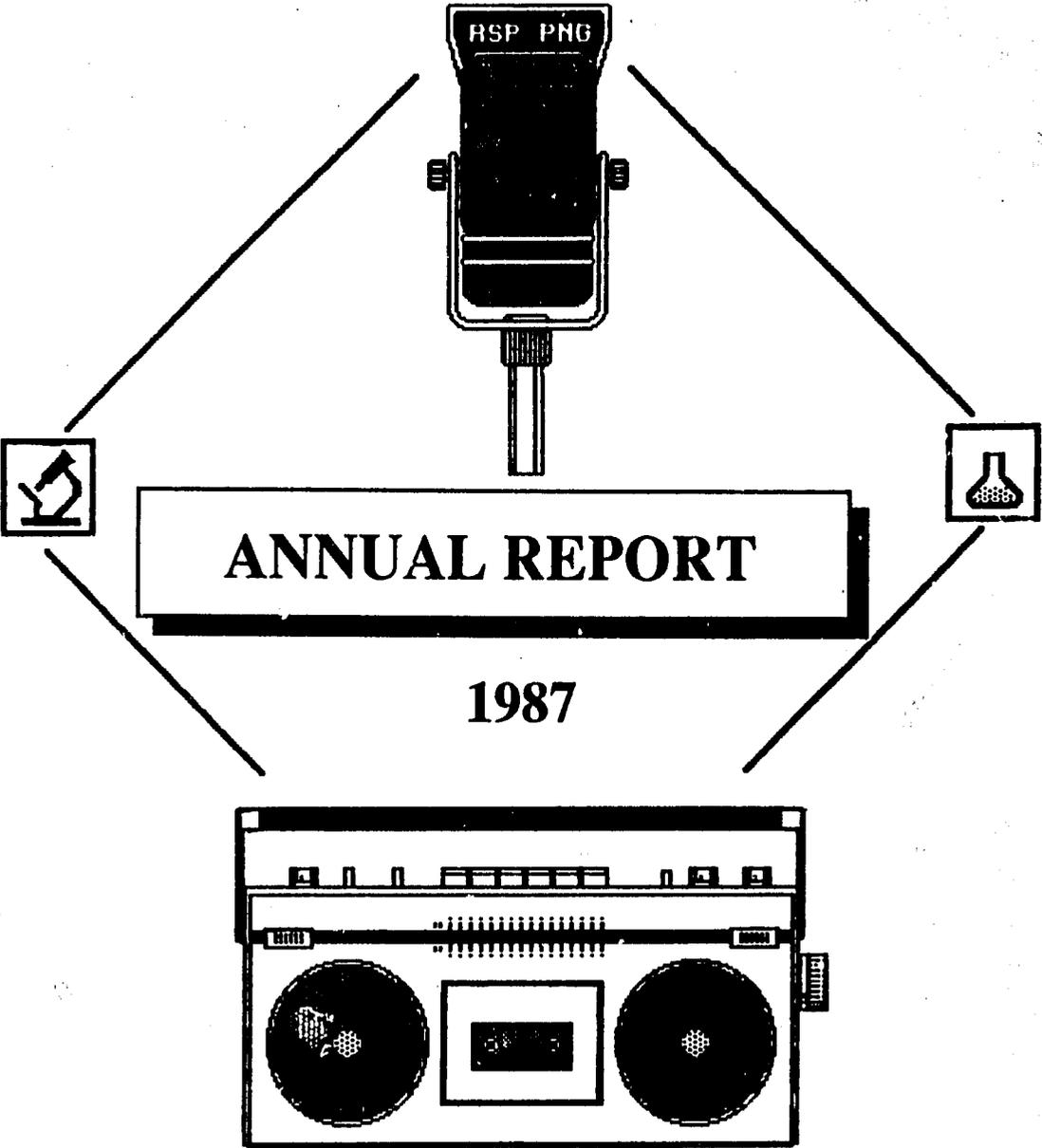


RADIO SCIENCE PROJECT

PAPUA NEW GUINEA



EDC

Education Development Center, Inc.

PDAAY-853

asn = 59725

1987
ANNUAL REPORT
TO THE
AGENCY FOR INTERNATIONAL DEVELOPMENT
BUREAU FOR SCIENCE AND TECHNOLOGY
OFFICE OF EDUCATION

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CONTRACT # DPE-5818-C-00-4087-00

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RADIO SCIENCE PROJECT ANNUAL REPORT 1987

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INTRODUCTION

The Radio Science Project (1984-1989) is funded by the United States Agency for International Development (AID) under a contract with the Education Development Center (EDC), Newton, Massachusetts. The Project began working in Papua New Guinea (PNG) in 1986 under an agreement signed between the Papua New Guinea Department of Education (DOE) and EDC. The purpose of this Project is to develop and test a radio-based science program for children in grades 4-6 attending community (rural) schools in Papua New Guinea. The Project addresses two of the most important educational issues in Papua New Guinea today: quality and efficiency. At a time when the standards of education are perceived to be declining, the Project aims to develop a method for providing systematic, high quality instruction in primary science -- a subject for which many teachers consider themselves to be inadequately prepared. The Project also seeks to improve the capabilities of classroom teachers to teach science. Because severe budget cuts require greater efficiency in the delivery of education, the Project aims to develop a highly cost-effective program of distance education for primary science.

The radio programs are based on the official community school curricular in science and also include aspects of health, agriculture and community life. The lessons teach the core science curriculum; they are not designed as supplementary material. The radio science lessons for Grade 4 will be broadcast in 1988, Grade 5 in 1989, and Grade 6 in 1990.

The radio science lessons are based on the concept of interactive radio instruction (IRI) that calls for maximum student participation during the broadcasts. The lessons are presented in a lively and engaging fashion that hold the children's attention and stimulate them to participate in the lessons. The scripts for the lessons are written specifically for the children in PNG, using Papua New Guinean writers, actors, sound effects and examples; however, adaptation of these lessons for use in other countries should not be difficult. Each week for thirty weeks children will have two thirty-minute lessons. Each lesson will consist of a 20 minute broadcast during which the classroom teacher will participate in a supportive role. After the radio portion of the lesson, the classroom teacher will conduct specific, complementary, post-broadcast activities as outlined in a teachers guide. Both broadcast and post-broadcast portions of a lesson will be supported by worksheets and science materials.

The Radio Science Project offices are located in the Department of Education Curriculum Unit, Port Moresby, Papua New Guinea.

A Radio Science Lesson

The topics for Grade 4 include ecology, animals, heat, light, sound, magnetism and electricity. See Appendix A-C for more information on the grade 4 curriculum.

The following is an excerpt from one of the lessons on light; see Figure 1 for the accompanying worksheet.

Segment 3

Lesson 422

Page 6 of 21

MIRRORS

MRS. LAKA: Children, you will need your worksheets again and mirrors. Get your mirrors now.

PAUSE (:03)

MRS. LAKA: Now you are going to work in pairs. You are going to work with your partner.

PARTNER SONG (:15)

MRS. LAKA: Partners, place your worksheet between you.

PAUSE (:03)

MR. VAGI: One partner, you will use the mirror first... Pick up the mirror. The other partner's turn will be next. Everyone, look at Box Six... You will see a word. The word is written backwards... The partner with the mirror, place your mirror on the right side of the word so you can read it in the mirror.

PAUSE (:05)

MR. VAGI: The word is mirror. Everyone say: mirror.

PAUSE (:02)

MR. VAGI: Now it's the other partner's turn. Give the mirror to your partner.

PAUSE (:03)

MR. VAGI: Everyone, look at Box Seven, you will see a word... The word is written backwards. Place your mirror on the right side of the word so you can read it in the mirror.

PAUSE (:05)

MR. VAGI: The word is arrow. Everyone say: arrow.

PAUSE (:02)

MR. VAGI: Now give the mirror back to your partner.

