new material);

- design the programs to be entertaining as well as educational to capture children's interest and attention. Children, teachers, and parents will

participate both by sending in questions to be answered and occasionally by on-the-air appearances (recorded on cassettes at project schools);

- o adapt primary school science curricula into lessons and scripts for recording and broadcasting; four levels will be developed and tested in sequence, one each year for four years. The costs and benefits of beginning with higher levels, where science is more developed as a subject, versus beginning with first grade and having a full cohort of students progress through the levels during the project, will investigated and decided before adapting any curriculum;

  - Grades 1 and 2. Units will be related to the reading curricula and broadcast once a week. In countries where the mother tongue is the language of instruction for the first grade, the broadcasts will be in the mother tongue. The units will emphasize exploring, observing, and learning how science concepts apply to daily life in health, nutrition, and agriculture.

  - Grade 3. Units also will be related to reading but will be broadcast twice a week. Units will develop the vocabulary necessary for science, especially if there is a transition from mother tongue to second language at this level. Science lessons will continue toteach children to explore and observe, as well as to compare, to begin to question (and answer) "why and how." Units will continue to relate to daily life applications.

  - Grades 4 and 5. Science units will be broadcast twice a week and continue vocabulary and language development. Students will build skills such as classifying and predicting and will begin to study science as a more formal subject.

  - Grades 6 and 7. Science units will be broadcast three times a week. Concepts will be geared to a more cognitive level, although science units will also contain material related to appropriate technology and vocational skills.

- o develop inexpensive instruction materials such as monthly newsprint science "readers" as well as simple, low-cost instructional equipment. Some materials may be adapted from SEPA units, but the emphasis will be on teaching the child to develop experience in his own environment. Teachers will be provided with simple equipment from a school kit or asked to gather materials from the environment, but they will not be expected to get involved in time consuming equipment construction. Each "package" of curriculum, materials, equipment and radio broadcasts will be designed in units of two weeks or a month each, so that other countries can adaot and mix them according to their own needs;

- o broadcast the lessons to participating classes. The broadcasts will be for 20-30 minutes each, from one to three times a week according to the levels outlined above. The lesson broadcasts will be designed so that teachers will not have to do a great deal of preparation, although follow-up activities will be suggested. Students will be encouraged to send in questions to be asked and answered during broadcasts,

- o orient teachers in using the radio science broadcasts and materials through teachers guides, and through one-day workshops including videotapes or slides at the district level. School directors and district school inspectors and supervisors will be included at the workshops to help them understand the Radio Science program;

- o broadcast weekly programs for teachers of each of the four levels. The broadcasts will help teachers prepare for the next week's classroom broadcasts. The new material will be explained to teachers and suggestions made for equipment needed from the school science kit, or materials to be gathered. Teachers also will be encouraged to send in questions, suggestions, and problems for discussion during teachers' broadcasts;

- o distribute cassettes of students and teachers programs, so that those who miss broadcasts can listen. The cassette recorders will also be used to record students and teachers questions and comments

for use on the air or for feedback to the radio science staff;

- o experiment with the newer teaching technologies, such as low cost electronic instructional devices. This will be done in a limited number of schools in order not to interfere with evaluation of the radio science programs. The expectation is that during the project the supplementary role of these devices can be better understoood.

- o develop and implement formative and summative evaluation plans.

Formative evaluation will emphasize testing of lessons, instructional materials, and equipment for students' understanding and learning, as well as for appropriateness and effectiveness. Means of data collection will be testing of children's learning, observation (through checklists) for children's use of new information and skills and for teachers' use of lessons and broadcasts, interviews with teachers and parents about the science program and radio broadcasts. As in the previous radio education projects, formative evaluation will be continuous rapid feedback process during the school year so that a tested set of lessons is available at year's end.

As part of the evaluation, the project evaluation specialist will carry out a small research project, in cooperation with a national group of SEPA graduates and university educators, to learn more about how children learn science, what science concepts they retain, and how they apply science concepts to their own experience.

The project will document development and recurrent costs of radio science education. It will also maintain records, such as monthly logs, to track the administrative requirements for establishing and maintaining radio science education programming.

For at least the project's first two years, the technical assistance contractor, the host country MOE, and S&T/ED project directors will meet twice yearly to discuss the project, its progress, and learnings about radio science instruction. These directors will seek the counsel of both U.S. and host country advisory groups in science and radio education. At these semi-annual meetings, project directors will reach decisions on

science education content and methods of supplementary equipment, teacher understanding and use of the radio science education programs, recurrent costs, and radio program administration. These meetings will serve as mile-posts to assess the project and guide future directions.

Summative evaluation of students learning will be done through a lapped year design as in the Kenya Language Arts Projects. As the program is introduced, students in each subsequent grade will be tested for learning through pretests at the beginning of each school year of students' prior knowledge and end-year post tests to measure their learning during the school year.

The Evaluation Plan is included in Section 4.

develop and implement a dissemination program. These activities will begin in the second year of the project and will take the form of:

- networking and interchange of ideas and visits with science and radio education specialists from other national and regional radio educations organizations;

- occasional papers on project findings and on primary school science and radio education in LDC's;

- distribution of model curriculum units, lessons, materials, radio scripts, and videotapes or filmstrips to LDC Ministries of Education;

- two annual conferences, in years three and four, for 15-20 African radio and science educators each year;

- three summary regional conferences in year 5 on instructional radio (mathematics, science, reading, and English as a Second Language) for Africa and the Near East, Asia, and Latin America; and

- technical assistance for up to 4 dissemination sites for planning radio science instruction, training MOE science and radio staff, and

advising them during initial stages of implementing radio science program. Project funds are provided in years three through six to support implementation costs, including additional technical assistance, at the dissemination sites. In the case that a MOE needs external funding for long-term technical advisors, equipment or materials to carry out adaptation of instructional radio programming, it will be assisted in project design toward securing USAID or other donor funding. Toward the end, the project funding authorization includes the possibility of up to four million dollars of USAID mission add-ons to the contract. Implementation of add-ons will depend on the sucessful performance of the project contractors and A.I.D. decisions on the acceptability of add-ons to project contracts.

