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9. ABSTRACT
A review of priorities in research and development in educational technology. In the light of the rapid growth of educational problems in many less developed countries, recommendations are made to guide project selection and procedures by the Agency for International Development: tie research and development into all demonstration activities; support the use of radio, TV, audio media, TV alternates (videotape or disc players), and programmed instruction; projects which combine two or more media; detailed definition of objectives and goals for projects; and training of research personnel in less developed countries. Proposed projects are briefly outlined, ranging from one that seeks to identify cultural and sociological variables in education, to another which aims at making inexpensive TV receivers.

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ACADEMY FOR EDUCATIONAL DEVELOPMENT

Research and Development Priorities in Instructional Technologies for the Less Developed Countries

A Summary

Report Number Two
1973

This report has been prepared by the Academy for Educational Development under Contract No. AID/csd-2829 for the Office of Education and Human Resources, Bureau for Technical Assistance, Agency for International Development.

Section 220 of the Foreign Assistance Act of 1970 directs the U.S. Agency for International Development to undertake a wide array of activities aimed at assisting the developing countries in their use of communications technologies for education, agriculture, health, and community development. The technologies consist of radio, television, programmed teaching systems, computers, and communications satellites.

To carry out some of the activities mandated under Section 220, AID has contracted with the Academy for Educational Development to direct scientific research on the use of educational technology, to assess educational effectiveness and cost implications of various alternative communications systems, and to develop ways of applying electronic communications systems to agriculture, nutrition, population, and community development.

This report is one of a series prepared by the Academy and its subcontractors for AID under the terms of the contract. The reports in this series include:

1. Research and Development Priorities in Instructional Technologies for the Less Developed Countries
2. Research and Development Priorities in Instructional Technologies for the Less Developed Countries: A Summary
3. Alternative Communications Systems for Education in the Less Developed Countries
4. Broadcast Satellites for Educational Development: Possible Key Policy Decision Points, 1973-1978
5. Broadcast Satellites for Educational Development: The Experiments in Brazil, India, and the United States
6. Strategies for the Use of Mass Communications Media in the Technologically Developing Nations: Basic Education, Family Planning, and Nutrition
7. Communication Strategies for Agricultural Development
8. Communication Strategies for Development: A Summary
9. Technical-Economic Considerations in Public Service Broadcast Communications for Developing Countries

R&D PRIORITIES IN INSTRUCTIONAL TECHNOLOGY FOR THE LDCs

A Summary of Findings and Conclusions

By

Sidney G. Tickton and Robert D.B. Carlisle

Based on field investigation and a technical report
written by James G. Miller

Prepared for the Agency for International Development
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CONTENTS

		Page
Foreword, by Alvin C. Eurich		1
I	Overview, by Sidney G. Tickton	3
	A. Background	3
	B. Conclusions of the Study	9
	C. Highlights of the Technical Report	13
II	Summary of Technical Report, by Robert D.B. Carlisle	22
	A. The Research Priorities	22
	1. Improving the Learning Process	25
	2. Improving Educational Efficiency	33
	3. Increasing Access to Education	41
	B. Selecting the Media	51
	1. Introduction: 40 Media Possibilities	51
	2. Five Media with Promise	59
	3. Use of Radio	62
	4. Use of Television	64
	5. Use of Audio Media	68
	6. Use of TV Tape	69
	7. Use of Programmed Instruction	72
III.	Brief Descriptions of New Project Ideas, by James G. Miller and the Members of the Research Team	75

FOREWORD

This is the second in a series of reports on policy issues on the use of instructional technology in the underdeveloped countries prepared under contract by the Academy for Educational Development for the Agency for International Development. The studies were conducted under the general direction of the President of the Academy, and were carried on during the years 1970-1973 by nationally known specialists in educational technology.

Part I of this report is a brief overview of research and development priorities in educational technology prepared by Sidney G. Tickton, Executive Vice President of the Academy. This paper was presented to AID technical assistance officials in late 1973 and to other administrators in early 1974.

Part II provides a nontechnical summary of the conclusions on research and development priorities in educational technology deriving from the work done under the AID contract by Dr. James G. Miller, former Vice President of the Academy. Dr. Miller carried on a good deal of day-to-day field work, interviewed and discussed the objectives, findings and conclusions of the study with leading professionals in the field, and then prepared a comprehensive and detailed 500-page technical memorandum which he discussed at length with various AID officials. Part II was prepared by Dr. Robert D.B. Carlisle, formerly Assistant Vice Chancellor of Educational Communications at the State University of New York and Director of Educational Projects at the Corporation for Public

Broadcasting.

Part III is a series of proposed research projects in priority areas. The objective here is to assist LDCs to devise, try out, perfect and evaluate systems which hold significant promise.

The assembly of the data and backup information for this study was possible only because of the cooperation and assistance of literally hundreds of persons in various parts of the country. They met with Dr. Miller and various Academy officers to discuss educational technology and R&D priorities on countless occasions. They provided the information needed where they could, offered their best judgment as to courses of action that might be followed, and were helpful to the Academy in a great variety of ways. The Academy uses this opportunity to thank them publicly and to express appreciation for their many contributions.

The Academy also wishes to acknowledge with warm thanks the advice, counsel and assistance provided during the course of this study by the representatives of the Agency for International Development. In particular, we are grateful to Dr. Clifford Block, Educational Technology Officer, TA/EHR/AID, who acted as project monitor for these studies, and to his associates, Ms. Annette Buckland and Mr. David Sprague. They have been exceedingly helpful on many occasions and we thank them for their assistance as well as their continued patience.

Alvin C. Eurich
President
Academy for Educational Development

R&D PRIORITIES IN INSTRUCTIONAL TECHNOLOGY FOR THE LDCs

An Overview
by
Sidney G. Tickton

A. Background

For many years educators, technology specialists, economists, the grant officers of leading foundations, and the officials of governmental and intergovernmental agencies have been trying to develop a set of research and development priorities in educational technology for use particularly in the lesser developed countries. Although the objective of their efforts seems to have been clear enough and the technique required seems to have been simple enough, the reaching of the intended goal has eluded researchers and administrators alike both in the United States and abroad. Today many of the leading practitioners in the field believe that they are no closer to agreement on what the priorities are, or what they should be, than were their predecessors a generation or even two generations ago.

As the technicians floundered in their discussions of how best to proceed, what areas to support, and which pilot projects to start first, it has become increasingly clear to the makers of grants both public and private (and especially to their superiors who are responsible for the appropriation of funds), that the educational problems of the LDCs have been growing rapidly. In many countries, in fact in most countries, the situation is substantially worse than only a few years ago. As the result of the growth in population,

worldwide and particularly in LDCs, the absolute number of illiterates has increased significantly in the past decade alone. New and expanded educational programs, both those financed by the appropriate educational agencies and ministries in LDCs themselves as well as those supported by USAID and the various international agencies, have been able to do little more than stem the tide.

As a result, many educators and officials in positions of authority are now ready to admit that gradual incremental changes in educational policies or in educational practices have not yet, and are not likely soon, to provide solutions to the most critical of the educational problems. New, dramatic, and imaginative changes in educational techniques and programming, and especially in educational planning, accompanied by the infusion of large quantities of new funds, both from local sources and international agencies, will be needed, if success is to be achieved in improving in any way, let alone substantially, the effectiveness of the educational system of the LDCs.

It is against this background that the Academy research team observed that there were examples of educational projects in the United States and abroad that showed that educational technology could help solve major educational problems and could do something significant about meeting large-scale educational needs. The ingredients required for a modicum of success were (a) a current educational problem for which a solution was urgent; (b) a great

desire in an LDC to meet the challenge of the times, and (c) funds available from both internal and external sources to institute change.

In this connection the research team noted, for example, a number of interesting developments that seemed to hold promise for expanded use of educational technology in LDCs. They were the following:

a. The use of programmed instruction, tapes, films, and other technological devices: For the training of technicians and mechanics of all types in industry and commerce, the training in technical operations and some not so technical in the military services, trade schools, and in some colleges, particularly junior colleges.

b. The use of television and video tapes in professional education: By a number of leading medical schools to extend the range of influence of leading faculty members; also in the post-baccalaureate education of engineers on the premises of their own companies by such institutions as Southern Methodist University, Stanford University, University of Minnesota and the University of Michigan.

c. The use of simulation and gaming: As a part of the educational process at NYU's Graduate School of Business and at other leading schools of business administration.

d. The use of television for the education of elementary and secondary school children: In El Salvador, Samoa, Korea, Niger, and the Ivory Coast, as well as in the United States; in some cases under carefully controlled conditions for learning and evaluation.

e. The growing awareness of the possible use of cable television in schools and libraries: Schools are using cable to reach the homebound, provide summer review courses, inform citizens about school issues, and expand the variety of courses available to all students. Public libraries are using cable to provide video reference services.

The successes that have been achieved indicate that if technology could only be organized to do the job it could help to improve education in the LDCs and could help overcome problems whose solution has long been defied. What would be needed is:

- a systems approach
- a small amount of specialized research and development, and
- a great dedication to achieving a number of small-scale provable results.

It was with this limited goal in mind that the Academy's research team carried on its study. The aim was to seek ways which could

harness technology to the solving of some of the educational problems of the LDCs. In the process the goal was to establish, if possible, a theoretical and conceptual framework for future R&D activities.

During the course of the study, the research team ran into a number of major educational issues in LDCs which the AID monitors and the Academy staff felt could and should be addressed. Among these, for example, were the following:

(1) Too many students; too few teachers

(2) Low immediate payoff in relation to development

(3) Poorly or untrained teachers

(4) High drop-out rates

(5) Unique rural training needs

(6) Escalating costs of education and training

(7) Low R&D capability in LDCs.

The research team also found that it had to operate within one important constraint; that is, attention had to be confined to projects where an impact on education in the LDCs could be made within five to ten years. New long-term, basic research on the learning process, for example, and similar projects were outside the scope of AID's immediate interest. They were to be excluded, therefore, from the Academy's study. The focus was to be instead on the applying of

the new knowledge recently derived from research (or in the process of being derived) to existing educational problems or to new educational projects that might be developed in LDCs during the next few years.

Against this background and within these limitations the research team focused on three priority areas. They were:

(a) "Software"; for example, program content and techniques, utilization, feedback, application to appropriate objectives, individualization, combinations with other educational techniques, etc.;

(b) "Hardware"; for example, reliability of receivers and power sources, costs thereof, ease of repair, etc.; and

(c) Systems planning and management.

The Academy's research team then proceeded to identify and describe a number of high priority R&D projects which would be illustrative of those possible for completion during the next few years. They looked for projects where successful research could lead to small breakthroughs with possible worldwide significance. They were concerned, particularly, with evaluating the results achieved and in demonstrating what might be achieved within the "art of the possible."

The research team felt that if AID could do something along these lines in a small way, other organizations and agencies, both public and private, and both here and abroad, could carry on the R&D process further. There would be an opportunity also to use the resources of the many educational networks and the loose confederations of educational organizations and talented persons which already are in operation around the country and around the world. With leverage provided by these groups small successes could be turned into "giant steps forward," for education in both the developed countries as well as in the LDCs.

B. Conclusions from the Study

Proceeding within the objectives and constraints provided by AID, the research team concluded that:

1. R&D in educational technology by AID should be concerned with four high priority areas, as follows:

   a. How to improve learning; more specifically, how to learn faster at present levels of quality.

   b. How to improve the educational efficiency of systems; more specifically, how to educate people of all ages cheaper at present levels of quality.

c. How to improve access to information education and training; more specifically, how to make education available to a greatly increased number of students.

d. How to repeat successes; more specifically, to find a way to duplicate the success in one LDC in the economic, social, political and educational setting of another LDC.

2. AID should tie R&D educational technology into field work being carried on in one or more LDC. No research of a theoretical nature should be supported, nor should any research be carried on in a vacuum without immediate LDC validation.

3. AID should take five types of action during the next few years in order to apply research and development results to future projects in lesser developed countries. These should be the following:

First type of action: AID should tie research and development into all projects demonstrating how educational media can be used to improve instruction or reduce costs. This means that every new project should include a carefully worked out research design, a detailed plan for

the evaluation of results, a cost-benefit analysis to the extent possible, an examination of alternatives, etc.