22

Shadows

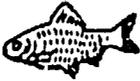
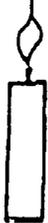
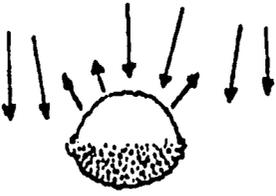
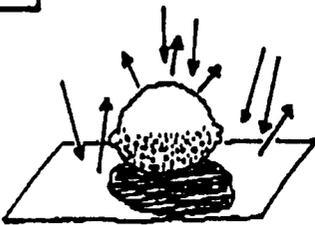
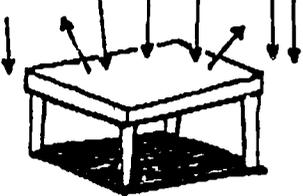
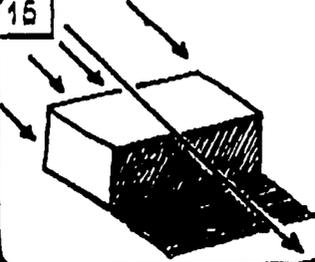
1  fish  cat	2  house  coconut tree	3  axe  dog	
4  car  ball	5  flower  candle		
6 MIRROR	7 ARROW	8 LIGHT	9 SHADOW
10 REFLECTED	11 SYMMETRIC	12 	
13 	14 	15 	

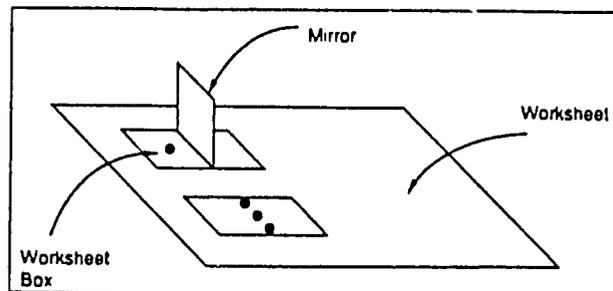
FIGURE 1

Some of the special characteristics of this lesson are as follows:

- o The children are taught important concepts about the properties of light.
- o The script is written in a style that requires the active participation of the children.
- o The lessons incorporate simple, inexpensive materials--worksheets and mirrors.
- o The children are required to work together in pairs, in part, so they can share the materials and, thus, reduce the implementation costs of the Project.
- o The teachers have a supportive role during the lesson.

After the broadcast, the teachers conduct follow-up activities. An excerpt from the Notes for the Teacher of the previous lesson is given below. Notice how this activity prepares the children for the next radio lesson, which is excerpted above.

1. The children will use the worksheet and their mirrors to make images in the mirrors.
2. The picture below shows how the children should place their mirrors on their worksheets.



3. Tell the children to find Box Thirteen on the worksheet.
4. Demonstrate to the children how to place their mirror on the worksheet.
5. Have them place the mirror on the picture in Box Thirteen so the reflection in the mirror produces a circle.
6. Have the children use their mirrors to complete the pictures in Box Fourteen and Fifteen. (fourteen - a butterfly, fifteen - a rug).

The teacher's role is crucial. During the broadcast the teacher's role is supportive of the radio. In the post-broadcast period the teacher has full responsibility. An important goal of the project is to extend teachers' capabilities and confidence; the Project aims to make the classroom teacher a more competent science teacher. Yet, the resources for teacher training are limited and include only the Notes for the Teacher, a 10-minute weekly teacher training broadcast scheduled to begin next year, and an occasional face-to-face training session. In addition, the radio broadcasts to the children serve as a useful model for the teachers as exemplified in the previous example.

The Radio Science Instructional Package for each grade consists of:

- o 60 radio science lessons, 20 minutes in length
- o 60 post-broadcast lessons for the teacher, 10 minutes in length
- o A Radio Science Book with lesson worksheets
- o Notes for the Teacher, a teacher's guide to the radio lessons and the post-broadcast activities
- o A Radio Science Project science kit containing simple, basic materials
- o . A weekly 10-minute radio broadcast for the teachers.

I. CHRONOLOGY OF EVENTS

A. Summary

The major goal for the Radio Science Project in 1987 was to plan, script, produce and try out sixty Grade 4 lessons. At the close of the year the Project had completed and tested 15 science lessons. Although the project did not accomplish all its goals in 1987, it made significant progress during the year. The Project:

- o Hired and partially trained a staff; training emphasized interactive radio scriptwriting skills
- o Developed a curriculum for Grade 4
- o Developed and tested several lessons from the Ecology Unit and the Light Unit
- o Established and maintained good relations with the Science Curriculum Office and others in the Curriculum Unit
- o Developed an agreement with the National Broadcasting Commission (NBC) for broadcasting lessons in 1989-91; and a tentative agreement for 1988
- o Refined and approved the Summative Evaluation Plan
- o Completed a technical evaluation of the condition of the broadcast studio.

Yet the Project did not attain its goal of producing 60 lessons. This was a result of several of the following factors.

- o The Project did not have a full-time Science Educator from December 1986, to September, 1987. Two science education consultants provided assistance early in 1987--Melvin Webb from April through mid-August, and Frank Watson for May and June. Watson returned as Project Director and Science Educator in September, 1987.
- o The Project was unable to develop a timely production cycle for the lessons until late in April.
- o Throughout the entire year the Project faced technical problems in the broadcast studio as well as difficulties in maintaining a dependable group of studio actors and actresses.
- o Early in the year, the Project also had a strained relationship with the National Department of Education and the Department's Curriculum Unit.

B. Timeline of Project Events

January

Project Director on leave.

The Project staff under the direction of Joyce Hill and Kipa Maleva administered a baseline test to one Grade 3 and one Grade 4 class at Gaire School during the PNG school vacation. A Grade 3 and a Grade 4 class were tested at the Project offices. The baseline test was designed by Friend Dialogues.

February

PNG Community Schools open.

A baseline test was administered by cassette to all of the Project's schools in the Central Province.

Several trial scripts were developed.

David Kerrison traveled to Rabaul, Lae, and Wewak to visit the provincial radio stations and to talk with provincial education officials.

Advisory Committee met for the first time.

March

Steve Kozlow of Friend Dialogues and Charles Currin consulted on the general development of the Project.

The subcommittees in science, broadcasting, and evaluation held meetings.

April

Melvin Webb of Clarke University arrived as a short-term science educator for the Project.

The staff gave a presentation as part of the National In-service Training Week.

Melvin Webb and David Kerrison attended the Community Schools Science Meeting in Madang.

The staff traveled to Woitape area, Central Province to visit remote schools, collect baseline information, and try out segments of lessons 401-404 (Grade 4, lessons 1-4).

Work began on the ecology lessons. A decision was made to try out the lessons using cassettes rather than radio broadcasts.

May

The first two ecology lessons were produced, delivered, and observed in 2 schools in the National Capital District, 6 schools in the Central Province, and 6 schools in the Eastern Highlands Province.

Tom Tilson, Technical Monitor, Education Development Center, arrived to work with the Project for two weeks.

Frank Watson, University of Vermont, arrived as a science educator consultant for one month.

The Science Subcommittee met.

June

Work on the ecology lessons continued -- two lessons were produced, delivered, and observed.

Webb and Watson continued as consultants in science education.

The Science and Evaluation Subcommittees met.

Watson returned to the United States at the end of the month.

July

Four lessons in ecology were produced, delivered, and observed.

August

Webb returned to the United States in mid-August.

One ecology lesson was produced, delivered and observed.

David Kerrison, Project Director, left the Project and returned to England.

September

Frank Watson returned as the new Project Director and Science Educator.

The last ecology lesson was produced, delivered and observed.