The project will strongly encourage implementation of dissemination sites in the Asia, Near East, and Latin American regions. At least one site should be supported in implementing the complete radio primary school program (mathematics, science, English as a Second Language.)

2.3 Project Site

The project site has not been finally determined although extensive conversations have been underway for several months with the USAID Mission at one possible site. The USAID HRDO contributed ideas for this project proposal and now is consulting with the host government on their interest and capacity for participating in the Radio Science project. Once the project site is selected, and a contract signed with a technical assistance organization, plans for implementing the project will be formalized through an A.I.D.-Host Country Project Agreement. See Section 5.2, Institutional Requirements.

2.4 Inputs

National Staff

The Ministry of Education will delegate personnel from its staff for the Science Education Resource Center, the radio station, and primary schools. Since Radio Science will be

developing and evaluating innovative programming and require more staff than a normal MOE level of effort in curriculum development, the project will provide grant funds for costs of additional MOE specialists and support staff. Small salary supplements may be paid to regular MOE staff if daily hours exceed the normal working day. These details, including criteria and procedures for employment of project personnel, payment of salaries and salary supplements, will be specified in the USAID-host country project agreement.

Project staff requirements will include at least:

- two science education specialists
- two curriculum design and evaluation specialists
- two instructional materials specialists (one with graphic arts skills)
- two evaluation specialists
- seven radio recording production staff (producer and actors)
- four curriculum assistants-script writers
- four evaluation data gatherers
- four secretaries
- three drivers
- two materials production assistants teachers at 20 primary schools

Technical Assistance. The project will require 18 person years long tecnical assistance on-site, 4.5 person years for a U.S. based project coordinator, and 31 work months of short-term technical assistance. The four long term technical advisors will be specialists in science education, instructional radio curriculum and materials, instructional radio broadcast programming, and evaluation. These advisors will provide up to two person years consulting to other LDC project dissemination sites, with additional needed technical assistance to be drawn directly from dissemination budget. To benefit from the experience of African science educators, the project will attempt to recruit third country education specialists among the technical advisors. Any resulting cost savings will be used to increase consulting to project dissemination sites. Formative and annual summative evaluation will also be done by the contractor, but mid-term and final evaluation will be done by AID staff and external evaluators. A project advisory group of several U.S. science educators will confer with AID in Washington semi-annually to review the project and provide recommendations. See table on Technical Assistance for details.

TECHNICAL ASSISTANCE

Long Term

YEAR-	1	2	3	4	5	Total Work Years
Project Coordinator (U.S. based, & secretarial time)	30 (1/2 yr)	60	66	61	77	4.5
Science Educator/ Chief of Party	60 (1/2 yr)	132	145	160	176	4.5
Radio Curriculum & Instruct. Mats.	60 (1/2 yr)	132	145	160	176	4.5
Radio Broadcast	60 (1/2 yr)	132	145	160	176	4.5
Evaluation	60 (1/2 yr)	132	145	160	176	4.5
TOTAL ($000)	270	588	646	711	781	22.5
					$	2,995

Calculated on year one base of $120,000 per person plus 10 percent inflation each year. Person year includes support and overhead costs, except for home office coordinator).

Short-Term Consultants

Year	1	2	3	4	5	Total Work Mths
a) Education Anthropologist	2 mo.	2 mo.	-	-	-	4
b) Graphic/Print Specialist	2 mo	2 mo	-	-	-	4
c) Innovative Instructional Technologies Specialist	-	2 mo	2 mo	-	-	4
d) Education Economist	-	1 mo	1 mo	-	1 mo	3
e) Other (as needed)	2 mo	2 mo	2 mo	2 mo	2 mo	10
f) External Evaluation Specialist	-	-	3 mo	-	3 mo	6
						31
g) Project U.S. Advisory Group ($000)	9	10	11	13	13	
TOTALS ($000)	45	70	70	29	60	274

(Short-term calculated on a year one base of $6,000 per month, plus 10 percent inflation each succeeding year.

Training. In order to avoid long absences of project staff, little long-term training is planned. Staff training will be done primarily through in country workshops for project personnel, conducted by the short and long term technical assistance staff. In the first year project staff will travel to the Kenya Language Arts project to observe the radio lesson production and teaching process. To support continued improvement in science education, two national science educators will be trained long term at the graduate level. Teachers will participate in and will receive teacher's guides to the radio science lessons. Where the MOE already provides annual teacher training programs, Radio Science will coordinate project teacher workshops with the established programs. Radio programs for teachers and the student science programs themselves will also improve teachers' knowledge and teaching skills.

Teachers will participate in one day workshops every year for four years. The first workshop will be held during the first year of the project, prior to the school year. Each year first level teachers and additional MOE educators will be participate in workshops. Second level teachers will begin with the second workshop, and so on, so that a total of 260 teachers and other educators will be trained over LOP as follows:

	Workshops	Workshops	Workshops	Workshops
MOE educators	10	10	10	10
Teachers				
1st level	20	20	20	20
2nd level	20	20	20	20
3rd level	--	--	20	20
4th level	--	--	--	20

Commodities. Costs will include media production and broadcasting equipment, radio receivers and batteries, students' science curriculum and materials, school science teaching equipment kits, curriculum reference library (sample texts, films, and materials), printing and graphics materials preparation and equipment, media production materials (audio tapes, videotapes, etc.), and instructional devices.

Three vehicles will be required for travel of project evaluation assistants to schools, delivery of materials to

schools, and field supervision. These vehicles should be heavy duty six passenger vans.

Diffusion. These costs will include networking with other science and radio education organizations, exchange of documents and information with other science education centers, distribution of project developed instructional and radio broadcasting materials to other LDC MOE', two annual conferences for about 20 African educators each year, and three regional summary conferences for about 25 educators for the Near East and Africa, Latin America, and Asia. Two person-years of consulting for dissemination sites are included under Technical Assistance.