Second type of action: AID should direct its support to systems of educational intervention which use the following media in the following order of priority:

1) Radio - more precisely, broadcast live instructional radio;
2) Television - broadcast live instructional TV;
3) Audio Media - tape, cassette, cartridge, record player;
4) TV Media Alternatives - videotape, or disc players, and
5) Programmed Instruction - programmed textbooks, teaching machines, and computerized programmed instruction.

The research team felt that this order of priority for these media had a somewhat higher potential for success and cost effectiveness than many of the other possibilities.

Third type of action: AID should direct funds to the support of projects which combine the use of two or more media to deal with a single problem. The combination of radio, posters, village forums, and local monitors in the Guatemala Basic Village Education project is an example of an imaginative combination of communications media opportunities.

The various mechanisms for transmitting all or part of the message, none of which are either expensive or complicated, tend to reinforce each other. They increase the possibilities of success of the project thereby, as well as the prospect of holding costs down to the lowest possible level. In this connection, the research team felt that it would possibly be extremely useful for AID or other international agencies to provide LDCs with scenarios showing how mixes of media were used in an educative project to to handle efficiently a specific learning problem.

Fourth type of action: AID should spell out the objectives and goals of the projects it supports much more clearly than has been the case in the past. It will be possible thereby to measure the results with respect to carrying on the educational process "quicker and cheaper" (a) more objectively and (b) from time to time during the life of the project. Here the study team observed that in the past the objectives of the LDCs on many occasions were to expand educational opportunity to include more people, in more places, at more times, and in more

academic subject areas. The objective of AID on the other hand was, in part at least, to achieve more learning at a lower level of cost. The absence of a uniformly agreed to set of goals and timetables by the maker of grants and the receiver of grants has clearly made it more difficult to measure the progress in achieving objectives within a given period of time.

Fifth type of action: AID should support more extensively than in the past, and for greater periods of time, the training of research personnel in LDCs. Trained educational researchers are in short supply in every country particularly the LDCs. Many projects which are successful with the assistance of outside technicians and researchers lose much of their impact when key personnel are diverted to other activities or depart for their home countries. More local, well-trained persons are essential for a high and continued payoff in educational technology.

C. Highlights of the Technical Report

The technical report includes a compendium of new project ideas in the use of educational technology in LDCs. These are not the only ideas that developed during the study, but are instead the ideas selected by the st

eam as those most likely to succeed -- if undertaken with adequate unding in an LDC which has a high interest in the potential for sucess and is willing to commit appropriate personnel and time to the roject for its entire life.

A good project idea, adequate funding, and internal commitment were erceived as the ingredients necessary to achieve the potential success or the projects identified and described by the research team.

Of the new project ideas identified by the research team and desribed briefly in Part III of the summary report:

(1) seven projects are designed to make learning better and quicker, by, for example,

- making education content more attractive and relevant
- encouraging the adoption of TV and other technologies
- utilizing and training personnel better
- using feedback better in order to obtain greater cost effectiveness

(2) three projects are designed to make learning cheaper or more efficient by improvements in

scheduling

- methods of evaluation
- cost effectiveness
- TV hardware innovation

(3) five projects are designed to make education more accessible by:

- replicating the Mexican success with radio
- using TV for nonformal rural education
- using radio to handle nutrition, health and population problems
- using the open university idea for secondary education
- experimenting with less expensive media in urban centers

(4) three general projects are designed to:

- create an information system on educational technology
- develop a media map showing how different media are used around the world for formal and nonformal education
- train well-qualified persons in LDCs to become evaluation specialists

The projects described by the research team are only illustrative of what can be done to use educational technology to improve learning in LDCs.

After a long series of interviews and discussions, the research team found that every researcher in educational technology, as well as every operator of an educational improvement project, has his own set of R&D priorities and his own list of pet projects. Most proposals to the research team were found to incorporate the researchers' points of view, and were not directed at either the needs of or the point of view required to be taken by a grant-making agency, particularly an organization operating with government funds under government auspices.

We summarize here in this overview statement a number of illustrative projects to show the range of possibilities examined by the research team. Further details are available in Part III of this report.

Project #1. A proposal to reduce costs by using paraprofessionals instead of fully-trained teachers.

- Projects carried on here and abroad as well as research findings in numerous studies make it clear that paraprofessionals are a largely under-utilized source of educational manpower.

- Paraprofessionals could be useful as instructors in language, mathematics, social studies, and elementary science. They are more readily available

than trained teachers, they are anxious to teach both in school systems and in nonformal education settings and they cost less than fully-trained teachers.

- The proposed project would work with a number of key variables:

  (1) fully-trained teachers would be used in some classrooms, paraprofessionals in others;

  (2) some teachers would be traditional in the classroom; others would follow behavior modification techniques;

  (3) instructional aids would be used in some classrooms, but not be used in others.

- These variables would produce eight combinations for research study.

- The proposed project would require the use of objective criteria for determining success or failure. In language, for example, we already know how much should be learned in one year of study with a fully-trained teacher. How can the same results be achieved in six months with a paraprofessional using technology?

Project #2. A proposal to train teachers to be change agents, using audio and video tapes.

- New skills are needed by teacher-trainers; there aren't very many teachers capable of teaching other teachers to become change agents, particularly in LDCs.
- The goal of the proposed project would be to capitalize on the abilities of a few good teacher trainers by using media to do the job better, cheaper, and quicker than possible by conventional means.
- The project would compare TV and conventional means.
- If this project was successful, every LDC that wished to do so would be able to expand substantially the number of teachers who could act as change agents.

Project #3. A proposal to expand the use of radio in nonformal educational settings by improving feedback techniques.

- The project would aim to work out feedback techniques which could help improve nonformal education in rural areas of LDCs in agriculture, nutrition, health and family planning.
- The medium would be broadcast radio; it is widely available now in LDCs, but is seldom used for educational purposes.

- In developing this proposed project, planners would have to find out the effect of program content and tone, and frequency of broadcast, degree of localism, etc.; also whether the programs actually meet the listeners' needs or were they ignored or turned off?

- The proposal is that the project managers would work with leader figures in the test communities, involving them in deciding on appropriate areas for nonformal educational broadcasting, and inviting their participation as feedback agents. There would be a need to work out training programs for these agents and to develop a system for expediting the transmission of feedback to central points for transmission to program producers.

- Goal of project: to increase access to knowledge and skills and do it better and cheaper than other possible ways.

Project #4. A proposal for the development of inexpensive TV receivers.

- The goal of this proposal would be to cut the costs of both formal and nonformal educational TV in LDCs by finding ways to make inexpensive black and white TV receivers.

- The problem is: while more than 96 percent of all households in the United States own a TV set, most of the 2 billion potential buyers throughout the world cannot afford sets. Until cost is reduced, extensive use of TV for instruction will develop much too slowly.

- Producing low-cost black and white receivers (say $20 a set) would make possible mass instruction by TV, to say nothing about the other uses of television for information and pure recreation.

- If a big enough potential market could be demonstrated, then manufacturers or governments could be expected to do the necessary research to make low-cost sets a practicality.

- Need here: to analyze the TV market in LDCs, and to work with manufacturers to determine the potential volume needed to encourage them to do the R&D needed; possibly then to subsidize the R&D work required.

D. Final Note

1. There is a need to concentrate R&D in educational technology on projects which can make learning:

   (a) quicker at the same level of quality;

   (b) cheaper at the same level of quality;

(c) more accessible to greater numbers of people;

(d) provided by methods that, when successful, can be duplicated in other LDCs.

2. These goals and objectives are achievable. They will take a single-mindedness of purpose at AID and in the LDCs above and beyond anything ever attempted before. All AID projects using technological media certainly could not be confined to this single-mindedness of purpose, but a few could.

3. These goals require simple ideas for projects and limited objectives such as teaching elementary language, or teaching mothers about nutrition.

4. Overall objective for R&D at AID: a research breakthrough, narrow and pinpointed, that can be picked up and carried forward by others. There should be objective criteria for successes or failures. A successful project would be one that produced learning quicker or cheaper or covered more people at the same level of cost. No deviation from these criteria could be permitted for the projects that are involved.

5. If a small number of R&D projects with these criteria could be successful in LDCs and then pyramided by educational networks, the results could have tremendous educational significance throughout the world. There is a good possibility that this can happen during the next few years.

II

SUMMARY OF RESEARCH REPORTS ON PRIORITIES IN EDUCATIONAL TECHNOLOGY PREPARED BY JAMES G. MILLER

By Robert D.B. Carlisle

Part A - The Research Priorities

After a year of research and countless meetings, seminars and interviews, Dr. James G. Miller prepared for the Academy for Educational Development a brief chart of priorities in educational technology as follows:[1]

Main Priorities	Subpriorities
1. Improve the Learning Process	a) Improve effectiveness of instructional presentation and introduce more relevant content
	b) Enhance the role of the teacher or change agent in delivering education
	c) Improve evaluation techniques
2. Improve Educational Efficiency	a) Encourage new kinds of organization and staffing
	b) Improve fiscal management of education
	c) Stimulate use of management information systems
	d) Relate facilities to changing learning patterns
	e) Develop inexpensive, durable technologies
3. Improve Access to Education	a) Extend formal education to more people
	b) Expand education in rural areas

Main Priorities	Subpriorities
3. Improve Access to Education - cont'd.	c) Extend formal education to formal environments
	d) Use educational technology to implement lifelong learning

These priorities, said Dr. Miller, apply in general to both formal and nonformal education -- some, more to one than to another. Further, educational technology will be used whenever appropriate to convert these priorities from theory to substance.

These priorities were built on a list of convictions and principles evolved during the study. They were as follows:

- AID is concerned with the uses of education to improve the quality of life in LDCs. This should be accompanied by a reduction in costs.
- It is vital to learn first how a nation perceives its goals and problems, and what its resources are. Then one can decide which of the technologies might help meet the particular educational problems.
  - -- The host nation itself should come up with a plan and a commitment to educational technology.
  - -- Under no circumstances should "tools" dictate program.
  - -- R&D projects should emphasize strategies inexpensive enough to be practical for the host country.
- The central concern should be the student himself. Projects must be learner-oriented, not teacher-oriented.
  - -- To be practical for LDCs, there must also be real consideration for other levels -- the class, the school and school system, the nation, perhaps even the international community.

- Nonformal education must be given much greater emphasis than in the past.

  -- The newness of nonformal education means freer innovations are possible. But intensified evaluation will be vital, precisely because these programs are so new.

- Formal schools should give more attention to the special needs of rural education, rather than perpetuating elitist, colonial, urban approaches.

- To be successful, a rural program may have to grow from the grassroots level. It is imperative to understand why such a program succeeds, before transferring it to other places.

- The primary goal of R&D should be improving the learning environment by surrounding the student with more complete teachers and more effective technologies.

  -- Teachers should be trained to create the better learning environment, <u>before</u> the nation builds more schools.

- The greatest savings may stem from using paraprofessionals instead of trained teachers, from mass instruction using media that transmit over networks, and from making instruction through technology available when the students want it.

- Educational technologies do not represent the <u>only</u> answer. They are not, in Dr. Miller's words, "inevitable."

  --As a corollary, country differences are significant. All technologies will not suit all lands in a uniform way.

- Effective software -- the program material -- is at least as important as satisfactory hardware, if not more so. Usually it is more difficult to get or develop.

- The "small" media -- those usable in single class or home, or easily carried from village to village -- should be actively considered. Mass media like TV should not be given automatic preference just because they have worked well sometimes.

The remainder of this chapter discusses briefly each of the priorities and subpriorities.

Priority #1 - The Learning Process

For over three years, Charles Silberman studied the state of education in America. One of his conclusions could hold for both developed and developing nations:[2]

> The degree of ignorance about the process of education is far greater than I had thought. Research results are more meager or contradictory and progress toward the development of viable theories of learning and instruction is far slower.

The going has been slow, but professionals have studied the matter. "The heart of education," said the Commission on Instructional Technology (CIT), "is the student learning... All our studies, inquiries, research, and deliberations have begun and ended here: with the student as learner..."[3] People differ distinctly in the way they learn -- as the CIT puts it, "in the speed at which they learn, in their motivation to learn, and in what they desire to learn." Regrettably, schools often "cater only fractionally to these individual differences."