Jamey Friend, Friend Dialogues, Project subcontractor, conducted training workshops in scriptwriting and production in interactive radio for all Project staff and members of the DOE Curriculum Unit. These workshops continued throughout the month. The workshops were coordinated with the development of radio lessons for the unit on light.

The Project participated in the conference - "The Use of Audio-visual Materials in Education and Training in Papua New Guinea". A demonstration radio lesson was

used to illustrate the principles of interactive radio and show how the Project will teach science using the radio.

Jim Hoxeng, Project Officer, AID/Washington, arrived late in the month to review Project activities.

October

The first meeting of the Advisory Committee was held since the change in Project Directors. The Committee reviewed the progress of the Project and the new development and production goals set out by Watson.

Scripting and production of the light lessons were started.

The pre-test for the light unit was developed and administered in 8 selected classrooms.

The first two light lessons were delivered and observed.

The three Project subcommittees began regular meetings to consider issues on curriculum, broadcasting, and evaluation.

Meetings began with NBC to obtain permission to broadcast lessons in 1988-91.

Work on the light lessons was completed. Work began on the first lessons for Grade 4.

The design for the summative evaluation arrived from Friend Dialogues and was given to the Evaluation Committee for review.

November

The Science Subcommittee approved the Grade 4 Radio Science curriculum and sent it to the Advisory Committee for final approval.

The Science, Broadcast and Evaluation Subcommittees met. The Project received permission from the Community School Board of Studies to add 20 minutes per week to the Grade 4 primary science community, bringing it up to 60 minutes.

Mr. Noga, Director, Kundu Service, NBC, approved the Project's broadcast design for the broadcast of lessons in 1989-91 in the East Sepik and Central Provinces. He also indicated that it may be possible to broadcast lessons in the Central Province in 1988.

The teaching and observation of the light lessons were completed. These were the first lessons produced by the Project that included science equipment. Mirrors were provided for pairs of children in each Project classroom.

The posttest for the light unit was administered in the classrooms that received the pre-test in October.

The Advisory Committee met and approved the Grade 4 Radio Science curriculum. The Committee asked for a written statement from the NBC on the agreement for broadcasting in the East Sepik and Central Provinces.

Joyce Hill, Radio Producer, outlined problems with the equipment in the broadcast studio. She recommended that a qualified engineer be brought in to examine the studio.

Joyce Hill presented Radio Science workshops to new teachers at St. Benedict's Teachers College in Wewak.

Lesson planning for the first four lessons of the 1988 Grade 4 curriculum was completed. The first lessons provide children with an introduction to interactive radio.

December

Charles Currin spent two weeks working with the Project's summative evaluation design. His work was in preparation for Steve Kozlow's visit in February, 1988. Currin met several times with the Evaluation Subcommittee to discuss the evaluation design and implementation plan. Currin also advised on implementation plans.

PNG Community Schools closed for summer vacation.

Scripting of the first four science lessons (to follow the initial introductory lessons) of the 1988 Grade 4 Curriculum commenced. These are the first lessons of the Living Things - Animal Unit.

A questionnaire was administered to the teachers and headmasters who worked with the Project during the 1987 school year. The questionnaire data were analyzed late in the month.

Michael Popo and Frank Watson conducted a workshop for 30 senior teachers at the University of Papua New Guinea in the use of interactive radio to teach primary science.

Joyce Hill continued her investigation of the broadcast studio which revealed that the studio needs major repair.

II. IMPLEMENTATION PLANS

A. Project Objectives for 1988

The year 1988 will be a critical one for the Radio Science Project. In 1987 the Project hired and trained staff, produced many lessons, established a positive working relationship with the DOB, finalized evaluation plans, and reached a broadcasting agreement with the NBC for 1989. The first priority of the Project in 1988 will be to develop and maintain a production schedule. In addition, the Project must make substantial progress in answering the broader questions which make this Project significant, vis-a-vis high quality science education in developing countries. Some of these questions are:

- o How well can radio teach science to children?
- o What are the components of science teaching that are most and least effective using radio?
- o Can the IRI methodology that has been developed so successfully in previous Projects be extended to meet the new demands of science teaching, such as a more open-ended, inquiry approach and greater use of hands-on materials?
- o Can the science curriculum meet the educational needs of the great majority of young people in PNG who will continue to live in rural communities?
- o What can we learn about the nature of scientific thought among children in PNG that will help us develop more effective lessons?
- o How can we utilize a radio-based component to provide more effective in-service training?

In December, 1987, the Project developed plans to achieve the following objectives in 1988:

- o Develop and broadcast 60 radio science lessons and the accompanying post-broadcast activities for Grade 4
- o Evaluate the condition of the broadcast studio
- o Develop a stable and consistent team of studio actors and actresses
- o Obtain a final written agreement from the NBC on the broadcasting of lessons in 1988-91
- o Complete the formative evaluation of the Grade 4 Radio Science curriculum
- o Complete the Grade 4 summative evaluation plan so that the Central and East Sepik Provinces can be evaluated in 1989 (see Appendix D for the most recent version of the evaluation plan)
- o Design the curriculum for the Grade 5 Radio Science lessons

- o Begin writing the Grade 5 radio lessons for broadcast in 1989
- o Continue to strengthen communication and collaboration with the Department of Education and the Curriculum Unit
- o Design 10-minute radio lessons for teachers to be broadcast over Radio Central each week during the school year
- o Continue a program of staff development in the areas of production, scriptwriting, acting, evaluation and science curriculum development.

B. Project Objectives for 1989

- o Complete the summative evaluation of the Grade 4 lessons in 30 schools -- 20 in the Maprik area of the East Sepik Province and 10 schools in the Baramba area of Central Province
- o Develop the Grade 5 lessons and broadcast them over Radio Central to 20 schools -- 2 in the National Capital District, 10 in Central Province and 8 in the Eastern Highlands
- o Co-sponsor a conference in collaboration with the Radio Learning Project in PNG. The conference will give special attention to the Radio Science Project and will also include an opportunity to present the experiences and findings of other IRI Projects
- o Produce a video tape of the Project.

The Project is scheduled to terminate at the end of 1989. Because of the late start-up date of the Project, however, more time will be needed to complete the work. EDC plans to request from AID/Washington a "no-cost" extension of the Project through early 1991. This extension is essential if the Project is to meet its objectives of developing, testing and evaluating three years of a science program. More time is also needed to complete the various studies related to the research questions listed under Project Goals for 1988. In addition, the Government of PNG may decide that the program is not sufficiently complete, or that they do not have enough experience with the radio series before 1990 to decide if they want to formally adopt and implement on a national basis these lessons. Finally, a full complement of lessons may be essential if these lessons are to be adopted and used in other countries.

If the Project is not extended, EDC will prepare a final report with a summary of work accomplished, findings, and recommendations.

C. Project Objectives for 1990

Should an extension of the Project be granted, the objectives will be to continue the work of the previous two years as follows:

- o Develop the Grade 6 curriculum
- o Broadcast the lessons for Grades 4-6
- o Complete the summative evaluation for Grade 5 lessons in East Sepik Province and Central Province
- o Prepare the information needed by the Ministry of Education to make a decision on whether or not to institutionalize Radio Science Project in 1991. (If a positive decision is reached, the Project will assist in developing an implementation plan for national dissemination.)

The EDC field staff would complete their work in PNG by the end of 1990.

D. Project Objectives for 1991

EDC plans to ask for an extension only through early 1991. The following activities are planned for 1991:

- o Begin broadcasting the lessons for Grades 4-6 to a much wider audience if the DOE gives approval for widespread use of the program
- o Refine the plans for national dissemination
- o Prepare for the summative evaluation of the Grade 6 lessons to be completed by the DOE
- o Write the final report of the Project.