Host Country Contributions. In addition to salaries of project personnel the host country will provide:

- Office and other space for project personnel, equipment and materials production
- Radio broadcast preparation facilities and transmission time
- Routine operational costs such as rent, utilities, and maintenance

USAID Contributions. USAID will contribute administrative support by the Human Resources Division and the administration office. Personnel from mission funded projects will work with the project to develop curriculum, to train teachers and to coordinate Radio Science with other education development projects. USAID will plan for and provide future education funds to support expansion of radio education nation-wide, beginning in the projects' third year.

The summary of costs is shown in the budget, section 3.1

2.5 Implementation Plan

Administrative Arrangements

Project implementation, including technical assistance, procurement of commodities, and training, will be done by a U.S. contractor. This organization will work closely with the Ministry of Education, existing entities (e.g., the radio station), and the project established Science Education Resource Center. Through a USAID-host government Project

Agreement, the MOE will commit its full cooperation to developing the Radio Science Project and continuing the radio science education program through the Curriculum Division and Science Education Resource Center, after completion of S&T/ED funding. The MOE will delegate qualified employees from the curriculum, instructional materials, and radio departments to participate in the project, and will delegate or employ other required personnel, including secretarial and other support staff. The technical assistance organization and MOE staff should form a national advisory group on science education composed of university teachers, college and secondary level science educators, school leaving examiners, and community representatives. This group will meet quarterly, review project progress, advise the project director and chief or party, and coordinate project work with other education organizations.

S&T/ED project monitoring including annual on-site reviews will require 4 person months each year. S&T will work with USAID to establish the project agreement with the host government. The agreement will spell out in detail responsibilities of each party.

The contract will be let through open, competitive bidding procedures. Major selection criteria for the contractor include:

- Experience of proposed personnel in developing and evaluating instructional radio programming in LDC's;
- Experience of proposed personnel in science education, preferably in LDC's;
- Established record of high quality performance and successful working relations with host nationals [by the organization] in development education projects; and
- Previous experience in the region where the project site is located, and knowledge of national language and culture.

Agreement, the Moe will commit its full cooperation to developing the Radio Science Project and continuing the radio science education program through the Curriculum Division and Science Education Resource Center, after completion of S&T/ED funding. The MOE will delegate qualified employees from the curriculum, instructional materials, and radio departments to participate in the project, and will delegate or employ other required personnel, including secretarial and other support staff. The technical assistance organization and MOE staff should form a national advisory group on science education composed of university teachers, college and secondary level science educators, school leaving examiners, and community representatives. This group will meet quarterly, review project progress, advise the project director and chief or party, and coordinate project work with other education organizations.

S&T/ED project monitoring including annual on-site reviews will require 4 person months each year. S&T will work with USAID to establish the project agreement with the host government. The agreement will spell out in detail responsibilities of each party.

S&T/ED has thoroughly reviewed options for contracting. S&T/ED extensive experience with prior instructional radio projects shows that these projects are very specialized and demanding in their technical requirements. Radio Science will be especially demanding due to the considerable professional debate on both optimal methods for teaching science and on the most appropriate ways for teaching science by radio. It will require a Contractor with a depth of expertise in both science teaching and instructional radio techniques. S&T/ED discussions reviewed the Contractors, including 8a and small business firms, that have had contracts for S&T/ED projects, and the potential Contractors, including Historically Black Colleges and Universities, that presented proposals for the Increasing Efficiency of Education Systems project, and concluded that open competition would provide the greatest opportunity for the technical creativity and responsiveness to project objectives required for Radio Science.

Proposed Implementation Schedule

Month/Year	ACTION	Responsible Agent
May	PP approved	AID/W
August	Contractor Selected	AID/W
September	Project Agreement signed	AID/W, USAID
FY 1985		
October	TA advisors contracted and on-site	Contractor
October	Key national staff identified and delegated to project	Host government Ministry of Education (MOE)
	Begin implementation planning, including school selection and assessment of primary school science curricula	Contractor, MOE
November	Implementation Plan completed; schools selected	Contractor, MOE, USAID, AID/W
	Post test for control group summative evaluation, first level	Contractor, MOE
	Begin two-month workshop for local staff, including travel to Kenya Language Arts project	Contractor/MOE
	Begin adaptation of first level science curriculum and development of radio scripts	Contractor, MOE
January	First workshop-for first level teachers	Contractors, MOE

February	Begin broadcasting and formative evaluation of first level	Contractor, MOE
Monthly, February thru November	Project staff visit schools for field supervision and formative evaluation, first level	Contractor, MOE
March	Semi-annual conferral on project process and directions	S&T/ED, Contractor, MOE, USAID
August	On-site project review	S&T/ED
	Semi-annual conferral on project progress and directions	S&T/ED, Contractor, MOE, USAID
FY 1986		
November	Post-test of level one; process pre-test post-test data	Contractor, MOE
	Post-test for control group level two	
December	Two week workshop for project staff	Contractor, MOE
	Begin preparation of second level science curriculum and radio scripts	Contractor, MOE
January	Second workshop for first and second level teachers	Contractor, MOE
February	Pre-tests, first and second level	Contractor, MOE
	Begin first and second level broadcasts	Contractor, MOE

Monthly, February thru November	Project staff visit schools for field supervision and formative evaluation, second level	Contractor, MOE
	Prepare videotapes or filmstrips for project & dissemination site use	Contractor, MOE
March	Semi-annual conferral on project progress and directions	S&T/ED, Contractor MOE, USAID
April	Begin international network of science educators, including distribution of project findings and occasional papers on radio and science education	Contractor
September	On-site project review	S&T/ED
	Semi-annual conferral on project progrss and directions	S&T/ED, Contractor, MOE, USAID
	First Conference of African Science and Radio Educators	Contractor, MOE, S&T/ED
<u>FY 1987</u>		
October	Begin contacts for first dissemination site	S&T/ED, Contractor
	Distribute project findings and papers on radio science and education	Contractor, MOE
November	Post-tests for first and second levels	Contractor, MOE
	Post-test for control group level three	