In recent times, attention has swung toward this goal of improving the learning process. More and more people recognize that learning can and will occur in many circumstances other than the generic school. There can be different approaches to, and different environments for, learning. No timeless law says this phenomenon will only occur in a classroom, with so many pupils, and class periods of set length. Nor are there cement-bonded rules on student-teacher ratios. One teacher for 15 students might seem ideal, one to 40, wholly negative. But some

are seeing positive values in having a larger number of students per teacher.

It may also be that effective learning can occur where peers act as surrogate teachers or tutors. At least it is well worth researching, as AID is currently doing, through the American Institutes for Research.

AID defines educational technology as a systematic way of defining, carrying out, and evaluating the total process of learning and teaching, in terms of specific objectives based on research in human learning and communication, and employing a combination of human and non-human media to bring about more effective instruction.[4]

When we consider then what role the educational technologies can play in the improvement of the educational systems, formal and nonformal, of the developing countries, we must address the ability of the technologies to make the learning process itself more effective. The research priorities discussed here, therefore, have as their aim to gain a better understanding of those elements of the education system in developing countries which have been traditional barriers to more and better education and which may lend themselves to solution by the nontraditional use of educational technology.

The multiple problems that confront education have no single solution. However, an increasing number of examples where countries have applied the educational technologies in the manner of comprehensive reform provide sound evidence that learning can be significantly

improved. In many other instances, the impact of technology has been low in both quantity and quality. The chief problem in these instances appears to be a lack of understanding about the process of human learning. The developing country education problems demand a nonconventional solution which can provide an approach flexible enough to meet the needs of a large, varied audience at an affordable cost.

Technology has this potential, yet it requires a broad array of research and study to determine the most appropriate applications. The first set of priorities here focuses on the learning process.

1. (a) Improve instructional presentation and present more relevant formal and nonformal education and information through appropriate, effective use of educational technology.

In a word, this has to do with content, and with the urgency of making it reflect the real cultural and national needs of a developing country. In too many places, the approach to content looks back at another era. Edgar Faure and his Unesco associates speak directly to this situation:[5]

> ...the academic model which is still highly regarded in so many countries...is today out of date and obsolete, not only so far as the working classes are concerned, but even in its utility to young people from the bourgeois class for which it was originally devised. It implacably reproduces the quirks of preceding generations.

This must not continue, said Faure. Rather, a "truly modern education" should be fashioned, one integrating "word, sound and image," one that will "link education to life ...invent or rediscover an educational system that fits its surroundings..."[6]

For the short-term learner (the early dropout), and for the long-term student, too, there ought to be a kind of learning that is relevant to the individual's life. Perhaps this will keep the short-termer in school longer and more nearly normalize the number of years it takes him to finish an elementary education.

If one emphasis stands out, it has to do with developing effective materials for nonformal education. Far too little is known about this, about reaching a farmer with new ideas on increasing his crop yields. Actually, those disseminating agricultural information may well have experience applicable for those officials with an education and information need in family planning, health or nutrition. But, there remains much to be learned about technique.

A further challenge involves effectively moving from development of the content, either nonformal or formal, to the production of effective media programs. It is a difficult task to revise content to speak to people's real needs. It is harder still to produce a good TV or radio program which conveys the content in a convincing manner. In El Salvador, several years were invested in learning how to make this conversion. Maybe that time lag can be cut as additional projects provide future program content planners experience to draw upon.

But much guesswork remains about the relevant curriculum, the ways media can be used, and how the teacher or learning agent fits into

this changing scheme of things.

1. (b) Enhance the role of teacher and change agent in delivery of information and education using the technologies, in both formal and nonformal education.

In Niger, officials have used monitors, rather than professional teachers, to run classes receiving televised instruction.[7] The results have been gratifying. After special training, the monitors approached their work with enthusiasm, newly aware that the TV-shaped curriculum was more appropriate than traditional education to the young people of Niger.

In microcosm, this innovation addressed the overall issue of the delivery agent, the teacher, in LDCs. It is too simple to say that all nations have a shortage. Actually, some countries have excess capacity at one level, too few qualified teachers at another. But there persists nearly everywhere large numbers of elementary school teachers who are poorly trained. Further, teachers are expensive, often accounting for 70 to 90 percent of education budgets.[8]

Neither AID nor the Academy recommends replacing the teacher with technology. The good teacher is essential to learning. What is at issue, rather, is making that good teacher stretch farther. He cannot do the whole job alone -- and the media can teach. So, compromises may be in order. Monitors and paraprofessionals in combination with the media may be a solution, as the Nigeriennes have found, to support the efforts of the professional few.

The fact is, as Edgar Faure reports, "the teacher's role is changing, in that the authoritative delivery of knowledge is being supplemented by spending more time diagnosing the learner's needs, motivating and encouraging study, and checking the knowledge acquired."[9] And the media can "relieve the teacher of exclusive concern with the transmission of knowledge and thereby enable him to pay greater attention to his mission as educator."[10] Here again, the media may extend the available teachers, as well as enhance the quality of the program.

Inevitably, teacher-training must undergo metamorphosis so that, as the Faure Commission believes, "teachers are equipped for the different roles and functions imposed by new technologies." [11] Specialists and auxiliaries must work side by side with the professionals; pupils should instruct others -- and thus teach themselves. The technologies can capitalize on and extend to the fullest the vital ingredient of the qualified teacher.

In nonformal education, the human element is equally important. "Change agents" in rural areas become vital. Could media substitute? Could TV, radio and cassettes train the village leader as a conveyor of new information? Careful research is required to determine an effective approach. The experience thus far is limited, but precedents are appearing. At six Unesco-supported teacher institutes in Africa, the main purpose is to "produce rural educators well adapted to the local conditions under which they will work and skilled at initiating and organizing a wide range of community development activities";[12] in short, locally oriented change agents.

But will teacher and change agent accept and utilize technology? What will be the right mix of teacher and medium? These are questions for the research ahead. That acceptance is more likely if improved evaluative techniques can show that media will help reach valid objectives.

1. (c) Improve evaluative techniques to aid in development of educational programs and to assess their effectiveness.

Too often, systems for feedback have been neglected in the use of media in education. It is an error that planners are learning to correct. In El Salvador's education reform utilizing TV, second-term math failures worried project managers. With research evaluation teams, through questionnaires and interviews, team members learned that pupils had fallen behind because too many basic concepts were included in the vital programs. Program producers adjusted the schedule to provide for more review units before the course ended.[13]

Such feedback is absolutely essential to effective use of the media. Ideally, there should be two types -- formative evaluation, which measures the effectiveness of "pilot" materials and of ongoing programs mid-stream, and summative, which appraises a program after the fact. Did it meet its stated objectives and national need?

The last-minute "afterthought" approach to evaluation is only a few percentage points better than useless. Actually, as was the case in El Salvador, a feedback unit ought to synchronize with the program producers from the start, to pretest programs before a full series is ever transmitted officially. In reality, it may be that outside help has

to prepare the questionnaires, the instruments for sound inquiry. But eventually this task must be done by trained LDC specialists themselves. More needs to be known about the process of formative evaluation. In nonformal education programs even less has been attempted. The question the educator must answer about his program is "Has someone learned what you hoped he would? If not, what program modifications may be required?" Better methodologies for formative and summative evaluations should increase this likelihood, and have a pay-off in heightening the efficiency of the whole educational process.

Priority #2 - Improving Educational Efficiency

During the sixties a remarkable circumstance occurred in LDC education. Enrollments jumped at the rate of 6 percent a year, 60 percent in the decade.[14] On the face of it, this should augur very well for the total growth of developing lands.

Available data also indicates that about half the children do not finish the third grade, and that it takes an average student 12 to 17 years to finish sixth grade because he drops out or repeats.[15] The inefficiency of such educational systems is apparent.

With enrollments growing, school systems have ballooned -- but with little change in organization, method, or orientation. Curriculum? Mainly the same as always. Classroom instruction? Traditional techniques. The clientele may be bigger, but elitist, colonial-era methods persist.

Simply changing appearances won't help much. One school administrator suggests that:[16]

> Until we stop our futile efforts at minor adaptations of our obsolete egg-crate schools and build a new organizational and administrative structure, we have small prospect for success in gaining the full potential of recent advances in science and technology to dramatically improve learning.

Yet, it is not realistic to expect countries' education budgets to increase substantially. Increasingly, countries must work within already available resources to give attention to many aspects of the educational system including: modern organization and management, different staffing and new analytical tools.

2. (a) Encourage new kinds of organization and staffing to make alternative learning environments more efficient.

Ideally, education engages one human being with another. Education is, or should be, a "people" business. Without losing sight of this ideal, the traditional labor-intensive ways of instruction and school operation cannot be afforded to meet the increasing educational needs in today's world.

To engineer for change, a "managerial revolution" may be required. New thinking is in order. If a language lab is more cost-effective the more hours a day it is used, then schools must turn this reality into practice. To do this, re-ordered leadership will be required. Innovative staffing patterns must be tried. If the teacher supply is inadequate, attention must be given to the alternatives, such as the use of auxiliaries, laymen, even pupils themselves. The concept of differentiated staffing merits more study and application to the LDC arrangements.

Again, educational technology is an option, a strong one, but one which may demand very radical and new organization. Yet we need greater understanding about such key questions as the best mix of media and human delivery agents for a given nation. If professional teachers are in short supply, what other personnel inputs are necessary in combination with a medium's message? Also, in combination with new organization, what new approaches to educational budget management can be applied?

2. (b) Improve the understanding of modern fiscal management of education, for greater efficiency and cost reduction.

Developing nations have to make their educational budgets go farther. In many countries, budgets have reached plateaus. So the available funds will have to work harder, or differently, which will require new fiscal management and an understanding of the alternatives available.

The challenge, of course, is how to improve the quality of life, yet reduce educational costs. Most school-system administrators in developing or developed countries are not prepared for this degree of planning.

> In the decades ahead, administrators will be required to make many complex decisions which they are not now being prepared to make wisely.[17]

To be sure, there are sound suggestions on how a nation might cut educational costs. Edgar Faure's associates had various recommendations (in the face of "one of the most difficult problems to solve"). Attendance could be staggered, using double shifts; "radically different" teaching methods might be tried; and semi-qualified teachers, well-backstopped, could be hired. And, not to be overlooked, a nation should consider "employing cheaper 'media' than formal schooling."[18] TV may not seem cheaper, but in the Ivory Coast, they count on it to lower costs. Teachers had to be upgraded, which may increase costs per student from $60 a year to $80. But by increasing efficiency, the Ivory Coast hopes to reduce from fifteen to eight the number of years a student takes to finish the primary grades. This would drop the cost per pupil from $900 (for the 15-year sequence) to $640 (for the 8-year completion).[19]

However, financing of the educational technologies cannot be viewed in a vacuum. Will they, in the first place, lead to more efficient use of existing resources? Also, introducing media will bear on a dozen other factors -- substantial matters like revised teacher training, uses of nonprofessional monitors, problems of space, schedules, materials distribution, maintenance. It becomes essential to understand all these aspects of fiscal management and what their ties are to the whole educational decision-making process.

2. (c) Stimulate the use of management information systems for improving decision-making and general efficiency.

The new science of management information systems, which has developed in the United States during the past 35 years, may offer LDCs methodologies to be adopted for increasing efficiency. Better planning on a continuous basis obviously aids decision making and may provide for effective learning.

The 1973 AID strategy paper on education defines the first of AID's program emphases having to do with "education/human resources development needs":[20]

> The need for improved analysis of the education sector, leading to better diagnosis of deficiencies; improved design of, and planning for, change; and attention to the economics of education .

To sharpen the analysis first demands a lucid statement of objectives, then explaining how these can be met, followed by writing a comprehensive plan of action. As a prelude, planners must know how

to assemble the necessary data -- enrollments; percentages of dropouts, repeaters, individuals not being educated at all; teacher turnover, etc.

After plotting the dimensions of the current educational crisis, Coombs determined that education-systems management must be modernized, or the situation will worsen:[21]

> Unless...systems are well equipped with appropriately trained modern managers -- who in turn are well equipped with good information flows, modern tools of analysis, research and evaluation...the transition of education from its semi-handicraft state to a modern condition is not likely to happen.