III. CONCLUSION

The year 1987 was a critical transition year for the Radio Science Project in which it moved from delays and uncertainty to a firm footing. At the beginning of the year a science educator was not in place, there was still much need for training of the staff, and the project had not established a production process that could meet the required schedule. In addition, the field staff was not making the best use of available resources such as the project subcontractor or even the experts in PNG. There remained tension with some important DOE officials.

By the end of 1987 the situation was totally turned around. The accomplishments include:

- o A science educator was on site beginning in April.
- o In September a new Project Director took over.
- o The Grade 4 curriculum was refined and approved.
- o Staff workshops on scriptwriting and lesson development were completed.
- o Ten lessons in ecology and 5 lessons in light were developed and tested in thirteen Grade 4 classrooms in the National Capital District, Central Province and Eastern Highlands Province.
- o The summative evaluation plan was revised and ready for final approval.
- o The field team was fully utilizing the expertise of Friend Dialogues and drawing on the experience of specialists in PNG.
- o Relations between the Project and the Curriculum Unit were much improved.

The progress in 1987 was substantial. By the end of the year the project had a well coordinated working plan, a team that had gained considerable experience, and a clear vision of the work to be done in 1988 and beyond. The tasks to be accomplished in 1988 are substantial, but we are confident that the challenges will be met and that by the end of the year the project will be well on its way to fulfilling the overall goals of the project.

APPENDIX A

SUMMARY OF GRADE 4 CURRICULUM

RADIO SCIENCE PILOT PROJECT
GRADE 4 PRIMARY SCIENCE

CONTENT OVERVIEW

UNIT	CONTENT
LIVING THINGS - ANIMALS:	Distinguishing between living and non-living things based on observation; identifying animals according to certain criteria - size, movement, behavior, body covering, reproduction, growth, environment, and life cycle.
ECOLOGY:	Describing and classifying animals and plants according to the environments in which they live (seashore, grassland, rainforest); describing the interdependency of living things; identifying a simple food chain.
HEAT:	Identifying and giving examples of the three forms of matter - solid, liquid, and gas; describing what happens when solids, liquids, and gasses are heated and cooled.
LIGHT:	Observing the characteristics of light travelling in straight lines, bouncing off things, passing through other things; the resulting shadows when light is blocked, and how natural light can be broken up into colors.
SOUND:	Identifying how sound originates and the different ways sound travels through solids, liquids, and air.
ELECTRICITY AND MAGNETISM:	Classifying things that magnets can and cannot pick up; making a simple electrical circuit from wire, a torch battery, and a lamp; classifying things that are conductive; identifying how a switch works in a simple circuit.

APPENDIX B

**Outline Of The Grade 4 Science Lessons -
Introduction, Living Things, and Ecology**

APPENDIX B

OUTLINE OF THE GRADE 4 SCIENCE LESSONS -

INTRODUCTION, LIVING THINGS AND ECOLOGY

UNIT 1: INTRODUCTION TO RADIO SCIENCE LESSONS

1. Introduction 1 -- March 1

Practice in listening and responding to the radio science teachers. Answering orally yes/no and multiple choice questions. Use of the teacher cue. Practice using the right hand and writing response.

Segments:

1. Intro--
2. Answer Orally:Yes/No
3. Answer Orally:Multiple
4. Teacher Cue
5. Right/Left-Right (1)
6. Writing Response
7. Outro

NOTES TO THE TEACHER: Exercise Book Drawing from Worksheet.

2. Introduction 2 -- March 3

Continued practice in listening and responding. Using the Radio Science Book. Using the left hand. Answering riddles orally.

Segments:

1. Intro
2. Teaching the Science Song
3. Right/Left-Left (2)
4. Using the Worksheet
5. Constructed Response (Riddles)
6. Outro

NOTES TO TEACHER: Revise right/left

3. Observation 1 -- March 8

Practice in the process skill of observation. Using the right and left hand. Using arrows to indicate direction and practicing visual observation.

Segments:

1. Intro
2. Observing in the Classroom
3. Observation Song
4. Arrows-Direction
5. Right/Left Ex. R/L(3)
6. Outro

NOTES TO THE TEACHER: Visual Observation Puzzle

4. Observation 2 -- March 10

Continued practice in observation, listening to sounds, following directions, sorting objects and using right - left in pictures and diagrams.

Segments:

1. Intro
2. Sound Guessing Game
3. Right/Left Pic R/L (4)
4. Observing and Comparing
5. Outro

NOTES TO TEACHER: Outside Observation Search

UNIT 2: Living Things -- Animals

5. Living and Non-living Things -- March 15

Living things have characteristics by which they can be described and distinguished from non-living things. They take in food, give off wastes, grow, respond to stimuli, and reproduce their own kind.

Segments:

1. Intro
2. Characteristics of Living Things
3. Revise R/L (3)-Right/Left Song
4. Puzzle Game -Living/Non-Living
5. Outro

NOTES TO THE TEACHER: Outside Search For Living/Non-Living Things.

6. Characteristics of Animals -- March 17

Animals have characteristics by which they can be described and identified. Children can easily see the differences in size, shape, color, coverings, and structures of animals.

7. All Living Things Need Food to Live -- March 22

All living things need food to live. Animals depend upon plants for food. Plants use non-living materials (air, sunlight, water, minerals) for energy necessary to live.

8. Coverings of Animals -- March 24

The bodies of animals are covered in different ways -- fur, skin, scales, feathers, shells, hair.

9. Animals Differ in Many Ways -- March 29

Animals differ in size, color, body parts, coverings, where they live and what they eat.

10. Animals Move in Different Ways -- March 31

Animals have different ways of traveling from place to place. They swim, run, walk, hop, crawl, or fly.

11. Some Special Animals -- April 12

An investigation of the appearance, food getting, and movement of lesser known living things.

12. Animals Reproduce -- April 14

One of the characteristics of living things is that they are able to reproduce their own kind. Living things reproduce in many different ways.

13. How Animals Grow and Change -- April 19

All living things change in appearance and behavior as they grow.

14. We Use Animals in Different Ways -- April 21

Describing and naming some ways that people use animals as pets, as food, for work, etc.

15. Animals Grouped According to Characteristics -- April 26

The many different kinds of animals have characteristics and behavior by which they can be described, identified, and classified.

16. Animals Live in Many Places -- April 28

Living things live in a great variety of environments: oceans, fresh water, forests, grassland, etc.

19'

17. Animals Without Bones -- May 3

Many animals have soft bodies with no bones for an internal support system. This feature is used to classify animals.

18. Animals With Bones -- May 5

Some animals have bones as an internal support system for their bodies.

19. Bones -- May 10

Learning about how bones provide a structure for the body of the human being.

20. Muscles -- May 12

An investigation of how the muscles move the bones and enable the human being to move about.

21. Characteristics of Living Things - Plants -- May 17

Plants have characteristics by which they can be described and identified. Children can easily see the differences in size, shape, color, and structures of plants.

22. Growing Seeds -- May 19

Identifying seeds and investigating what is needed to make seeds grow into plants.

23. Parts of Plants -- May 24

Identifying and studying the parts of plants, leaves, stems, roots, and flowers.

24. How We Use Plants -- May 26

Describing and naming some ways that people use plants.

Lesson details for units in Ecology, Heat, Sound, Light, and Electricity will be sent to you.

20

ECOLOGY UNIT

Grade 4 radio science lessons for the ecology unit. Developed and tried out in 15 community school Grade 4 classrooms from April to September, 1987.