	Process first and second level pre-test, post-test data	Contractor, MOE
December	Two week workshop project staff	Contractor, MOE
	Begin preparation of third level science curriculum and radio scripts	Contractor, MOE
January	Third workshop for second and third level teachers	Contractor, MOE
	Second and third level pre-tests	Contractor, MOE
	Begin first, second and third level science broadcasts	Contractor, MOE
Monthly, February thru November	Project staff visit schools for field supervision and formative evaluation, third level	Contractor, MOE
March	Mid-term external evaluation	External contractor or other AID
April	Distribute project findings and paper on radio and science education	Contractor, MOE
	Conferral on project progress and directions based on external evaluation findings	S&T/ED, Contractor, MOE, USAID
May	Select first dissemination site, and provide technical assistance	S&T/ED, host USAID & MOE, Contractor

September	On site project review	S&T/ED
	Conferral on project progress and directions	S&T/ED, Contractor, MOE, USAID
	Second Conference of African Radio and Science Educators	Contractor, MOE S&T/ED
FY 1988		
October	Begin contacts for second dissemination site	S&T/ED, Contractor
	Distribute project findings and papers on radio and science education	Contractor, MOE
November	Post-tests for second and third levels	Contractor, MOE
	Process second and third levels, pre-test and post-test	Contractor, MOE
	Post-test for control group, fourth level	Contractor, MOE
December	Two week workshop for project staff	Contractor, MOE
	Begin preparation of fourth level science curriculum and radio scripts	Contractor, MOE
January	Fourth workshop, for third and fourth level teachers	Contractor, MOE
February	Pre-tests for third and fourth levels	Contractor, MOE

	Begin first, second, third and fourth level science broadcasts	Contractor, MOE
Monthly, February thru November	Project staff visit schools for field supervision, and formative evaluation, fourth level	Contractor, MOE
April	Distribute project findings and papers on radio and science education	Contractor, MOE
May	Select second dissemination site & provide technical assistance	S&T/ED, host USAID & MOE, Contractor
July, August September	Regional conferences of radio and science educators Africa and Near East, Asia, Latin America	Contractor, S&T/ED
October	Conferral on project progress, including dissemination sites	S&T/ED, contractor, MOEs, USAIDs
	Review additional dissemination sites	S&T/ED, host USAIDs, host MOE's
<u>FY 1989</u>		
October	Distribute findings from project dissemination sites, and papers on radio and science education	Contractor, MOE
November	Post-test of third, and fourth levels	Contractor, MOE
December	Final processing of pre-test/post-test data	Contractor, MOE

January	Government continues first, second, third fourth level broadcasts	MOE
March	Final Evaluation of Radio Science at develomental site	External Contractor or other AID
May	Distribute findings from final evaluation,	USAID, MOE, S&T/ED
	Select third dissemination site & provide technical assistance	S&T/ED, host USAID and MOE, Contractor
<u>FY 1990</u>		
October - August	Continue contractor support to radio and science education network, including distribution of materials and information	Contractor
October	Select fourth dissemination site and provide technical assistance	S&T/ED, host USAID & MOE, Contractor
November-August	Provide technical assistance & other required support to dissemination sites	Contractor
August	Final project inspection at developmental and dissemination sites	S&T/ED, USAIDs
September	Final Report	Contractor
September	Project Assistance Completion Date	AID/W

3. FINANCIAL PLAN

Grant funding will support most project costs with additional budget from host country and USAID contributions. As detailed in Section 2.4, the host country will provide for its own personnel, facilities including offices, radio broadcasting and transmission, and routine operational costs, and USAID will contribute its own direct hire and other project personnel, as well as later funding for nationwide expansion of the program. If necessary, in the initial years of the project, grant funds will be used for support of additional national personnel. Other costs particular to the development of new instructional radio programming, including evaluation by project staff will be funded by the grant.

3.1 Post Project Continuation and Expansion Costs will involve a modest cost per student year over current education costs, since the MOE budget already provides for instructional materials for each child and for salaries of its personnel. Additional costs will involved short workshops, broadcast transmission time, and administration of the instructional radio programs. Based on the Nicaraguan and Dominican projects, recurrent costs are estimated at less than one dollar per student year. During the developmental stage of the project, efforts will be made to minimize recurrent costs and strengthen administrative, curricular, and technical capabilities of the MOE so that at project end, the MOE will be able to effectively support the instructional radio programming.

3.2 BUDGET ($000)

S&T/ED Funded Costs

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	TOTAL
Technical Assistance							
Long Term	270	553	646	711	781	-	2,966
Short Term	45	70	70	29	60	-	274
National Staff							
Salaries							
10 Professional	60	66	73	80	88	-	367
5 Staff	30	33	37	40	44	-	184
Training							
Long Term	-	-	35	35	-	-	70
Short Term	-	20	20	20	-	-	60
Staff Training	20	7	7	8	8	-	50
Teacher Workshops	-	3	6	9	12	-	30
							210
Commodities							
Radio Production and Transmission Equipment	50	50	50	-	-	-	150
Radio Production Materials	10	10	10	10	5	-	45
Radio Receivers and Batteries	16	1	1	1	1	-	20
Cassette Recorders and Batteries	16	1	1	1	1	-	20
Science Equipment Kits for Schools	1	1	1	1	1	-	5

Printing Graphics, Media, Equipment and Materials	20	20	15	15	-	-	70
Science Curriculum and Instructional Materials-pupils	4	6	8	11	11	-	40
Instructional Devices	-	10	10	5	-	-	25
Science Curriculum Reference Material	10	10	10	10	-	-	40
Vehicles	20	20	20	-	-	-	60
Vehicle Operational Cost	9	15	17	19	20	-	80
Microcomputer (for Evaluation)	5	-	-	-	-	-	5
Equipment Repair and Maintenance	10	12	14	16	18	-	70
							630
<u>Diffusion</u>							
Science and Radio Education Network	10	20	40	80	100	110	360
Materials Distribution	-	-	5	10	15	10	40
Information Exchange	-	5	10	12	15	7	50
African Science Conferences	-	-	37	43	-	-	80
Regional Conferences	-	-	-	-	180	-	180
Initial Costs, Dissemination Sites	-	-	150	200	300	1,350	2,000
							2,710