Given adequate information and analytical tools, planners can begin to decide whether, how, where and how much to harness the technologies to the educational reformation of their nation.

2. (d) Increase consideration of relating educational facilities to changing learning patterns, in both formal and nonformal education.

Salaries are the greatest burden to a nation's operating education budget, but "facilities" -- the new school building, as a key example -- can have a sizeable impact of their own. Too many politicians have what Dr. Miller calls the "tombstone complex," for which building a school is ingenious therapy.

Too often, the school is built, and then people sit down to decide on its particular program. This parallels putting media hardware before the software cart, before the educational problem has been dissected.

There is nothing sacrosanct about school facilites. Edgar Faure's commission saw this and wrote:[22]

> School space is no longer necessarily a cell containing thirty or forty individuals...Multi-purpose areas with mobile partitions and separate booths can be adapted at will to large or small groups or to individual study... (The school) is becoming at once a club, a workshop, a documentation center, a laboratory and a place of assembly... The typical school building has lost much of its importance in countries with limited resources.

As alternatives, says Faure, there should be new relationships between teacher and pupil, creative pedagogy, even classes in tents. To serve a nomadic population in the Fars region of Iran, educators tried "schools without buildings"; results have been "often superior" to traditional classes nearby. The developing countries, concludes Faure, "would be better advised to focus most of their attention on the non-material aspects of schooling."[23]

Why not bend the facilities into working for parents and community? In Laos, Liberia, the Philippines, and Sierra Leone, parents are brought into the schools to help design education.[24] In some places, the school's library has become the public library, its assembly hall the local theater, its workshops and sports facilities available to adults after hours and on holidays. The primary schools of Tanzania are open to the entire community.[25] Equipped with adjustable space, the facilities can be used for adult education, a day-care center, a kindergarten, a training center for small village industries.

But if new buildings must be built, they should reflect the advent of the technologies. The egg-crate design has little relevance and less adaptability for the hardware of the second industrial revolution; and yet the dynamic community's school layout should.

2. (e) Initiate the development of inexpensive, durable technologies for appropriate extension of formal and nonformal education.

The educational media can do wonders. But they can also be discouragingly costly, complex, cumbersome, and fragile. American educators have cringed at their costs; once acquired, their complexity and fragility have created more problems than the strained patience of teachers will gladly entertain. Small wonder the equipment sometimes gathers dust. It should not be suprising, either, that these same problems, and this same outcome, would transfer easily to LDCs in their uses of educational hardware. If technologies are to be used extensively in developing lands, changes need to be made.

Much of the hardware sold to school systems is designed mainly for uses other than educational. Prices are geared to what the commercial market can bear and in many cases the equipment shortly becomes obsolete. Equipment frequently is not good enough to meet the needs of the classrooms.

To be practical for LDC use, the technologies must be simplified. Prices must be far lower. Sturdiness must be stressed. Special hazards such as the effects of persistent heat and humidity have to be researched and countered. This will require a new cooperation between

the educators and the manufacturers. They will have to be shown with charts that they can develop a major market in LDCs -- if they can just solve the problems inherent in so many devices.

Nor does this issue stop with the electronic media. TV programs without associated handbooks for teacher and student have little business being on the air. So, ways must be found for developing very inexpensive printed materials, particularly for use in rural areas.

Priority #3 - Increasing Access to Education

Increasing the access of child and adult to both information and education may be the most critical issue facing educational planners. Without question the educational technologies represent one way to meet that challenge.

The immensity of the problem can be counted in terms of people, measured in hundreds of millions. On the plus side, almost 650 million are being educated today in formal institutions around the world, according to Faure's Unesco Commission.[26] But in contrast:

- More than half the total population of developing regions have never been to school. Less than 30 percent of their young people go to secondary school; less than 5 percent continue on to college.

- Between 1950 and 1970, the world's rate of illiteracy dropped from 44.3 to 34.2 percent. But the actual number of illiterates has grown from 700 million in 1950 to 783 million in 1970. At this rate, by 1980 the percentage of illiteracy may be down to 29 percent, but the real numbers will stand at 820 million.

- Between 1960 and 1968, the number of children between 5 and 14 who did not go to school increased by 17 million. Following that curve, by 1980, youngsters of that age group not attending school will total 230 million, more than one-fourth of the world's illiterates.

- In 1968, 40 percent of African children eligible for primary school were actually enrolled; 15 percent of those eligible for secondary school were attending. In Asia, the figures were 55 and 30 percent, respectively; in Latin America, 75 and 35 percent.[27]

And so education that Americans would consider basic is bypassing tens of millions elsewhere. Acknowledging these figures, Faure and his associates concluded:[28]

> Since the end of the Second World War, an immense effort has been made to extend school enrollment for children and adolescents and to combat adult illiteracy. It has produced considerable results. However, it is becoming evident that even if this effort were increased to its utmost, using the same means as in the past, it would not enable foreseeable needs to be met.

To increase access to education, a great deal must be done. Existing institutions must be used to dispense education, and more flexible routes should be perfected. It is increasingly evident that equal access to a rich learning environment is not possible by traditional means. Some recourse to technology may be essential.

It would be wrong to imply that access has to do only with formal education. On the contrary, it is, if anything, even more vital in nonformal education, in efforts to improve the quality of people's lives by advising them on agriculture, nutrition, health, and family planning. Here, technology can be of tremendous importance, particularly for those in the rural areas of the evolving countries. If the urban adult is frustrated by lack of educative communications, then the far-distant rural adult is crippled by it.

3.(a) <u>Extend formal education to more people through educational technology</u>

An array of now familiar problems discourages the assumption that formal education can be expanded through conventional means. As one alternative, nations might embark on programs encouraging self-learning. This approach, says Edgar Faure, "especially assisted self-learning, has irreplaceable value..."[29] Then he offers a critical footnote: "The effectiveness of solitary study is greatly enhanced by acquiring techniques for self-instruction and having many auxiliary aids available."[30] To help people teach themselves, schools should incorporate new technologies -- language labs, programmed and personalized teaching aids, and audio-visual equipment.

As another alternative, TV may be used to reach large numbers of students. American Samoa's undertaking outlines the potential of this medium. Originally, these islands had 43 elementary schools, supervised by teachers who had on the average a fifth-grade education. Then, in 1964 TV was introduced, not to enrich or supplement, but to carry the main weight of instruction. In time, six broadcast channels were activated, and today the studio produces 200 instructional programs a week for some 10,000 students.[31]

Not without its problems, the Samoan system nevertheless involves a sizeable concept, of which TV is only one part. That concept has key building blocks -- comprehensive curriculum reform, a break

from rote memory to more conceptual learning, production of instructional materials reflecting the Samoan environment, and an administrative reorganization. It represents a fundamental rebuilding of the islands' educational system, and relying heavily on broadcast TV.

3.(b) Expand information and educational systems in rural areas through educational technology

AID has concluded that "the very poor, the rural populations and the socially or ethnically isolated continue to have least access and the lowest quality of education."[32] Those in rural sections seem to be the most deprived, victimized by geography, locked into isolated villages.

Julius Nyerere has described how children in African villages traditionally "learned by living and doing ... Education was thus 'informal'; every adult was a teacher to a greater or lesser degree..."[33] Through careful research, educational technologies -- the smaller portable media -- could build on that tradition to help those isolated for generations enhance their quality of life.

There is a wide range of practical information that should reach villagers and farmers with ease. Family planning, nutrition, and health advice, as well as agricultural information, should be brought to them. Lester Brown tells of the "Green Revolution" and its beginnings in Mexico in 1944; Mexico had previously depended upon the U.S. for its food supply.

A quarter of a century later, wheat output had tripled, and that of corn had doubled.[34] Perhaps the specific ingredients of the "Green Revolution" would not apply across the board for LDCs. But appropriate messages about agricultural innovation should be transmitted, and technology could bear much of the burden. Change agents in the nearest village could be trained to use audio cassettes as one device to carry the story to the most remote of the farms.

In some countries, a framework already exists for applying technology to this kind of education. Kenya's Red Cross operates centers for village women, who come to live at the site for four weeks of classes on hygiene, nutrition, home care, and animal husbandry.[35] Again, audio devices with pre-recorded commentary could share the teacher's tasks. So might colorful comic books, silent, single-concept films, or, in time, even video cassettes.

A variety of problems must be solved before the effective use of technology in the countryside becomes feasible; for example, how to quickly and efficiently replace disabled units, where and how to get suitable, stable power. But the variety of technologies increases almost daily. If one medium is too elaborate to be successfully employed in the remote countryside, then research can indicate others more suitable for that task.

3.(c) Extend formal education to different groups in nonformal environments

In 1968, after reviewing the crisis in education,

Philip Coombs concluded that a key ingredient in the strategy of response must be innovation.[36] It would not come automatically or easily; it might be politely received, then just as politely shelved. But "it must become a way of life for education." Coombs wrote:[37]

> Learning takes time and it takes motivation, and millions of youngsters and adults who cannot get to school have plenty of both. What they need beyond this, however, is access to the "stuff" of learning. Surely, with all the modern miracles of communication... some systems could be devised to feed the appetites of these learning-hungry people.

Edgar Faure's international study group argues against simply continuing education in schools.[38] "All kinds of existing institutions, whether designed for teaching or not ... must be used for educational purposes." they believe. Those who aspire to higher education should find it "accessible through many different paths and at any age, in many forms ..." There should be "less formalism" in institutions, a "more flexible framework." No individual, says Faure, should be "compelled to give up using educational services for life if he leaves the system." On the contrary, all procedures should encourage his lifelong pursuit of learning.

3.(d) Use educational technology as a means for carrying out the concept of lifelong learning

Education is not a phenomenon bound by the walls of a schoolhouse. Nor is it limited by the student's completion of twelve years of instruction. Lifelong learning can exist where the motivated student seeks it, and the media can serve as tutor and guide.

It is scarcely surprising that the Faure report counts lifelong learning as its very first principle for innovation:[39]

> Every individual must be in a position to keep learning throughout his life. The idea of life-long education is thekeystone of the learning society.

Certainly the technologies can and must help. Choosing the most effective technologies for this purpose, however, is a crucial challenge in itself.

NOTES

Section II, Part A

1 This and all references to Dr. James G. Miller throughout this summary are based on Dr. Miller's report, Research and Development Priorities in Instructional Technologies for Less Developed Countries (Washington, D.C.: Academy for Educational Development, 1973).

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5 Edgar Faure, et al., Learning To Be: The World of Education Today and Tomorrow (Paris, UNESCO, 1972).

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24 Schramm, Big Media, Little Media.

25 Ibid.

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33 Faure, et al., Learning To be.

34 Lester R. Brown, Seeds of Change: The Green Revolution and Development in the 1970's (New York: Praeger Publishing Company, 1970).

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37 Ibid.