LESSON TITLE: LIVING THINGS

Segments:

1. Introduction
2. Needs of Living Things
3. Living and Non-Living Things
4. Living Things in Their Environment
5. Food Chains
6. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

LESSON TITLE: THE SEASHORE COMMUNITY

Segments:

1. Introduction
2. Introduction to Communities
3. The Seashore Community
4. Living and Non-Living Things in the Seashore Community
5. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: SEASHORE ANIMALS

Segments:

1. Introduction
2. Identification of Seashore Animals
3. Description of the Crocodile
4. Food Chain Game
5. Sorting
6. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: SEASHORE BIRDS

Segments:

1. Introduction
2. General Feature of Birds
3. The Beaks of Birds
4. Identification of the Starfish
5. The Feet of Birds
6. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: **GRASSLAND COMMUNITY**

Segments:

1. Introduction
2. General Features of the Grassland Community
3. Introduction to Animals and Plants of the Grassland Community
4. Compare the Grassland Community with the Seashore Community
5. A Grassland Community Food Chain
6. Identify the Sea Turtle
7. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: **ANIMALS AND PLANTS OF THE GRASSLAND COMMUNITY**

Segments:

1. Introduction
2. Plants of the Grassland Community
3. Animals of the Grassland Community
4. Burning in the Grassland
5. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: **RAINFOREST COMMUNITY**

Segments:

1. Introduction
2. General Features of the Rainforest Community
3. Identification of Rainforest Animals
4. Energy
5. Entertainment -- Movement and Energy
6. The Wallaby and the Anteater
7. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

Lesson Title: **ANIMALS AND PLANTS OF THE RAINFOREST**

Segments:

1. Introduction
2. Plants of the Rainforest
3. Food chain of the Rainforest
4. Bird of Paradise and Cuscus
5. Entertainment -- Energy and Science Song
6. Forest in Danger
7. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

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Lesson Title: **WALK AROUND THE SCHOOL**

Segments:

1. Introduction
2. Looking Around Inside the School
3. Getting Ready for a Trip Around the School
4. Post-Broadcast Lesson -- Classroom Teacher -- Notes for the Teacher

APPENDIX C

Example of Teacher's Notes - Light Unit

APPENDIX C**EXAMPLE OF TEACHERS' NOTES - LIGHT UNIT**

Each radio science lesson has a script, a worksheet and a guide for the teacher known as NOTES FOR THE TEACHER. This lesson also has an additional worksheet to be used during the post broadcast lesson.

NOTES FOR THE TEACHER**RADIO SCIENCE PILOT PROJECT**

GRADE 4

LESSON 21

LESSON TIME: 10 MINUTES

SCIENCE NOTES FOR THE TEACHER

All things reflect part or all of the light falling on them. Light coloured things reflect more light than dark coloured ones. Objects which are smooth will reflect more light than those which are rough. A mirror has a very smooth and polished surface. Mirrors form images by the reflection of light from their surfaces. They form mirror images of objects when placed in the right place. An image of the object can be seen in the mirror. See Teachers Guide Grade 4 Science pages 62-64, and 74 for more information.

YOU WILL NEED:

- o Two pieces of scrap paper for each child - the paper should be the same size for each child (old newspapers could be used)
- o Radio Science Book page 21 to be shared by pairs of children
- o Mirrors to be shared by children.

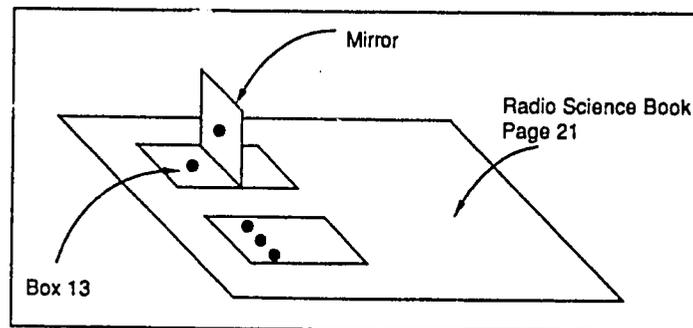
DO THIS BEFORE THE RADIO LESSON:

- o Have the children sit in pairs so that two children can share one Radio Science Book.
- o The radio teacher will ask the children to work as partners with the mirrors. Be sure that pairs of children have their Radio Science Book between them. The child on the left of the book is Partner A. The child on the right of the book is Partner B. Please make sure that the children understand this.
- o Hand out the two sheets of scrap paper to each child.
- o Hand out the Radio Science Book page 21, one to each pair of children.
- o Hand out the mirrors, one to each pair of children.

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DO THIS AFTER THE RADIO LESSON:

- o The children will use the Radio Science Book and their mirrors to make images in the mirror.
- o The picture below shows how the children should place their mirrors on the Radio Science Book.



- o Tell the children to find Box Thirteen in the Radio Science Book on page 21.
- o Demonstrate to the children how to place their mirrors on the page.
- o Have them place the mirror on the picture in Box Thirteen so the reflection in the mirror produces a circle.
- o Have the children use their mirrors to complete the pictures in Boxes Fourteen and Fifteen. (fourteen -- a butterfly, fifteen -- a rug).
- o If you have time, use the special worksheet MIRROR FUN, Figure 2, with the children.

CONCLUDE THE POST BROADCAST LESSON:

- o When light hits objects, the light is reflected.
- o We see because of reflected light.
- o Some objects reflect light better than others. Mirrors and other smooth and polished objects are good reflectors of light.
- o Mirrors reflect images of objects when placed next to objects.

MIRROR FUN

Use your mirror to complete the pictures in the boxes

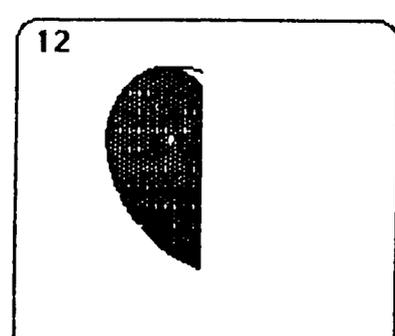
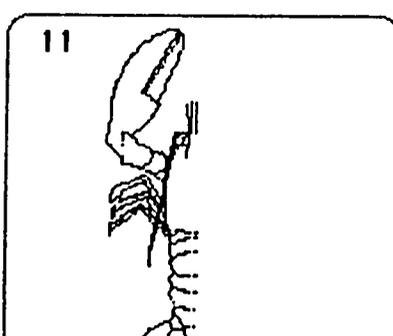
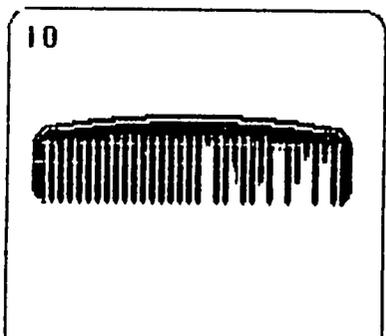
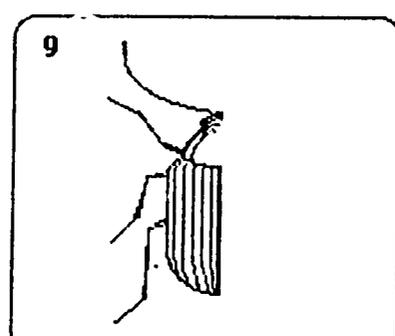
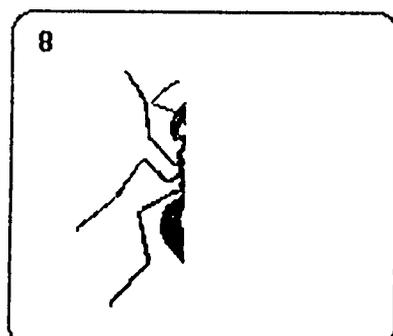
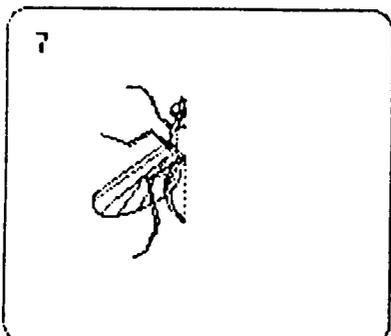
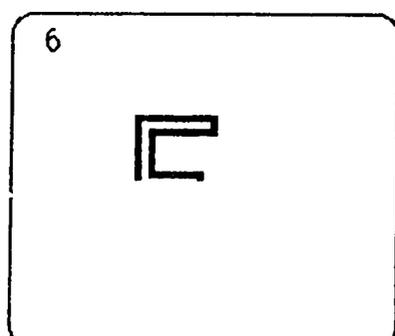
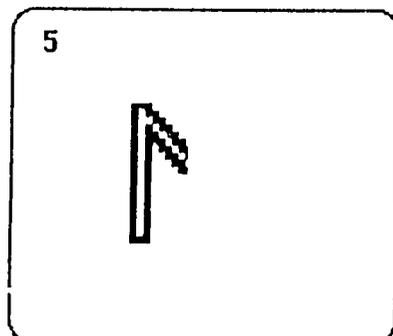
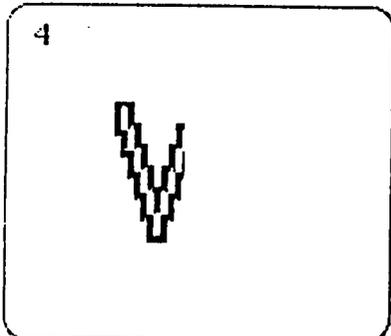
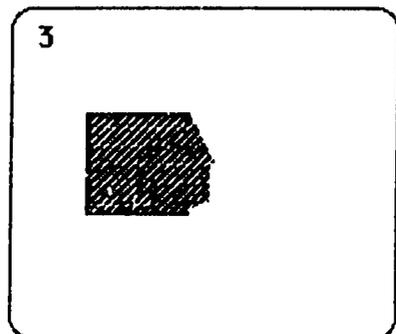
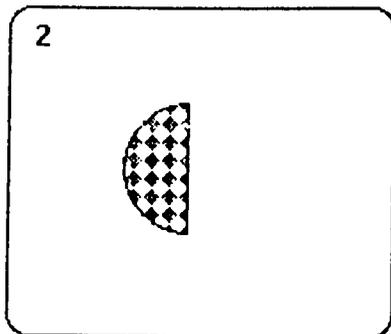
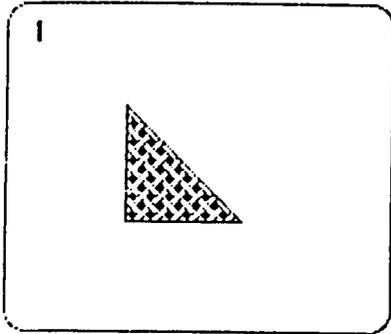