Subtotals	606	934	1,313	1,365	1,660	1,427	7,305
Contingencies	60	90	130	135	160	140	715
Total S&T Funded	666	1,024	1,443	1,500	1,820	1,567	8,020
Host USAID Project Expansion Add-on	-	-	200	200	300	300	1,000
USAID & Other Donor Add-ons at Dissemination Sites	-	-	500	1,000	1,000	1,500	4,000
TOTAL PROJECT AUTHORIZATION							13,020

3.3 Local USAID Contributions ($000)

Administrative Support	15	17	19	21	23	-	95
IRDO (10%)	12	14	16	18	20	-	80
Other Project							
Personnel (10%)							
o Curriculum	12	14	16	18	20	-	80
o Teacher Training	12	14	16	18	20	-	80
o Instructional materials	12	14	16	18	20	-	80
Project Expansion Add-on (as above)	-	-	200	200	300	300	1,000
TOTAL USAID FUNDED							1,415

3.4 Funding Obligation Schedule & Expenditures (S&T/ED Funds) ($000)

Fiscal Year	Obligations		Project Year	Expenditures	
	Increment	Sum		Increment	Sum
1. (FY 84)	500	500			
2. (FY 85)	300	800	1. (9/84-3/85)	566	566
3. (FY 86)	900	1,700	2. (9/85-3/86)	1,024	1,590
4. (FY 87)	1,500	3,200	3. (9/86-8/87)	1,443	3,133
5. (FY 88)	1,600	4,800	4. (9/87-8/88)	1,500	4,633
6. (FY 89)	1,600	6,400	5. (9/88-8/89)	1,820	6,453
7. (FY 90)	1,620	8,020	6. (9/89-9/90)	1,567	8,020

3.5 Host Country Support ($000)

	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL	Year 6 Recurrent Costs
Personnel							
Science Educators (1)	5	5.5	6	6.5	7	30	7.7
Curriculum (1)	5	5.5	4	615	7	30	
Evaluation (1)	5	5.5	6	6.5	7	30	
Instructional Materials (1)	5	5.5	6	6.5	7	30	7.7
Radio Producer (1)	5	5.5	6	6.5	7	30	
Actors (4)	12	13	14	15	16	70	
Script Writers (2)	6	6.5	7	7.5	8	35	
Evaluation Assistants (2)	6	6.5	7	7.5	8	35	4
Secretaries (2)	5	5.5	6	6.5	7	30	3.5
Drivers (2)	5	5.5	6	6.5	7	30	3.5
						350	25.4
Facilities							
Office	2.4	2.6	2.9	3.2	3.5	14.6	3.8
Curriculum & Instructional Material Space	2.4	2.6	2.9	4.3	3.5	14.6 340	
Science Ed Resource Ctr.	2.4	2.6	2.9	3.2	3.5	14.6	3.8
Radio Studios & Facilities	2.4	2.6	2.9	3	3.5	14.6	
						53.4	7.6

Materials and Equipment (500,000 students)	-	-	-	-	-	-	-
Teacher Workshops	-	-	-	-	-	-	250
(20,00 teachers)	-	-	-	-	-	-	25
Radio Transmission							
Broadcasting Time	5	5	20	35	50	115	50
TOTAL HOST GOVERNMENT FUNDED						523.4	309

4. EVALUATION PLAN

As the third and final part of the primary school instructional radio projects, Radio Science will emphasize orientation toward development over research. The Nicaragua Radio Mathematics project as the first experiment, necessarily gathered information on numerous classroom variables such as student participation, student verbalization, time with nothing to do, and time devoted to content, and compared these processes as well as the final products, student learning (Tilson 1978). Formative evaluation testing of student learning and observation of student and teacher response to radio lessons provided rapid feedback on information to be repeated or script redesign for future lessons. Summative evaluation results showed the students taught with the help of the radio lessons learned more at potentially great savings to the government since students no longer needed to repeat grades to achieve a year's learning. In the Kenya Language Arts project, summative evaluation also showed substantial, statistically significant increases in learning (Imhoof, 1983: 7). Formative evaluation likewise has provided invaluable information for correcting problems. Further, teachers and headmasters reported that they themselves as well as parents were positive about the programs, and wanted to continue participating in it.

Thus, formative evaluation in the Radio Science project will be essential to testing lessons and the instructional radio broadcasting methodology. The project evaluation team will test students learning of pilot lessons and provide feedback within two weeks to curriculum and lesson designers, so that the curriculum team knows if the next lessons should proceed to new concepts or practice and reinforce concepts not yet mastered by the students. The contractor evaluation specialist and the MOE evaluation staff will jointly design and carry out this evaluation.

The evaluation specialist will work with national educators to assess the data and learn more about children's learning and application of science concepts. Further, the project will track development and recurrent costs as well as administrative structures and tasks. An education economist will analyze these data and report how both recurrent costs and administrative tasks can be minimized.

The contract evaluation specialist and MOE staff will also be responsible for design and implementation of yearly pre-tests and post-tests for summative evaluation of student

learning under the new curriculum and radio programs. These results will be compared with test results of student learning of the traditional curriculum without radio, through a lapped-year design. As in the Kenya Language Arts project, post test will be administered to students in project schools for each level in the year prior to broadcasting science education programs for that level. For example, in one school, students in the traditional science program (T) would be given the post-test at the end of third grade; in the following year new students in the third grade (i.e. last year's second grade) receiving the radio science program (R) would be given the post-test. The results of third grade class T can be compared to those of third grade class R, showing if the radio science has contributed to significant gains in test scores. The lapped year design thus avoids possible lack of similarity in subjects in different control and project schools and eliminates the problem of contamination of control schools, whose teachers might use the radio broadcasts even though they are not participants in the project.

Finally, external evaluation will be done by other consultants and AID technical specialists at mid-term and final points in the project. They not only will examine project results but also assess project progress and objectives against original plans.