38 Faure, et al., Learning To Be.

39 Ibid.

Part B - Selecting the Media

Introduction: 40 Media Possibilities

There are no less than 40 instructional media that LDCs might consider. A brief summary of the media, along with a number of different characteristics to be considered in an LDC, is set forth in the table that follows.[1]

CHARACTERISTICS OF VARIOUS INSTRUCTIONAL MEDIA

Instructional Medium	Can user carry it around?	Can user use it individually at school or college?	Can user use it individually at home?	Can user determine when it is to be used?	Can user control rate of information flow & repeat if not understood?	Can user interact actively with input?	Is indi-ualized "branchi possibl
Tutorial sessions or small group discussions	No	No	No	No	Sometimes	Yes	Rarely
Class lectures	No	No	No	No	No	No	No
Lettering, writing on blackboard, charts, flash-cards, flannel boards, diagrams, graphs, maps, fotonovelas, billboards, rubber stamp designs	Often	Yes	Yes	Sometimes	Sometimes	Yes	No
Stage scenery sets	No	No	No	No	No	No	No
Letters, written papers, documents, books, work-books, comic books, tests, programmed textbooks, other printed educational materials, newspapers, journals, pamphlets, com-puter print-outs, Braille writings, punched paper tape	Yes	Yes	Yes	Yes	Yes	Sometimes	Only wit programm textbook
Demonstrations	Sometimes	Sometimes	Sometimes	Sometimes	Sometimes	Sometimes	No
Dramatizations	No	No	No	No	No	No	No
Exhibits	No	Sometimes	No	Yes	Yes	Sometimes	Rarely
Field trips	No	No	No	No	Sometimes	Sometimes	No
Photographs, filmstrips, film loops, microfilm	Yes	Yes	Yes	Yes	Yes	No	No
Teaching machines	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Silent motion pictures	Yes	Sometimes	Rarely	Rarely	No	No	No
Filmstrips, film loops, or slides with audio tapes, sound-on-slides, audio fil	Yes	Yes	Yes	Sometimes	Yes	No	No

CHARACTERISTICS OF VARIOUS INSTRUCTIONAL MEDIA
Continued

Instructional Medium	Can user carry it around?	Can user use it individually at school or college?	Can user use it individually at home?	Can user determine when it is to be used?	Can user control rate of information flow & repeat if not understood?	Can user interact actively with input?	Is i ual: "bra pos
14. Sound motion pictures	Yes	Sometimes	Rarely	Rarely	No	No	
15. Telephone	No	Yes	Yes	Yes	Yes	Yes	
16. Broadcast live instructional radio	Yes	Yes	Yes	No	No	Yes, if feedback	
17. Telewriting, telewritevision	No	No	No	Rarely	No	No	
18. Audio tapes, cassettes, cartridges, records	Yes	Yes	Yes	Yes	Yes	No	
19. Dial-access audio tapes	No	Yes	Rarely	Yes	In some systems	Rarely	
20. Teletype, telegraph	No	Yes	No	Yes	Yes	Yes	
21. Closed-circuit audio lectures	No	Yes	No	No	No	Yes, if feedback	
22. Radiovision	No	No	No	No	No	Yes, if feedback	
23. Slow-scan TV	No	No	No	No	No	Yes, if feedback	
24. Broadcast live instructional TV	No	Yes	Yes	No	No	Yes, if feedback	
25. Closed-circuit live instructional TV	No	Yes	No	No	No	Yes, if feedback	
26. Broadcast tape-recorded instructional TV	No	Yes	Yes	No	No*	No	
27. Closed-circuit tape-recorded instructional TV	No	Yes	No	No	No*	No	

CHARACTERISTICS OF VARIOUS INSTRUCTIONAL MEDIA
Continued

Instructional Medium	Can user carry it around?	Can user use it individually at school or college?	Can user use it individually at home?	Can user determine when it is to be used?	Can user control rate of information flow & repeat if not understood?	Can user interact actively with input?	Is ual "bra pos
28. Facsimile transmission	Yes	Yes	Possibly	Yes, during hours sender is able to transmit to user	No	No	
29. Audio pointer	Yes	Yes	Yes	Yes	Yes	No	
30. Phone vision	No	Yes	Yes	Yes	Yes	Yes	
31. On-line computer aids to learning & scholarship	No	Yes	Rarely	Yes, unless too many other terminals are in use	Yes	Yes	
32. Instructional computerized games and simulations	No	Yes	Rarely	Sometimes	Yes	Yes	
33. Computerized programmed instruction	No	Yes	Rarely	Yes, unless too many other terminals are in use	Yes	Yes	
34. Videotape or disc recorders	Possibly	Yes	Possibly	Yes	Yes	No	
35. Video language laboratories	No	Yes	No	Yes	Yes	Yes	
36. Computers which output visual words and numbers, moving and still pictures, and audio language	No	Yes	No	Yes	Yes	Yes	
37. TV information storage	Yes	Yes	No	Yes	Yes	Yes	
38. Holographic information storage	No	Yes	Possibly	Yes	Yes	Yes	
39. Instructional interactive TV, time-shared TV	No	Yes	Yes	Yes	Yes	Yes	
40. Dial-access instructional TV	No	Yes	No	Yes, unless too many other terminals are in use	Sometimes	Rarely	

As seen by Dr. Miller, these are not just new era third and fourth generation electronic devices. Rather, included are conventional forms such as lectures, charts, workbooks, and field trips. The 40 media are compared in terms of such characteristics as their portability, degree of student interaction, whether or not the medium's signals can be carried on an electronic network, and costs per user-hour.

By no means do all the media score high. Less than half are portable. A student could use slightly more than half at home, but in some cases would have to coordinate his schedule with that of a group. Many of the devices give the individual control over the rate of information, but some do not; for example, students rarely exert any influence on the rate of progress of class lectures, which Dr. Miller feels is one of the primary reasons why lectures are far from perfect learning situations.

Most of the 40 media preclude the student's interaction with them. A notable exception is the small discussion group. Also, very few permit "branching," in which the individual is given an intensive review only of things he does <u>not</u> know. Computerized programmed instruction allows for this; broadcast live TV and radio do not. As for appealing to sight and hearing, face-to-face situations (lectures, etc.) do this, while books and texts do not. And because TV does, a case could be made for labeling it more intimate and direct than books, radio, or a computer terminal.

Most electronic media have something important in common: They can be transmitted over channels and networks. In theory, they can be sent from any point and used at any other. This, observes Dr. Miller, "facilitates diffusion of knowledge and makes possible democracy of access to educational information." Recognizing the commitment previously recommended to "increased access," this is a capability to remember when final choices of media are made.

As for costs, a few generalizations are noteworthy:

1) Lectures are less expensive than small group discussions;

2) Electronic media may not have the advantage of human contact, but some of them can turn out to be as cheap as, or cheaper than, face-to-face teaching;

3) Printed materials may seem to be cheaper than most electronic technologies, but may not actually be when the latter are used with large numbers of students.

4) Electronic media projecting image and sound will be more expensive than those presenting sound alone;

5) Computer-related media are far more costly than other media.

Keeping developing countries' specific needs and resources in mind, one can make some observations about each of the 40 technologies.

1) There are several strikes against the small group session. It is more expensive than traditional teaching, and it requires trained teachers.

2) Class lectures are expensive, too, but less than small groups. Again, the teachers must be trained.

3) Lettering, writing, etc., also demand trained teachers, but costs of the devices are low.

4) Stage scenery sets are of limited use, and quite costly.

5) Written papers, documents, books, newspapers are effective enough, but using them with a large number of students can result in heavy charges for reproduction and distribution. Programmed textbooks have one unique advantage: The student can interact with them, and "branch."

6) Demonstrations are distinctly specialized, principally useful in science education.

7) Dramatizations may be costly, but there's no substitute.

8) Exhibits offer modest value for science and history.

9) While of use for geology and applied arts, field trips can be quite expensive.

10) Photos and filmstrips are fairly expensive with no chance for interaction. They have none of the advantages of sound and motion.

11) Teaching machines are a major medium. They are flexible and encourage interaction. But they're too costly to be broadly useful in LDCs.

12) Silent films are expensive and provide for no student interaction.

13) Filmstrips and slides with audio tapes can be expensive. Again, no chance for interaction or "branching".

14) Sound motion pictures can demand big budgets, and do not invite interaction. TV permits economical distribution.

15) Telephone network transmission may not be dependable and costs are high.

16) Broadcast live radio is another major medium, even though it has no pictures and no interaction option. Its costs can be very low for large numbers of users.

17) Telewriting and telewritevision are new, interesting, but not yet in wide use. Given a feedback channel, students can interact, but it is an expensive addition.

18) Audio tapes, cassettes, cartridges, and record players lack a visual component, and have the advantages and disadvantages of radio. Portability could be a big plus.

19) Dial-access audio tapes are expensive. So are their network circuits.

20) Teletype and telegraph are relatively costly, and networks for them may not be adequate or even available in LDCs.

21) Closed-circuit audio lectures, usable in an entire school, can be more economical than single-class lectures. But this technology demands a multi-speaker system.

22) Radiovision is expensive. For one thing, its visuals have to be delivered to district, school, or class.

23) Slow-scan TV offers still pictures in series, without motion. Attention can wander. The technique needs testing.

24) Broadcast live TV may be a major medium, but it does have shortcomings. No "branching" is possible. Costs are high, even though sizeable audiences could be involved. Maintenance and power supply may be problems.

25) Closed-circuit live TV is limited by local talent and the need for accessible TV sets.

26) Broadcast tape-recorded TV is much like live TV. One difference: A student can interact with live TV, if there is a feedback channel. He could <u>not</u> interact with the tape.

27) Closed-circuit tape-recorded TV is like its live equivalent, only on a smaller scale. Again, there is no opportunity for interaction.

28) The need for a good phone system clouds the outlook for facsimile transmission, an expensive medium.

29) Audio pointer, with the characteristics of a teaching machine, is little known, quite untried and expensive.

30) Phonevision needs a phone network or other channels not always existent in LDCs. It would be costly.

31) One-line computers are too expensive at this time.

32) The same holds for computerized games and simulations.

33) Computerized programmed instruction is a major medium, mainly because it can create a flexible learning environment. A student can interact and "branch." Costs may be beyond reach, but hardware experts say they will decrease.

34) Video tape and disc players rate as another major medium. A student may not be able to interact with them, but they have advantages. The individual can control scheduling, and can replay a program at whim. Costs are high, but should decrease.

35) Video Language labs are untried and may be too costly for LDCs.

36) Computers generating visual words and numbers and audio language are much the same: Experimental and too costly.

37-40) The same verdict stands, as of now, for TV information storage, holographic information storage, instructional interactive TV, and dial-access instructional TV.

Even though this listing of Dr. Miller's 40 technologies is compressed, key words come through, words that can affect, but not always fix, the decision on which ones would be most promising in an emerging nation. In the new era of individualized instruction, "flexible" and "student interaction" can count for a lot. "Too costly" and "experimental" would help to veto a number of the 40. So might requirements for special distribution systems. At any rate, it is apparent that a number of the technologies have no place in R&D projects designed for developing countries.

The Five Media with Promise

Looking at their potentials and remembering certain realities as well, Dr. Miller concludes that five sets of media hold out "particular promise" for education in LDCs. They are:

1) Radio - more precisely, broadcast live instructional radio,

2) Television - broadcast live instructional TV,

3) Audio Media - tape, cassette, cartridge, record player;

4) TV Media Alternatives - video tape, or disc players; and

5) Programmed Instruction - programmed textbooks, teaching machines, and computerized programmed instruction.

These are media from the past and for the future. Some have been available for half a century; radio, for example, was introduced in 1919 at the University of Wisconsin. But some of the other devices are relatively new. Videotape, introduced in 1956, went into studio use in 1958. The Teldec video disc, developed by A. E. C. Telefunken and British Decca, moves to mass production this year. Self-instruction machines emerged 50 years ago, yet the uses of programmed instruction for education have been subjected to intensive R&D only in the past two decades. And von Neumann's prototype computer, "Johnny", started operating barely 20 years ago.

By no means do each of these sets of media apply equally well for all developing nations. This is not Dr. Miller's message. On the contrary, his advice says: Determine first what the educational problem is, then see which, if any, of these media can help to solve it best. Schramm's advice would vary only in his urging that media be considered in a plural sense. The experience of the sophisticated Swedish educational system and Britain's Open University counsels him that a "media mix" may be the best approach -- "whatever... a particular course and particular classes seem to require."

There is considerable debate about the suitability of television for developing nation education systems.

Television is notoriously costly in money, ideas, personnel, and facilities. Armsey and Dahl offer their own warning here:[2]

> While, for many, "instructional technology" means "instructional television," the evidence is not conclusive as to the ways in which instructional television offers greater advantages as an aid to learning. Because the production costs and effort requirements are greater in television, both developed and developing countries should explore some of the other "things of learning."

Dr. Miller makes no special brief for TV. But it could lead to that goal already cited, "democracy of access to educational information." To be sure, he says, introducing TV "may require creation of a formal, politically and socially acceptable institution to operate the program." But, he adds, the "nucleus for this may already exist in an educational radio system or public television service."

Careful attention must be given to both the practical and political realities of a country. Perhaps a developing nation should select media other than TV -- the "small," rather than the "big," to borrow Schramm's terms. But if it already has a TV station (and most do), and if its ministers have seen the likes of "Sesame Street" on their assignments to the U.N., and if they have heard about instructional TV efforts in El Salvador and the Ivory Coast, then a judgment leaning toward popular sentiment (and away from the austere and clinical) is likely to be made. And if good TV can lure people toward learning, can that decision be all bad?