FIGURE 2

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APPENDIX D

**Design For The Summative Evaluation
Of The Radio Science Lessons**

APPENDIX D:
DESIGN FOR THE SUMMATIVE EVALUATION
OF THE RADIO SCIENCE LESSONS

Purpose of summative evaluation: For Grades Four, Five, and Six, the summative evaluation will compare learning gains of students who take Radio Science lessons with learning gains of comparable students who have conventional instruction. This evaluation will be concerned with the total learning package, including the children's workbooks, the teacher's notes, and the teacher training, as well as the radio lessons. Teacher and student attitudes about the radio lessons and science will also be assessed.

Testing instruments: To measure achievement, tests will be devices which will use some item from the criterion referenced tests already developed by the Curriculum Unit as well as completely new items. Friend Dialogues, Inc. will have primary responsibility for developing these tests. They will then be reviewed and approved by the Evaluation Subcommittee and the Advisory Committee of the Radio Science Project.

The Radio Science lessons may have an effect on the English skills of the students; if the Evaluation Subcommittee recommends it, test items in this area will also be included.

Teacher attitudes will be measured through the use of a questionnaire which will be administered to teachers before and after they use the radio lessons. Friend Dialogues, Inc. will also be responsible for devising this questionnaire which will again be reviewed and approved by the Evaluation Subcommittee and the Advisory Committee. A questionnaire for headmasters may also be devised if this is deemed necessary by the Evaluation Subcommittee.

Design of the Summative Evaluation: Because the three years of the Radio Science lessons will be designed as a continuing course, with each year of instruction prerequisite to the following year, the evaluation will be a longitudinal study of the cumulative effects of instruction. This means that Grades 5 and 6 will not be evaluated independently, but only in the context of a continuing series. There will be three evaluations conducted but these will not be separate evaluations of the three grades. Instead the three evaluations will be of:

Grade 4
Grades 4 and 5
Grades 4, 5 and 6

There will be a comparison made between the children who have the Radio Science lessons and a group of "experimental" children who receive "conventional" science classes now commonly given in PNG schools.

To control teacher, school, and community variables, the children in the two groups mentioned above will be drawn from the same schools. In principle, the

plan is to select two cohorts of children from these schools. One of these cohorts will be all of the children who start Grade 4 in Year 1, and the second cohort will be those children who start Grade 4 in Year 2. The schedule for the involvement of each cohort is as follows:

	Cohort 1 (conventional)	Cohort 2 (experimental)
Year 1	Grade 4	
Year 2	Grade 5	Grade 4
Year 3	Grade 6	Grade 5
Year 4		Grade 6

As can be seen from the above schedule, this kind of "lapped" design with two cohorts each followed for three years requires a total of four years to complete. The earliest year in which the study could start would be 1988.

Disadvantages of the design: One disadvantage of the proposed design concerns the time allocated to science instructors in Grade 4. The Radio Science lessons, including both the radio part and the non-broadcast activities, will take 60 minutes of classroom time per week. The control group, which will have conventional instruction, is allowed only 40 minutes of instructional time. The difference in time for science will be minimized to some extent by the inclusion in the radio lessons of topics from other disciplines including health, community life, and agriculture; since only the science portions of the lessons are to be evaluated, the evaluation results may be compromised if these non-science topics do not take up about 20 of the 60 minutes. This problem holds only for Grade Four since the other grades are allowed 60 minutes per week, including the current radio broadcasts in science.

Another disadvantage is that teacher turnover is so high that the two cohorts may not have the same teachers. Thus confounding teacher variables may not be well controlled. Also, since comparison data will be collected over three years, significant changes in the school or community during the intervening years might confound the comparison. Results for Grade 4 will not be available until the end of 1989, 1990 for Grade 5 and 1991 for Grade 6.

Selection of the cohorts: The study will be done in one or more provinces which will be selected on the basis of the ability to provide radio broadcasting. The lessons can be broadcast by a provincial station. The station (or stations) selected must agree to provide the following broadcast time:

1988	No broadcasting required
1989	Radio Science lessons for Grade 4
1990	Radio Science lessons for Grade 5
1991	Radio Science lessons for Grade 6

Note that this broadcasting schedule requires no time in 1988, two broadcasts per week in 1989 and 1990, and two broadcasts per week in 1991.

Once the province is selected, 30 schools will be selected by a stratified random selection process, where the stratification will be along lines such as urban/rural, fully blocked or not (fully blocked school has all six grades), School Leaving Examination scores, etc. Certain classrooms in the provinces may be excluded from the selection if accessibility is too limited to permit pretesting and posttesting.

The Radio Science Project will have the principal responsibility to carry out the school selection process. After selecting the provinces that will participate, this process will consist of a study of the relevant school data which can be obtained from the Measurement Services Unit and will include all the variables mentioned above, plus considerations of the feasibility of using the provincial radio stations to broadcast the lessons, approval of the appropriate provincial officers and, to some extent, accessibility. This may require visits to the provinces under consideration to talk to the officials and visit the schools. Schools, rather than classrooms, are used as the unit of selection for these studies because we will want to follow the same students through three years of school experience. In the larger schools, there may be several classrooms for a grade and the group of children may be split in different ways in different years. It is, therefore, important that we include all children in the grade, rather than only the children in one section of the grade. Also, the schools chosen must have Grades 3, 4 in 1988 because these are the three cohorts we will be following for several years.