5. PROJECT ANALYSES

5.1 Technical Feasibility of Science and Radio Education

SCIENCE EDUCATION PROJECTS IN AFRICA

A state-of-the-art assessment of primary school science education projects in Africa over the past twenty years, "Basic Science Education in Sub-Saharan Africa" (Lapp, 1983), was prepared as background for the Radio Science project paper and is available in S&T/ED. The findings are summarized here:

- Prior to the beginning of the African Primary Program (APSP) in 1965, Science education in African primary schools tended to simple health and hygiene, and natural studies, taught by dogmatic, rote methods.

- The African Primary Science Program, funded by the USAID and the Ford Foundation stemmed from the

desire of African educators to reform science education toward understanding of the environment. APSP began planning these reforms in 1965 at a conference of science educators from English speaking African nations. At three international curriculum workshops, participants agreed on four principles:

- using local materials for science units
- designing science units according to children's stages of intellectual development
- testing experimental science units in several countries
- choice by each country of science units for its own syllabus.

Science centers were established in seven nations (Ghana, Kenya, Malawi, Nigeria, Sierra Leone, Tanzania, Uganda).

By 1971, the APSP produced materials including 12 teachers' guides for science activities in the lower primary grades, 12 units on physical science and technology, and 10 units on biological sciences for the upper grades and 8 science books for children. About 2000-5000 copies of each were printed and distributed to the education ministries of the participating countries.

The Science Education Programs for Africa (SEPA) established in 1970, was funded by USAID, UNESCO, and the member governments to continue the work of APSP. It focused on training of science educators and building networks among them to support institutionalization of science education. The thirteen member nations include APSP participants (except Malawi) plus Ethiopia, the Gambia, Liberia, Swaziland, Zambia, Cameroon, and Botswana. SEPA activities also included development of teacher training materials, environmental science education, educational evaluation, out-of-school science education, and research on concept formation in science and mathematics. Two institutions have established centers that directly support continued improvements in African science education:

The International Centre for Educational Evaluation (ICEE) at the University of Ibadan, Nigeria.

The Science Education Training Course (SETC) at University College, Accra, Ghana.

SEPA published two important books for science educations, the Handbook for Teachers of Science, and the Sourcebook for Science Teachers. Another book, Teaching Primary Science, includes APSP material, and is now used extensively for teacher training.

SEPA's major long term effect has been at the national level. An evaluation found that the discovery approach of the curriculum often was not well understood or utilized by teachers: " ... field observations suggested actual implementation of this method was not as widespread as was expected on the basis of verbal commitment" (American Institutes for Research, 1973: 93). After visits to several countries, the evaluators concluded that educators found the materials needed adaptation for each country, and that teachers had not received enough training to understand the curriculum or to teach it correctly.

Other educational programs have focused less directly on primary science but supported reforms in primary school science.

1) Some national curriculum centers used formative evaluation techniques to develop locally relevant materials.

2) UNESCO sponsored pilot science education programs as components of integrated education and rural development projects. Most were for the lower secondary school level.

3) The British Council organized summer workshops and in-service education by science educators from Britain.

4) Peace Corps provided science instructors for secondary schools and teacher training colleges.

5) The World Bank helped to construct and equip science laboratories.

6) The Kenya Science Teachers College established a Science Equipment Production Unit (SEPU) to produce low cost equipment for secondary schools. Nigeria has established a similar equipment center for primary schools.

Radio and other distance teaching methods have been used to assist science education, but are not extensive.

1) In Zimbabwe, the Distance Science Teaching Project (DIST) used audio-cassettes, materials and untrained monitors for science correspondence courses. In 1981, the DIST cassettes were adopted into the expanded junior secondary school program.

2) Sierra Leone began broadcasting 24 weekly science programs in 1973, but the program was underutilized because teachers could not get the required materials, and many schools did not have radios or received only weak radio signals. Also there has been a lack of personnel and equipment to prepare new programs nor has the Ministry been able to continue providing print materials that should be used with the radio programs.

3) Botswana's Schools Broadcasting Unit provides science programs weekly for the upper primary grades. These are designed to be supplements to the science curriculum, not to be the primary means for teaching science. As in Sierra Leone there have been problems of poor radio reception and cost of purchase and operation of radios.

4) The Kenya Institute of Education has also developed science materials for radio broadcasting.

RADIO EDUCATION PROJECTS

Experience with Radio Mathematics and Radio Language Arts, the two projects most relevant to Radio Science, has shown radio to be both effective in increasing student learning, and efficient in delivering quality education with long term savings to LDCs in the form of significant decreases in repetition rates. In a Thai adaptation of Radio Mathematics, evaluation results also showed significantly more learning achieved by students taught with the assistance of radio (Sang-jan 1982; Galda 1984).

Evaluation of other radio education projects has shown that in numerous other cases, radio "... is the medium of choice which offers the greatest promise to fulfill the need of low-cost broad-based, relevant education." (Layne, 1980) In an annex to the project proposal for Radio Assisted Community Basic Education, Layne reviews experience with radio education projects, summarized briefly here:

Radio Mathematics Project - Nicaragua (S&T/ED) This example of the successful use of radio as an inexpensive instructional technology showed radio's special advantages for consistency of instruction and more attention for low ability students. "The major achievement was the ongoing alteration of the programming as a result of feedback from the field" (pp. 14-15).

Rural Radio Education Project - Paraguay A primary education curriculum directed to adult home learners, this project showed great success in retaining its students. The key in this out-of-school program was the monitor who had "a multiplying effect on the material..." (p. 24).

Radio Santa Maria - Dominican Republic Also a primary school curriculum directed to out-of-school young adults, Radio Santa Maria has shown similar success in providing quality and effective education at low cost. Again, the important element is feedback from learners on the lessons.

Radio Primaria - Mexico This program focusing on assisting classroom teachers be more effective and efficient, has had administrative and technical problems due to inadequate resources, supervision, and radio equipment (p. 36). This demonstrates the need to provide sufficient funds and to design the project to overcome the particular managerial problems found in the project host-country.