The Use of Radio

During the thirties millions of Americans were captivated by radio. But only a very small group saw that radio might educate as well as entertain. The change in attitude since then has been barely perceptible.

Elsewhere, radio has been an effective educational tool. The BBC's instructional programs on English as a second language have been in use in more than 60 countries. For 15 years, Japan, Austria, and Germany have operated "schools of the air." Australia has organized effective two-way radio service for isolated children in the nation's "Outback." And many LDCs have not been far behind. India, Brazil, Togo, and Morocco, among others, use radio to spread instruction on health, agriculture, community action, and literacy. Colombia' Radio Sutatenza has been impressive, building a remarkable system of public education. With AID support, Kenya combined radio and correspondence to improve teacher-training; outside aid has now stopped, the project is continuing with national support, costs have dropped below those of traditional teacher education, and academic objectives have been met in a shorter period of time.

With all of this, Dr. Miller feels that radio still has "not lived up to its potential." Too often it has become only a supplement, not the core of a course. And "showier" media like TV have drawn attention from it. But it can teach. He points to one study which concluded that, used with audiovisual aids, "both TV and radio were better than print, but radio was more effective than TV." A farther plus for radio is its lower cost.

A comparison in Brazil estimated the costs of radio at one-third to one-quarter the cost of TV.[3] And Schramm found that in a 1971 appraisal at NHK, Japan, production of TV programs ran 5.4 times as much as radio programs produced under largely the same circumstances.[4]

In summary, radio can be used effectively for educational purposes. Miller finds that the "greatest promise of instructional radio lies in its ability to present high quality teaching at relatively low cost when used in conjunction with other educational tools." Armsey and Dahl state it simply:[5]

> Developing countries may be more able to attain real gains in educational effectiveness through radio than through television.

And Dr. Schramm takes the position that "If there is a medium for nonformal education, it is radio." As support, he notes Paul Theroux's study of rural radio in Uganda. Almost nine out of ten rural families had no electricity -- but 36.3 percent had radios.[6]

The Use of Television

Five years ago Godwin Chu and Dr. Schramm looked at the research, then buried a hitherto relentless question about TV and education:[7]

> ...it has become clear that there is no longer any reason to raise the question whether instructional television can serve as an efficient tool of learning... The questions worth asking are no longer whether students can learn from it, but rather (1) does the situation call for it? and (2) how, in a given situation, can it be used effectively?

El Salvador, Niger, and American Samoa have all shown in the past few years that TV could do far more than just supplement ageless teaching methods. In each, TV has become the catalyst for educational reform at all levels. El Salvador's work with this technology has been exemplary.

The educational reform in El Salvador was directed initially to the junior high school level, or Plan Básico. When the first three-year phase ended, 40,000 junior high pupils had been in classes taught by retrained teachers who had as their tools a new curriculum involving TV. Today, the nation is beginning to expand the TV system to serve a much larger population of primary school children and adults. A major lesson has been learned: Technology, responsive to national commitment, can bring about rapid educational change.

Of genuine interest to other lands, a basic evaluation of TV's usage for education has been carried out in El Salvador. A team from the Academy and Stanford University's Institute for Communication

Research probed three of the main areas of concern -- organization and procedures of materials development, student attitudes and achievement, and training teachers to use instructional TV. In the first area, certain problems surfaced:

- a lack of experience in writing modern tests;
- the TV screen's shape severely limited the number of letters to be shown at any one time;
- some tests over TV had been poorly timed;
- supervisors should have collected test results more quickly;
- there was a need for feedback about student performance so that programs could be improved; and
- deciding how much to revise the programs after sifting through feedback was its own kind of problem.

In respect to teacher-training, the Stanford team analyzed the attitudes of those retrained and of those who had not yet completed the program, then observed:[8]

> Teachers using television in their classrooms showed very favorable attitudes toward television instruction at the beginning of the year and even more positive attitudes at the end. Two other teachers' groups in retraining, who had not yet used television, were more skeptical but still positive in their attitudes toward ITV.

With respect to student attitudes and achievement, the evaluation findings include:

- There was significant student learning gain in every course, in every grade, for every generation of students.
- In all three generations of students, the ITV students gained 15-25% more on general ability tests than did

their non-ITV peers.

- ITV students in all three generations completed the ninth grade with an achievement advantage over the non-ITV students.

The main point made about the El Salvador enterprise is that TV helped in significant ways to bring about substantial reform there. A great deal of information is available to researchers and planners from the El Salvador experience which perhaps, in time, other nations can assimilate with all that this implies in terms of savings and efficiency.

Of course, cost is of real concern when the technology is TV. No one denies that start-up charges can be enormous. But once the equipment is in place, once the children and adults of a nation are within reach of a TV signal, then the benefits can begin to materialize. "Sesame Street's" example reflects the potential.

For the 1973-74 season, "Sesame Street" had on its shelves 130 hour-long shows -- new, and yet not quite new. Fifteen minutes of each hour is brand new. The balance (filmed animations of numbers and letters) came out of one or another of the program's first four years. (This, in itself, represents major economy). It has cost the Children's Television Workshop $6,000,000 to produce and assemble these programs for the season ahead. [9]

During this season, those 130 programs will be transmitted once over the public network, then repeated in their entirety. So the shows available ought to be read as 260 rather than 150.

To introduce a further ingredient, in February 1973, the U.S. television rating service estimated that 8.5 million homes were tuned in to "Sesame Street." The Workshop knows the series also plays to sizeable numbers in schools, but it has no head-count. Nevertheless, it has assumed a gross audience of 9 million.

Applying that audience figure to the $6,000,000 budget yields a unit cost of 66 cents a child for the entire 130 shows. Figuring in the repeat of the entire series cuts that cost in half to 33 cents a child for the 1973-74 broadcast season.

Admittedly, the Workshop has used the Rolls Royce approach -- major New York studio, highly paid creative staff, one of the top TV directors in the country. However, when those charges are spread across a large (and growing) audience of children, the fiscal effectiveness of "Sesame Street" can hardly be disputed.

But this does not say that using TV guarantees safe passage to reduced costs. Rather, other benefits ought to be looked for. Messrs. Schramm, Coombs, F. Kahnert, and J. Lyle make a pertinent point about American Samoa:[10]

> (It) is not reducing its school budget by adding television; indeed, it has greatly increased it. But Samoa is betting that with television it can very substantially raise the (qualitative) level of its schools much faster than would be possible by the only other feasible method considered available -- a long-term program of teacher-training and replacement.

In their "Inquiry," Armsey and Dahl theorize that perhaps a saving might be realized from TV use through a "restructuring" of the teacher's role. Perhaps greater learning effectiveness can be found with TV. But at this time "major instructional television projects should be considered as experimental and not have to carry the burden of cost reduction."

On balance, Dr. Miller regards TV as a "young giant" in education. True, it is less than perfect. Live TV cannot be scheduled at students' discretion. Nor does it allow for "branching." Still, it has "great strengths, most of them inadequately tested."

The Use of Audio Media

In sharp contrast to TV and its significant hardware requirements, the "small" media may be better suited to developing country education, especially in rural education. Radio has long demonstrated its capability in this respect, as Dr. Schramm describes at length in "Big Media, Little Media." This would seem to be a tenable forecast also for the other audio technologies -- tape, cassette, cartridge, and record player.

Very possibly, records may be on their way out, yielding to the more durable, equally portable tape formats. In either case, the devices can offer music and language with real technical quality. But there are differences. Once the record has been pressed, its flexibility is less than say, a 2 1/2" x 4" cassette. Holding up to two hours of information, the latter can be stopped or started easily at will, and can be erased

and reused for new audio material. If anything, this format and the other audio technologies seem to be more suited to the challenges of LDC education.

Considering the distinct needs of rural education, inexpensive cassettes can carry into the village the sounds and culture of the city, but this is contrary to the objectives of most development programs. More importantly, these formats can pursue the special needs of the countryside -- instruction geared precisely to rural life, discussion of work opportunities, training of village leaders as lay teachers, and guidance for farmer and family on strengthening crops or health.

The applications may be unlimited. Armsey and Dahl hold that the "economy and ruggedness of audio technology recommend it for careful consideration for applications in developing countries..." Dr. Miller cautions that "appropriate for education as these audio media are, they have been subjected to little investigation or evaluation." They may not encourage student interaction or branching, yet they still seem "admirable" for LDCs and well worth systematic research.

The Use of TV Tape Alternatives

The American market for the video tape or disc player is just awakening, and it will be at least several years before they find their way broadly into the institutional communities of schools and business. Several more years will pass before many of them appear in American homes. Even so, their implications for developing-nation use merit early consideration.

Ostensibly, these formats are close kin of conventional TV. Standard studio techniques apply to each. A particular program can be fed live, or through an intermediate videotape step, to cassette or disc. There the new technologies begin to diverge.

In tape format, two incompatible types of cartridge-loading systems are on the market. Sony's "U-matic" cassette holds up to 60 minutes of programming on 3/4-inch magnecic tape. Retailing at about $1,000, its player attaches to a TV set's antenna terminals. Meanwhile, AVCO's Cartrivision offers two cassette sizes (30 minutes and 114 minutes) for use in its playback unit, which will sell for about $300 as part of a TV set. Sony's tapes will not play on Cartrivision, and vice-versa, reminiscent of the standardization problems which have plagued many of the new media from record playing speeds to video lineation.

Sometime this year, the German-British video disc, engineered by Teldec, should be available to consumers. Its program disc, like a phonograph record, will be no more expensive than a standard "LP," if a large number of copies is pressed. An 8-inch disc can hold seven minutes of black and white programming, and a larger size, 15 minutes. Looking ahead, Armsey and Dahl believe this video-recording system has the potential for "drastically reducing" the price of programs.[11] A special player unit is needed; its cost: $250. A record-changer is extra.

At any rate, these three versions, and undoubtedly others, will be more available and at decreasing costs. The argument for any of these video players has three strands. They permit scheduling by the individual, whereas broadcast TV does not; the user can turn on the device at will, and rewind a program five or ten minutes back, to review a point. Also, in a few short years, the recordings should have all the quality of color TV, yet be inexpensive and easy to use. Thirdly, the user can record a program "off the air," at least with the video cassette.

Beyond educating students, these technologies hold promise for training teachers. Dr. Miller imagines their providing "a wide range of role models to the prospective instructor through the use of packaged materials..." Beyond that, the cassette could record a student-teacher's performance before a class, for analysis later by peers and instructor. (To do this, a small TV camera would have to be engaged with the player-recorder unit).

The incompatibility between formats will have to be resolved, but the technologies are bound to improve, while their prices drop, all to the advantage of developing nations. As time passes, predicts Dr. Miller, the video disc may be better suited for them, because it promises to be mass-producible at low cost.

The Use of Programmed Instruction

Virtually nothing on the horizon gives the individual more flexibility and independence than the media clustered here -- programmed textbooks, teaching machines, and computerized programmed instruction. However, to the education planner in a less developed country, patience may have to precede exhilaration over their potentials. The problem, of course, is that not all these media are to be had economically in any nation.

Their advantages are distinctive. They demand active responses from the student, provide quick feedback so the student knows if he's right or wrong, heighten learning efficiency, and encourage the student to pass himself without an instructor. This could be highly felicitous in countries with teacher shortages.

But there are significant problems. Obtaining programmed textbooks may not be out of reach, but access to a computer for education still lies in the future for many countries. Also, too little research has been done on relating programmed instruction costs to education budgets. Nor is it clear how well this instruction does tasks other than just providing information and supervising drills. Then too, personnel with abilities to develop programmed instruction may not be available in the LDCs. Still another impediment is the reliance on literacy to understand this kind of instruction.

Cost is its own kind of problem. American producers say a one-year elementary school course might cost between $200,000 and $500,000. A programmed text might cost $1 to $10.[12] This is not within the bounds for most developing countries.