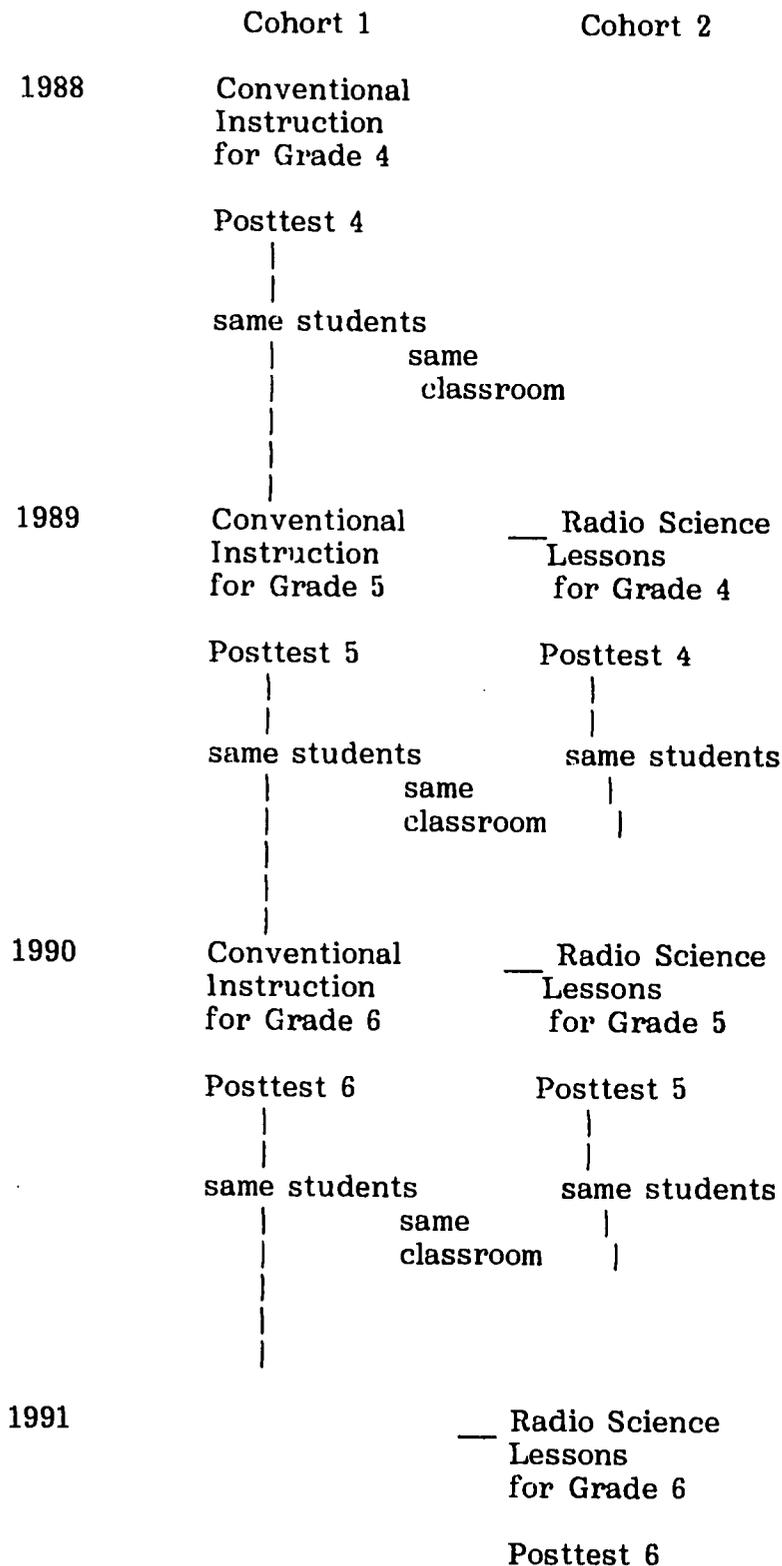
Identification of schools, classes and children: To make possible a more efficient data analysis and to follow the children in all cohorts throughout the years of the study, it will be necessary to assign identification codes to the children. The following system of identification will be used.

Each cohort will be identified by a number (1, 2, or 3). Schools will be identified by name of province and school. Within each school, students will be assigned numbers consecutively such that the students in cohort 1 will have numbers assigned from 100 to 399; students in cohort 2 will have numbers from 400 to 699; and those in cohort 3 will have numbers from 700 to 999. New students transferring into a school during the year will be given the next consecutive number in his cohort. Here is an example identifier:

```

1:Central:Sogeri:134
|  |  |  |
_____ student number
_____ school name
_____ province name
_____ cohort number
    
```

Schedule: The following is a brief schedule for evaluation activities:



External data to be collected: In addition to the test data to be collected as described above, other data on variables that might affect the children's abilities and knowledge of science will also be collected. These may include:

- information on individual children (age, sex, etc.),
- information on the parents (educational level, occupation, language spoken in home, etc.),
- information on teachers (age, years of experience, educational background, etc.),
- information on the classroom (equipment, number of students, etc.)
- information on the school (library, size of playground, number of classrooms, etc.), and
- information on the community (major language group, urban/rural, social services, etc.).

In the analysis, the correlations of these variables with science knowledge will be explored by means of stepwise multiple linear regressions. If any of them prove to affect the control and experimental groups differentially, the effect will be factored into the comparisons to be made.

Flow Chart of Activities by Year:

1987

- October: Draft questionnaire sent from FDI to PNG for review
- October: Draft evaluation design document sent from FDI to PNG for review
- November: Draft questionnaire with changes sent from PNG to FDI to be put in final form
- November: Draft evaluation design sent from PNG to FDI with changes to be put in final form
- November: Provincial radio station selected
- December: Final evaluation design document sent to PNG from FDI and approved by Advisory Committee
- December: Final form of the attitude questionnaire completed by FDI and sent to PNG

1988

- January: Schools selected and notified of schedule
- January: Attitude questionnaire reproduced by RSP staff

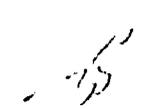
- February: Attitude questionnaire administered to teachers and headmasters in cohort 1 Grade 4
- March: Questionnaires sent to FDI for analysis
- April: Begin developing posttest for Grade 4 at FDI
- May: Posttest for Grade 4 sent from FDI to PNG for comments and suggestions
- June: Comments on posttest for Grade 4 sent from PNG to FDI
- June: Posttest Grade 4 completed at FDI and sent to PNG
- July: Artwork for posttest done in PNG; tests reproduced
- August: Posttest Grade 4 pretrialed and sent back to FDI for analysis and revision
- October: Posttest Grade 4 completed in revised version at FDI; completed posttests sent to PNG
- November: Artwork for posttest Grade 4 revised and tests reproduced by RSP staff
- November: Attitude questionnaire administered to teachers and headmasters in cohort 1 Grade 4
- November: Posttest administered to cohort 1 Grade 4
- December: Questionnaires and posttests sent to FDI for analysis

1989

- January: FDI completes preliminary analysis of questionnaires and tests and sends report to PNG
- February: Attitude questionnaire distributed to teachers and headmasters in cohort 1 Grade 5 and cohort 2 Grade 4
- March: Questionnaires sent to FDI for analysis
- April: Begin making up posttest for Grade 5 at FDI
- May: Posttest for Grade 5 sent from FDI to PNG for comments and suggestions
- June: Comments on posttest for Grade 5 sent from PNG to FDI
- June: Posttest Grade 5 completed at FDI and sent to PNG
- 