The experience gained with the science education and instructional radio projects provides these guidelines for the Radio Science project:

- Science education must stress an experience approach, but also promote inquiry and thinking skills;

- New science curriculum must become fully integrated into the curriculum division of an MOE and into the classroom teacher's daily routine;

- Science equipment and materials must be low cost, readily available, and produced by national government or private organizations;

- Instructional radio can support significant gains in student learning but must be guided by rigorous formative and summative evaluation data gathered at the listener (classroom) level on teacher and student attitudes and learning; and

- The instructional radio group must be fully incorporated into the MOE administrative and technical structure, provide thorough training, and be low cost so that the MOE can continue its operation;

- The key to radio's success is the application of a process model that combines effective instructional systems design, a dynamic radio curriculum, systematic writing and production procedures, empirical formative evaluation, modest amounts of print materials and teacher training (to minimize recurrent costs).

5.2 Institutional Requirements for Project Feasibility

Radio Science, as a research and development project, requires a host Ministry of Education that has sufficient administrative and technical capacity to provide support for the project. If these basic elements are not in place, the project will waste its efforts overcoming administrative and technical weaknesses instead of focusing on the development of innovative, sound educational programs. The MOE selected for the project should have the following characteristics:

- Curriculum improvements for primary science education should be underway. Science education specialists and science curriculum panels should be identified for the MOE Curriculum Division.

- Instructional Materials specialists and basic equipment should be in place, in support of curriculum improvement efforts.

- Educational broadcasting for adults, out-of-school youth, and for school children should have basic MOE facilities and staff for preparing and broadcasting radio programming.

- The MOE should demonstrate commitment to improved primary education through its own past and on-going efforts and projects with international donors. Improvements in the effectiveness and efficiency of primary education in recent years should be demonstrable, progress should be reasonable, even if gradual.

The radio program model is also important to the institutional design of the project. McAnany, et al, (1983) reviewed distance education including radio at length. The factors they cite supporting success of distance education projects (pp 319-21) have been taken into account in Radio Science Project design:

- o survival of the distance education institution itself, through minimization of costs (e.g. radio costs much less than television), and communication with users (students, teachers, and parents) to understand and respond to their acceptance of the innovative media. The Radio Science project is designed to minimize recurrent costs, and to seek feedback from users;

- o Socialization of the student in habits of study and self-instruction. This is more often a problem in non-formal, home based education. The S&T/ED model of radio instruction encourages school students, who continually respond to the radio, answering aloud, writing, or exercising;

- o quality of instructional materials. The S&T/ED methodology for developing instructional radio model constantly evaluates the programs and materials through observation and testing of student learning, and feeds this information back into the design of future programs.

The project development organization (usually a contracted consulting group) as an institution also influences the success or failure of the distance education program. McAnany, et al (pp 334-53) show that characteristics and comportment of an organization influence success in achieving project goals:

- o organizing staff and balancing power among segments of the projects. Success is promoted by establishing structures and techniques to build teamwork among professionals, staff, and consultants, and to foster respect and integration among expert and non-expert, foreign and national roles and values;

- o managing students, especially motivating those who study at home, rather than in more formal environments such as schools;

- o managing media production, planning and implementation, and evaluation. Media production must

focus on solving the original education problem and hence, maintaining flexibility in the mix of technologies. Implementation must adapt to unpredictable realities that can arise, such as budget cuts. Evaluation findings, both on the product instructional programs and on the process - organizational dynamics, must be used to improve project management.

5.3 Economic Considerations

The costs of instructional radio were studied intensively under the Nicaragua Radio Mathematics Project, which is the model for Radio Science. The project design, which involves high developmental costs, achieves low recurrent costs. At the developmental stage, the instructional radio programs require substantial initial expenditures for technical assistance and for extensive formative and summative evaluation, but these "... succeed in producing courses of instruction that are highly effective (as demonstrated by evaluation data), require a minimum of materials beyond the radio in the classroom, and are well accepted by teachers and students" (Gonzalez, 1980:34). At later stages, expanding radio instruction to large audiences can result in recurrent cost savings" ... from reduction in instructional time required to reach objectives, from reduction of investment loss from learner failure, underachievement, and drop-out, and from reduced expenditures for teacher salaries and teacher training" (Layne, 1980: D-3). Economic analysis of the Nicaragua data showed that if the early developmental costs are excluded, the recurrent costs for large numbers of students are 88 cents per student-year (Wells and Klees, 1978:284).

Further, a pilot test comparison of the effectiveness of the instructional radio with textbooks in Nicaraguan schools resulted in greater achievement by students receiving the radio instruction(Jamison, et al, 1981). Recent evaluations of the Thai radio mathematics programs confirm these results (Galda, 1984). Long term studies of actual recurrent costs of the instructional radio model are not yet available due to the discontinuance of the Radio Mathematics program by the Sandanista Revolutionary government, and to the recent initiation of the Kenyan and Dominican radio education projects. Nonetheless, the impact of these projects in producing statistically significant gains in student learning at minimal expenditures for teacher training and for teachers and students supplementary materials is strongly favorable to low recurrent costs.

5.4 Environmental Concerns

As a project directed to application of science in daily life, Radio Science will educate students to have greater understanding and respect for the environment. Its impact will be positive as students learn the causes and consequences of problems such as soil erosion, water pollution, overgrazing, and so forth.

Consistent with AID Handbook 3, App. 2D, Para. 216.2(c), the Radio Science Project will not require an Initial Environmental examination, since it falls under the criteria 216.2(c)(iii)(2)(i) and (ii). These criteria exempt "educational, technical assistance, or training programs except to the extent such programs include activities directly affecting the environment (such as construction of facilities)" and "controlled experimentation exclusively for the purpose of research and field evaluation which are confined to small areas and carefully monitored".