Introducing a computer's uses may bulge a budget now, but the expense is certain to drop. One study cited by Dr. Miller found traditional elementary-secondary education costing upwards of 38 cents an hour; computer-assisted instruction (CAI) came to $3.73 an hour. To make the changeover worthwhile, the latter would have to be ten times as effective. But Dr. Schramm offers a different view from a 1971 study. In 1965-69, a physics course with CAI averaged $5.85 a student hour; CAI coupled with elementary math and English courses cost $3.73 an hour in 1968-71. Projecting forward, the study forecast $1.06 to $2.18 as the student-hour charge for a medium size computer distributing to a few satellite centers in 1975, and $0.34 a student-hour for a large computer system with wide distribution to learning centers.[13]

It seems almost pre-ordained that computer charges will drop, and sharply. By sharing programs, Dr. Miller believes, school systems could begin to cut into those costs. "There is no question that the use of instructional radio and television," writes Dr. Miller, "is better understood and more appreciated today than is computer-aided instruction." Given time, its "real strengths" will be better appreciated.

Interestingly, programmed instruction had a very provocative trial run in Rhodesia until it became independent in 1965, a chapter described

by Dr. Schramm in "Big Media, Little Media." Some 75 programs had been developed when the nation changed its political course. In one specific test, two groups of adults with only primary school background were to be taught arithmetic for measuring soil contours. One team learned traditionally, the other, by a program. In a pretest, the class group scored 36.4, the program group, 32.9. Then, in post-testing, the former went up to 48.6 while the program-instruction students scored 67.3. Concludes Dr. Schramm:[14]

> The test results from Rhodesia leave little doubt that programmed instruction works as well in developing regions as in economically more advanced countries.

NOTES

Section II, Part B

1 This and all references to Dr. James G. Miller throughout this summary are based on Dr. Miller's report Research and Development Priorities in Instructional Technologies for Less Developed Countries (Washington, D.C.: Academy for Educational Development, 1973.

2 James W. Armsey and Norman C. Dahl, An Inquiry Into the Uses of Instructional Technology (New York: The Ford Foundation, 1973).

3 Dean Jamison, Marshall Jamison, and S. Hewlett, "Satellite Radio: Better Than ETV," Astronautics and Aeronautics, 1969.

4 Wilbur Schramm, Big Media, Little Media: A Report to the Agency for International Development (Stanford, California: Institute for Communication Research, 1973).

5 Armsey and Dahl, An Inquiry Into the Uses of Instructional Technology.

6 Schramm, Big Media, Little Media.

7 Godwin Chu and Wilbur Schramm, Learning From Television (Washington, D.C.: National Association of Educational Broadcasters, 1967).

8 Robert C. Hornik, John K. Mayo, Emile G. McAnany, and Wilbur Schramm, Television and Educational Reform in El Salvador: Research Report No. 7 (Stanford, California: Institute for Communication Research, 1971).

9 Schramm, Big Media, Little Media

10 Philip H. Coombs, Friedrich Kahmert, Jack Lyle, Wilbur Schramm, The New Media: Memo to Educational Planners (New York, UNESCO, 1967).

11 Armsey and Dahl, An Inquiry Into the Uses of Instructional Technology.

12 Schramm, Big Media, Little Media

13 Ibid.

14 Ibid.

III. THE PROJECTS

Introductory Comments:

The Agency for International Development, in its September 1973 publication, The AID Education Program Strategy, discusses its work in educational technology as resting on the following set of principles:

1. Focusing on pilot and operational projects which aim at major breakthroughs to make the learning process more effective and accessible.

2. Providing qualified professionals to help make these pilot efforts successful.

3. Assisting in the development of programs that are problem-oriented, not communications-media-oriented. The approach is to work toward solving key problems rather than searching for uses of available technology.

4. Assisting in the development of professional competence on the part of LDC personnel, with particular stress on systems-oriented project planning, project administration, quality content, careful evaluation, and planning for continuing innovation.

AID describes this overall effort as essentially a research and development program, directed toward assisting the LDCs to choose, try out, perfect, and evaluate systems which ld significant promise. These principles have guided Dr. Miller and others in preparing the ideas for the research projects which are summarized in this Section III.

The word "research" can be applied to all the projects listed if it is used broadly. Some of the studies have the character of experimental research, in which a specific set of hypotheses is tested by

precisely measuring certain variables under tight controls. But the other projects include simulations, model designs, engineering feasibility studies, case studies, pilot projects, market surveys, system analyses, and development activities. We believe that the present state of instructional technology in less developed countries demands such a broad rather than narrow definition of research limited to experimental hypothesis testing.

The objectives of the studies are also diverse. They include studies of comparative cost-effectiveness, cost analyses, feasibility studies, forecasts of needs or resources, and efforts to improve ongoing operations.

A major step in designing specific research projects is analyzing an important, complex question into several smaller questions that are susceptible to investigation by the techniques of behavioral science. Many aspects of behavioral science are in such early stages of development that we cannot obtain satisfactory answers to some of the most important questions. When faced with the alternative of answering an important question crudely or a trivial question precisely, we have chosen the former. We have done this for two reasons: (a) that decision makers in less developed countries urgently need to have more information to base their decisions upon even if that information is tentative; and (b) that crude analyses often must precede sharper, more complex, studies of a phenomenon. We have, however, tried to plan all the projects so that ultimately the validity of their conclusions can be evaluated.

In every case, also, we stress the need to study the entire system with all its living and nonliving parts, as well as all their relationships and interactions, and not a single subsystem or component abstracted from the others for purposes of analysis. It is essential to consider a wide range of variables in analyzing the potential impact of any one technology on an educational system. Everything must be taken into consideration from the character of the decision makers to the characteristics of each medium.

We also emphasize the importance of conducting research in a realistic setting, one which is most similar to the environment one may expect in mounting a long-term, operational project based on earlier, more "experimental," research findings. Until very recently, no major educational technology based reform programs had operated for a significant period in a developing country environment. Many less-than-nationwide reforms had been undertaken and indicated successful use of the technologies, particularly radio. With the implementation of such nationwide systems as those in the Ivory Coast and El Salvador, a "natural laboratory" providing realistic settings for research began to be developed. Without such operating programs the researcher may be unable to test and evaluate the factors required to make a successful educational technology system, the analysis of which is essential to an understanding of the problem.

This will have major implications for research designs in such settings. In his "Notes on Instructional Cross-Media Comparisons,"

Wilbur Schramm argues for the use of "quasi-experimental designs:"

> In a situation where true experimental controls are simply not available to the researcher, and especially where he finds it impossible to randomize his whole population of subjects, quasi-experimental designs have much to commend them. As a matter of fact, most of the better media comparisons in developing countries have been done with quasi-experimental designs, although they are not always so advertised. . . (they) are done with non-equivalent control groups, equated by some kind of statistical treatment or matched on the basis of a pretest or other previous scores . . . Given the best designs he (the researcher) can find for his purpose, given ingenuity, he can still make highly useful contributions to policy and practice.

In the implementation of the projects, we recommend the minimum possible use of foreign experts consistent with competent research and the maximum use of nationals of the less developed country involved. Some of the latter may need first to be trained in the United States or some other established country in order to learn how to conduct dependable and conclusive researches. Every one of the projects may well lead to educational innovation, and it is desirable for constructive innovation to be accepted and implemented. Such acceptance is likely to be accelerated greatly if the problems are identified by citizens of the country rather than aliens, and if they state the hypotheses, design the researches and make the plans and proposals.

While some would argue that AID and other development agencies should focus entirely on the practical application of what is now known, the Academy's continuing review of the "state of the art" strongly emphasizes the urgent need for the kinds of research described in this report. As stated in the 1973 review of prior AID

supported research, this research must meet the "overriding criteria for judging future research possibilities: The probability that the research will facilitate changes in education that will make it significantly better, cheaper, or available to a wider number of people in LDCs within a reasonable period of time."

This summary of the projects excludes, for the sake of brevity, the description of related research projects, relevant existing literature, and further details concerning staffing and scheduling, which are cited in Dr. Miller's complete report. Also, the choice of research sites is tentative. It is expected that suitable alternative sites may be identified as part of the process of undertaking any one of the proposed projects.

GENERAL PROJECTS:

Before proceeding to describe the specific projects, three broad-guage projects should be presented. They are close enough to the main priorities and hold enough potential to warrant this, even though they represent a different kind of urgency than the 15 projects which follow. In each case, these first three are useful concepts; they ought to be implemented when resources allow. In scope, they have to do with creating an information system on educational technology, the development of a "media map," and the training of LDC personnel as evaluation specialists.

GENERAL PROJECT A:

Its purpose is to design an information storage and retrieval system to help LDC educators choose the best technologies for their needs.

The problem has been that no computerized service exists. There are repositories available -- ERIC's Clearinghouse on Educational Technology at Stanford, and the Academy for Educational Development's Information Center on Instructional Technology in Washington. Neither is computerized; both are manually operated. Both would be prime sources of information for the recommended service.

In the past, LDC educators have been subjected to American sales and consultant enthusiasms about what technology is available, and what might work best. Better access to information could help those planners make more rational decisions. Accordingly, a wide range of information should be included in the data bank -- from power require-

ments, to needed personnel skills and ingredient costs.

The research design sets out three developmental phases. In the six-month Phase I, advisers would be chosen from all pertinent fields. In the following year (Phase II), on-line, time-shared computer services would be rented, and the accumulated information read into the memory system. Then, in Phase III (18 months), the system would be made available to users throughout the world.

The system would be designed and established in the United States, at a three-year total cost of $1,144,000.

GENERAL PROJECT B:

Its purpose is to create a "media map." It would show how different media are being used around the world for formal and nonformal education.

The problem has been that competent, concerned observers have never had a panoramic view of what technologies are being employed, where, and how successfully. Where is innovation going on? Where has LDC acceptance been good, or bad?

The research phase would include evaluation and publication of information to provide the answers to these questions. A method of staffing would need to be established to collect the information, then keep it current.

GENERAL PROJECT C:

The purpose would be to provide resources for training programs for research personnel from LDCs. Most should be trained at the M.A.

level, while a few would be advanced to the doctorate stage.

The problem has been that virtually all the research on uses of educational technology in LDCs has been done by outsiders. This reflects, in part, the fact that a pool of trained research specialists does not yet exist in these emerging countries. It would be far better if LDC citizens could conduct more of the research.

In most countries much of the basic and critical research should be taken over by these developing nations as rapidly as possible. However, legitimate cooperation between LDCs and research centers in the U.S. and other countries could and should continue indefinitely.

Training of LDC personnel should take place at both American centers and in LDC institutions. At the same time, it will be obligatory to maintain a corps of competent American researchers who, by interest and training, can perform tasks for LDCs in the years to come. Already, large expenditures are made by AID and other development agencies in the training of LDC personnel. Little emphasis, however, has been placed on the training of personnel specifically in the area of educational technology. Through careful selection and review of candidates, a portion of the current training resources may be brought to bear on this priority need.

PROJECT NO. I: CULTURAL AND SOCIOLOGICAL VARIABLES IN EDUCATION

This is a study of cultural and social variables affecting formal and nonformal education in less developed nations: values, motivation, curricular content, and adaptation to new technologies.

Objectives. The objectives of this field study are to analyze the effects of the above-mentioned variables upon the attitudes of rural people in less developed countries toward the formal and nonformal educational programs that are offered to them and to their children, in order to find ways to make the course material more relevant, attractive, and useful to them.

Ordinarily, educational programs are planned by administrators who may not share the culture of the rural people, and in some cases do not use the same language. This is particularly true if a less developed country has recently been a colony of another society. In these places, the language of the schools and of the people may be different. Language differences can also be found in less developed countries in which more than one cultural tradition is represented--Spanish and Indian, for example.

A further problem with educational systems in many of these countries is that most of the graduates of the schools do not find jobs commensurate with their education. A report to The Development Assistance Committee of the Organization for Economic Co-operation and Development (OECD) estimates that in some countries jobs are available for no more than 10 to 15 percent of the potential work force. It is important, therefore, that the education offered should make two of its goals: (a) to improve the quality of the lives of people in their rural settings and (b) to prepare them to understand and participate in the social change and expanded opportunities that will accompany their country's development.

The research design. It is proposed that two villages in each of three different less developed countries, perhaps Cambodia, Peru, and Botswana, be chosen for field studies and demonstrations. If more than one cultural background exists in the country, villages should be selected so that the multiple cultures are represented, if possible.