- July: Artwork for posttest done in PNG; tests reproduced
- August: Grade 5 posttest pretrialed and sent back to FDI for revision
- October: Posttest Grade 5 completed at FDI and returned to PNG
- November: Grade 5 posttest reproduced by RSP staff
- November: Attitude questionnaire redistributed to teachers and headmasters in cohort 1 Grade 5 and cohort 2 Grade 4
- November: Posttest administered to cohort 1 Grade 5; posttest administered to cohort 2 Grade 4 by Evaluator
- December: Questionnaires and posttests sent to FDI for analysis

1990

- January: Grade 4 data analyzed by FDI and report sent to PNG
- February: Attitude questionnaire distributed to teachers and headmasters in cohort 1 Grade 6 and cohort 2 Grade 5
- February: Classes in cohort 2, Grade 6 supplied with enhancement materials
- March: Questionnaires sent to FDI for analysis
- April: FDI begins to construct posttest for Grade 6
- May: Posttest for Grade 6 sent from FDI to PNG for comments and suggestions
- June: Comments on posttest for Grade 6 sent from PNG to FDI
- June: Posttest Grade 6 completed at FDI and sent to PNG
- July: Artwork for posttest done in PNG; tests reproduced
- August: Posttest Grade 6 pretrialed and sent back to FDI for revision
- October: Posttest Grade 6 completed at FDI and returned to PNG
- November: Posttest Grade 6 reproduced by RSP staff
- November: Attitude questionnaire redistributed to teachers and headmasters in cohort 1 Grade 6 and cohort 2 Grade 5
- November: Posttest administered to cohort 1 Grade 6 and cohort 2 Grade 5
- December: Questionnaires and Posttests sent to FDI for analysis
- 

December: Grade 5 data analyzed by FDI and report sent to PNG

1991

February: Attitude questionnaire distributed to teachers and headmasters in cohort 2 Grade 6

March: Questionnaires sent to FDI for analysis

November: Attitude questionnaire readministered to teachers and headmasters in cohort 2 Grade 6

November: Posttest administered to cohort 2 Grade 6

December: Questionnaires and posttests sent to FDI for analysis

December: Grade 6 data analyzed by FDI and report sent to PNG

Task Analysis Schedule: The following are general guidelines on tasks to be undertaken by the principal parties involved in the Radio Science Pilot Project summative evaluation.

Evaluation Subcommittee of the Project Steering Committee: This group has no direct data collecting responsibility, but must approve the evaluation design, oversee its implementation, and report on the progress of evaluation to the Advisory Committee.

Friend Dialogues, Inc.: Subcontracted by EDC, this agency is responsible for the overall summative evaluation design, test and questionnaire development, data analysis, and preparation of the evaluation reports.

Radio Science Project Staff: The Radio Science Project staff will have the primary responsibility for coordinating the evaluation work including liaison between Friend Dialogues, Inc. and the other agencies involved in the evaluation, the reproduction of evaluation instruments and materials, and the administration of the tests and questionnaires.

Education Research Unit (ERU): This unit will assist with the collection of field data and with the identification of persons who are qualified to assist with data collection on a part-time basis. The ERU will also give general advice on matters related to data collection and interpretation.

Research and Evaluation Unit (REU): This unit will comment on tests and questionnaires, participate in meetings of the Evaluation Subcommittee, and assist in orientation of temporary or part-time staff who may be engaged in field data collection.

Measurement Services Unit (MSU): This unit will provide the project with examination results for project schools and will, if necessary, allow the project

access to individual answer sheets of pupils from project schools so that more detailed analyses can be carried out. The MSU will also allow items from its criterion referenced test booklet for science to be used for project testing.

Other Useful Evaluation Data: Costs and documentation on the implementation process are two other areas where timely summative data will be needed. Overall project costs (and thus the radio science materials developmental costs) will be monitored through project and agency accounting procedures. Also, an independent costs analysis will be done in the last year of the project. Year by year cost data and some projections of maintaining the radio science lessons after the development years can be provided to the National Department of Education as well.

The project implementation process will be fully documented in the Project Director's monthly logs and annual reports which will address such issues as: How was the project managed? Did the Advisory Committee/subcommittee structure operate effectively? What was the turnover rate of Project staff? Was the time allocated to the project sufficient in view of the various constraints encountered?

J. Friend
S. Kozlow
January 20, 1988

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APPENDIX E

Radio Science Pilot Project Staff

APPENDIX E

RADIO SCIENCE PILOT PROJECT STAFF

Michael Popo, Professional Assistant --
School Liaison and Evaluation

Kipa Maleva, Professional Assistant --
Science Education - Scriptwriting

Paul Mungul, Professional Assistant --
Scriptwriting and Production

Pius Ripason, Professional Assistant --
Scriptwriting

John Khambu, Professional Assistant --
Evaluation

Roland Katak, Head of Evaluation

Patrick Ori, Studio Technician

Igo Poa, Secretarial Associate

Mary Kohm, Secretarial Associate

Tazi Rom, Driver and Materials Development

Joyce Hill, Chief Scriptwriter and Producer

Frank Watson, Project Director and Science Educator

5 Studio Actresses and Actors

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APPENDIX F

Radio Science Pilot Project Committees

APPENDIX F

RADIO SCIENCE PILOT PROJECT COMMITTEES

Advisory Committee

William Penias -- CHAIRPERSON
First Assistant Secretary
General Education Services
National Department of Education

Peter Baki
Assistant Secretary
Curriculum Development
National Department of Education

David Eyrich
Co-ordinator, Evaluation Unit
National Department of Education

Dr. Sheldon Weeks
Director of Research Unit
University of Papua New Guinea

Dr. Michael Wilson
Faculty of Education
University of Papua New Guinea

Dr. Lance Hill
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Mr. Modakewai
Assistant Secretary Teacher Education
National Department of Education

Mr. Reuben Egan
Port Moresby In-Service College

Godfrey Yerua
Superintendent, Measurement Services Unit
Curriculum Unit

Jon Hughes
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Curriculum Unit

Brian Deutrom
Superintendent, Curriculum
Curriculum Unit

Marion Ballard
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Curriculum Unit

Neil Murray
Superintendent, Materials Unit
Curriculum Unit

Uali Vagiriavi
Senior Inspector
Central Province Education Division

Paddy Fagan
Assistant Secretary for Education
Eastern Highlands Province

John Jelikikavas
Assistant Secretary, Education Division
Central Province

Bernadette Aihi
Senior Science Officer
Curriculum Unit

Dean Welty
Deputy Chief of Mission
U.S. Embassy

Robert Winship
Political Economics Officer
U.S. Embassy

Dr. Patrick Lowry
U.S. AID
U.S. Embassy

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Science Subcommittee

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Curriculum Unit

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Curriculum Unit

Bernadette Aihi
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Curriculum Unit

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Mr. Kipa Maleva
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Dr. Michael Wilson
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University of Papua New Guinea

Godfrey Yerua
Superintendent, Measurement Services Unit
Curriculum Unit

Mr. Michael Popo
Radio Science Pilot Project

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Broadcast Committee

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Curriculum Unit

Neil Murray
Superintendent, Materials Unit
Curriculum Unit

Iga Kila
Assistant Director, Development Broadcasts
NBC

Hitolo Avei
Acting Senior Office Schools Brocasts Unit
Curriculum Unit

Joyce Hill
Radio Producer
Radio Science Pilot Project

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APPENDIX G

Schools Using Radio Science Pilot Project Materials

APPENDIX G

SCHOOLS USING RADIO SCIENCE PILOT PROJECT MATERIALS

The following schools used the Project materials in 1987:

National Capital District

- o St. Francis - Koki Community School
- o Waigani Community School

Central Province

- o Gaire Community School
- o Hisiu Community School
- o Kuriva Community School
- o Tuberseria Community School
- o Porebada Community School
- o Sogeri Community School

Eastern Highlands Province

- o Lufa Community School
- o Faniufa Community School
- o Manto Community School
- o Okiufa Community School
- o West Goroka Community School

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