5.5 Social Concerns

As in the Nicaragua Radio Mathematics, Kenya Language Arts, and Dominican Republic Radio Community Basic Education projects, Radio Science will be directed to children in rural communities. The S & T/ED radio education projects have been socially and culturally acceptable to both children and adults. In Nicaragua, some 20,000 adults tuned in the programs to better their own mathematics. The Dominican project also has the solid backing of community members, who provide the radio center shelters and other support. Further, in Nicaragua, classroom teachers participating in the project reported favorable attitudes toward it; other teachers wanted to participate or even tuned in the programs on their own initiative. In the Dominican Republic the MOE has requested that the radio community education programs be included in the next AID project for schools. Similarly in the Kenya project, children, teachers, and ministry level educators report enthusiasm for the instructional radio programs. Finally, the Thai adaptation of the Nicaragua Radio Math programs shows that the instructional radio approach can be transferred successfully to a very different cultural context.

Radio Science will take action to foster social and cultural acceptability. Short term technical assistance includes an anthropologist to ensure that materials and methods are understandable and acceptable to school children and

community members. The project will make host country MOE staff and teachers more aware of traditional and modern concepts of agriculture, health and nutrition as well as show them ways of introducing new ideas, and building on children's prior knowledge. Project staff and teachers will be in contact with parents at project sites who will provide feedback to project staff as well as communicate with other local people about the project. Radio broadcasts will occasionally address parents and community to encourage them to listen, ask them to send in questions, and respond to questions and concerns.

Radio Science is directly relevant to female students and women as family caretakers concerned about health and nutrition, and as farmers and herders. Enlightened science education can show the importance of science for all persons. Through radio both women and men in the community will be able to listen to the science programs and apply the information to their own lives.

Diffusion of the model science programs is included in the project. Dissemination will involve adaptation, not extensive modification. First, because the programs are for primary school, concepts and materials must be relatively simple and so will be more easily adaptable. Second, since scientific principles are universal, science education specialists can readily adapt lessons, using examples from local flora and fauna. Third, the teaching materials to be developed will be low cost and made of products readily available in LDCs. Finally, the programs will be prepared in two to four week units that science educators in other countries can select and combine to fit their national curriculum.

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AID 1020-20 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

(INSTRUCTION: THIS IS AN OPTIONAL FORM WHICH CAN BE USED AS AN AID TO ORGANIZING DATA FOR THE PAR REPORT. IT NEED NOT BE RETAINED OR SUBMITTED.)

Life of Project:
From FY 84 to FY 90
Total U.S. Funding $8,020,000
Date Prepared: May 8, 1984

Project Title & Number: Radio Science 936-5818

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
Increase access to primary schooling while improving the efficiency and effectiveness of the education system.	Significant increase in: -percentage of primary age population enrolled in school -percentage completing primary school -percentage meeting secondary school entrance requirements -scores on national grade level achievement examinations	Education statistics and records of LDC's	Greater access to primary school will result in increased enrollments Improving program efficiency and effectiveness will decrease failure and dropout rates. LDC's will adopt efficient and manageable primary education models that become available.

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 84 to FY 90
Total U. S. Funding $8,020,000
Date Prepared: May 8, 1984

Project Title & Number: RAdio Science 936-5818

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose:	Conditions that will indicate purpose has been achieved: End of project status.		Assumptions for achieving purpose:
Develop a tested model for using radio to provide effective primary school science instruction at low cost	A tested instructional model that uses radio for science education will be in place Pupils show statistically significant gains in learning compared to pupils in control classes Instructional radio system recurrent costs are low and administration is manageable for LDC MOE's	Evaluation documents On site visits Project, government, and AID reports	Timely selection of project site AID, contractor, and host government fulfill their commitments to the project in a timely and effective manner

AID 1020-20 (7-71)
SUPPLEMENT I

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 84 to FY 90
Total U.S. Funding $8,020,000
Date Prepared: May 8, 1984

Project Title & Number: Radio Science 936-5818

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	**Magnitude of Outputs:**		**Assumptions for achieving outputs:**
Science curriculum, radio programs, and materials	Complete radio science curriculum, radio programs, and materials for levels 1,2,3, & 4	Materials and programs themselves, project reports, evaluation reports	Sufficient and timely funding provided by AID and host government
	Manuals, reports, and papers on radio and science education programming	On site visits to project centers and schools	Qualified personnel are available and employed by the MOE and the contractor
Teachers and educators oriented to radio science education	260 teachers and ministry educator	Interviews with MOE and other country officials, and with USAID personnel	AID, contractor, host government, and USAID provide timely, effective administration and support
Trained science and instructional radio specialists	19 science and radio education specialists with workshop and on the job training		Political and economic stability
	2 science educators with long term training		
Primary school pupils with significant learning gains in science	At least 2400 pupils over LOP (each pupil counted once, even though some will complete four years in the programs; total of 6000 pupil years)		
LDC science and radio educators informed about the radio and science education program	110 educators attending project conferences (from Africa, Near East, Asia, and Latin America)		
	5000 other educators informed through networks and exchange of information		
Radio Science and other S&T/ED model instructional radio programs begun at dissemination sites	4 dissemination sites in other LDC's		

AID 1020-28 (7-71)
SUPPLEMENT 1

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 84 to FY 90
Total U.S. Funding $8,020,000
Date Prepared: May 8, 1984

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	Implementation Target (Type and Quantity)		Assumptions for providing inputs:
- Technical Assistance			
Long Term, On-Site			
Science Educator	4.5 work years	On-Site Visits	Technical consultants will be available when needed, with required expertise, and able to develop a good working relationship with host country counterparts.
Curriculum and Instructional Materials	4.5 wy	USAID and contractor contracts and reports	
Radio Programming	4.5 wy		
Evaluation	4.5 wy		
Home Office Coordinator	4.5 wy		
Short Term, On-Site			
Education Economist	3 work months		
Education Anthropologist	4 wm		
Graphic/Print Specialist	4 wm		
Other, as needed	10 wm		
Outside evaluators	6 wm		
Science and radio education advisory committe	5 wm		
- Commodities	Radios, radio production equipment and materials, science education equipment and print materials, 3 vehicles and operational costs	USAID and contractor reports Procurement documents	Commodities will be procured in a timely manner; budget estimates are reasonable.

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