The study team should approach the villages in a spirit of trying to learn as much as possible about the values, motivations, and attitudes toward social change and innovation held by the people. Since it is desirable to form a basis of generalization from which educators can learn, procedures should, however, be as comparable in all the villages

as is consistent with relevant and responsive community work.

Phases in the project should be:

Phase I, six months. Recruit three teams, one each for each participant country and plan the project procedures.

Phase II, 1 1/2 years. In each community selected for study carry out the following steps:

(a) Gain the cooperation of the local teachers, school administrators, and nonformal educators by explaining the goals of the project. This presupposes cooperation on the part of governmental authorities and the higher echelons of the educational system in the country.

(b) Identify and contact others in the community whose good will and cooperation are necessary to the project and explain the objectives to them in detail.

(c) Hold meetings for any members of the community who wish to participate. These would give them an opportunity to express opinions and feelings, make suggestions as to what sort of subject matter they would like to have dealt with in formal or nonformal instructional programs, state their reactions to the courses of study available to them, formulate goals for community change, and suggest how the unique aspects of their culture could be preserved and used to enrich the national life.

(d) In the course of these meetings, the special needs of each community would be determined and then, in the light of those needs, cooperative action to make education more meaningful could be undertaken. Particular emphasis would be placed on nonformal adult education, adapting it as appropriate to the traditional backgrounds of the adults.

(e) Data would be collected by taping the proceeds of important meetings and interviews and having all members of the staff write daily protocols or diaries. Periodically opinion surveys would be conducted in the community, including one at the beginning and one at the end of the community action period, as well as one at the end of a follow-up period of six months.

Phase III, one year. Follow-up period, data analysis, and final report writing and dissemination.

Estimated costs. The total necessary amount of human effort of the staff and consultants would be 27 man-years for each country, or 81 man-years total if the project be carried out in three countries, as suggested. We assume that the equivalent of 1 man-year of consultant time would be needed in each country in each Phase, but that the other personnel could be indigenous to each country. The costs for a study in three countries, then, would be:

Phase I, six months	180 man-months	$ 360,000
Phase II, 1 1/2 years	468 man-months	936,000
Phase III, one year	324 man-months	648,000
TOTAL	972 man-months	$1,944.000

PROJECT NO. 2: CURRICULAR MATERIALS AND INSTRUCTIONAL SOFTWARE WITH DIFFERENT CULTURAL AND SOCIOLOGICAL EMPHASES

This is a comparison of a range of alternative forms of curricular materials and instructional software, with different cultural and sociological emphases, for classroom instruction of children and nonformal education for adults.

Objectives. This study has as its prime objective a formative evaluation of curricula designed to replace the traditional academic programs currently offered in many less developed countries with academic and practical training more relevant to the socioeconomic realities of life in these countries and to the cultures of the peoples.

The subjects taught in the schools of many less developed countries have been those traditionally offered in European schools. They were imported into the curriculum of those nations when they were colonies of European powers. Textbooks, teaching materials of other sorts, and teaching methods have been imported with little, or insufficient, adaptation to the culture in which they are to be used. They refer to elements of foreign cultures, and picture people that may be almost totally unfamiliar to students, particularly those who live in rural areas. What is more, they are, in many countries, presented in a language that is not the common speech of the people. Even programs that have been developed for a culturally quite similar less developed country may have these faults, since dialects of the same language differ and the materials may reflect a way of life unknown to the students. Textbooks developed for use in London, Paris, or Chicago may show houses, furniture, electrical equipment, machinery and foods unknown in the less developed rural environment. Or a type of agriculture, common in another less developed country, may be depicted that deals with different crops than the students know.

In addition, in less developed countries that have recently been colonies, the unwritten assumption of the educational system may have been that its products should be as much as possible like their foreign administrators. The schools may have been intended to train civil servants for a colonial administrative structure. A report of a French educational project in Mandoul, Chad says:

> The irrelevance of the programmes and methods of primary education to the problems of the rural world had turned the schools into machines for producing civil servants and unemployed. Despite the growth in the Chad's civil-service force (from 6,926 in 1962 to 11,188 in 1965), public administration could clearly not be regarded as a normal job outlet for all school leavers. Enrollments in the

Mandoul Valley (19 percent according to the 1965-1977 BDPA socioeconomic survey; in fact 35 percent at present but with a far smaller percentage of girls than of boys) were on a large enough scale to keep adding to the group of idle school leavers, who were poorly integrated into their rural setting. In 1967, Mandoul was generating a yearly quota of 2,000 school leavers in this predicament.

It is no wonder, therefore, that motivation to continue in school may be low among both adults and children.

The best interests of the governments and citizens of less developed countries require that the education offered in the schools and nonformal instructional programs prepare students for useful participation in their society's processes. In most of these countries, demand for trained administrative and managerial personnel can be expected to increase, as well as demand for technologists of all sorts. At the lower end of the educational scale, literacy will become more and more necessary as mechanization of farming and industry proceeds. Social mobility, at a minimum in many of these countries, particularly for rural and lower class people, can be expected to increase.

On the other hand, the pace of social change in many less developed countries is such that job openings for trained people will be limited for some time. If a large number of such people cannot find jobs, social unrest and personal unhappiness can be predicted.

Ideally, therefore, the curricula offered should both provide people to fill positions in government, industry, and education and be relevant to people living in traditional rural environments.

The research design. This project would be carried out in two communities in each of three developing countries, selected for their cultural differences from one another. The communities chosen, however, should be matched as closely as possible on population size, educational and social status of the people, and occupational characteristics. In each country one of the communities chosen would be urban, the other rural. It is suggested that the location of the project be in a part of a city with ready access to a rural region. Since the small rural community will probably have but one school, a single school of the urban community would be selected, preferably one which served a predominantly working-class area.

Phase I, one year. The project would begin with an exploration, with representatives of the community, of what they felt to be their needs for formal education of children and nonformal education of adults. Some questions would be:

- What is their perceived need for literacy?
- How much interest have they in work-study programs?
- What need is felt in each community for technical training?
- At what level of skill do they want training?
- What are their reactions to their housing, farming methods, social organization, and need for health and nutritional instruction?
- What are their attitudes toward the existing educational system, and its teachers and administrators?
- What are the religious or tribal customs that would affect acceptance of any educational plan?

Discussion leaders would become thoroughly familiar in advance with statistical information about employment opportunities, developmental plans for the region and for the country as a whole, and budgetary limitations. Community representatives should be helped to see the realities of the country's educational problems.

Such free discussions would permit the impressions of educational planners to be checked against the existing demand for particular sorts of educational programs. They would also facilitate acceptance of programs.

Phase II, one year. This stage of the project would include the development, by the project directors, of alternate curricula suitable for the different sorts of communities with which they were working. This does not mean that every community in each country would have a specially developed educational system. Communities would, however, have some choice among a number of alternative programs.

Some considerations are:

- What would be the comparative cost of printing suitable textbooks and presenting content material over mass media?
- To what extent would work-study or apprentice programs fill the needs of the communities?
- What sort of agricultural instruction would be suited to the crops and farming methods of the country?

- Should some of the fundamental courses in nutrition, technical skills, health, and family life be designed so that they did not require prior literacy training of the adult students?

- To what extent would programs be interchangeable among the different age groups and different countries, with suitable language and cultural modifications?

These curricula would then be discussed with the communities involved, to obtain feedback on the basis of which adjustments would be made in them if necessary.

Phase III, one year. The last stage of the project would involve comparision of the educational goals and demands of the various communities in the different countries. The alternative curricula would also be compared. A final report on findings and practical effects of the study would be written. This project would recommend changes in the educational systems of the countries in which it was carried out. The curricula would be tested in the various sorts of communities in all three countries. After a suitable period, comparisons of literacy rates, unemployment rates, and other relevant variables could be made but these would not be part of this project.

This proposed study is obviously closely related to Project I above. Sociological and cultural aspects of education investigated in this study are relevant to the development of any curricular materials developed for formal or nonformal education.

Estimated costs. For one country the staffing requirements over the three phases would total 15 man-years, or 45 man-years for the entire project in three countries. The resources needed, phase by phase, would be:

Phase I, one year	216 man-months	$ 432,000
Phase II, one year	216 man-months	432,000
Phase III, one year	108 man-months	216,000
TOTAL	540 man-months	$1,080,000

PROJECT NO. 3: IMPROVING ACCEPTANCE OF INSTRUCTIONAL TV

This is a study of how to facilitate acceptance of an educational innovation, specifically instructional TV, by administrators, teachers, paraprofessionals, students, parents, and other key members of the community in less developed countries.

Objectives. Introduction of instructional TV as an educational innovation has usually been complicated by resistance and opposition on the part of key members of the communities concerned. Educators have felt that their jobs were threatened or that their relationships with their students would deteriorate. Parents, students, and other interested people have feared lowered quality of instruction. In some places these negative attitudes have been dealt with in an authoritarian way. Their existence, however, hampers both introduction and operation of instructional TV. The objectives of this research, therefore, are to survey countries that have recently begun to use instructional TV in order to anticipate the problems that can be expected to arise in countries planning to introduce such programs, and to find ways to increase understanding and reduce opposition to them.

The research design. This study would consist of four separate but related phases:

Phase I, six months. A series of confidential interviews would be held with people in less developed countries who have experienced the introduction of instructional TV into their communities. The interview schedule would be designed to disclose the sorts of resistances which were encountered, the groups, organizations, or individuals who were most influential in opposing or facilitating implementation of the programs, and the methods that were used to overcome resistance and gain cooperation in the involved communities. Less developed countries in which educational TV has been established include: Colombia, El Salvador, Brazil (Rio Grande do Norte), the Ivory Coast, Niger, Malaysia, Singapore, and India. Interviews would be conducted in these countries.

A written report would be prepared, presenting the results of these interviews. It would carefully protect the identity of interviewers if they wished and also omit any references which might be personally damaging to individuals involved in any way in the decisions about instructional TV.

The final activity of Phase I would be a meeting held in the United States and chaired by the overall project director. This would include representatives of the countries in which the interviews had been held, educational decision makers from the

countries to be included in Phase II (see below), experts in instructional TV, and consultants on attitudinal change and innovation. This would be a planning session for Phase II.

Phase II, six months. An experiment would be conducted in Brazil, Venezuela, and Nigeria, all of which are in the early stages of planning and introducing instructional TV. In each of these countries, two large cities would be selected for study. These would be cities that were to have instructional TV introduced within the next few months. In the first city, which would act as a control, no particular preparation for introduction of the innovation would be made. This has been the usual procedure in countries which have implemented their instructional TV programs. That is, a decision has been reached at the higher echelons of the educational system and communities have been expected to comply with it. Implementation has typically been resisted. In Brazil, which has experienced resistance to introduction of instructional TV into the state of Rio Grande do Norte and elsewhere, a representative community in that region would be chosen as a special control in addition to another community just beginning to use instructional TV.

The second city in each country would be assigned to the experimental condition. In Brazil, this would be in a state other than Rio Grande do Norte -- say, Rio Grande do Sul which now has plans to undertake a statewide TV program. In these communities, educational and governmental leaders would be interviewed to determine which members of the community could be regarded as leaders of opinion and "gatekeepers" for innovation. After these people have been identified, a group of 20 or 30 who were willing to participate in training sessions and to work as change agents, for remuneration would be formed. These could be expected to include educational administrators, school principals, community business leaders, teachers and student leaders from a number of different schools.

In each country, a week of meetings would be held in which the technical and educational aspects of the medium would be explained; key people from other less developed countries in which instructional TV had been established would share their experience; free expression of positive and negative attitudes would be encouraged; and modern techniques of attitude change such as role playing, viewing of filmed role models depicting the teaching process using the medium, and some of the methods of encounter groups would be used. These sessions would be conducted by a team of skilled consultants. The change agents would then begin to work on a part-time basis in their communities, holding meetings and interviews and consulting with

influential people. Also community attitudes on matters relevant to instructional TV and education would be tested by interviews and surveys to get a baseline measure. The survey sample would include members of involved segments of the population such as parents, students, teachers, educational administrators, and leading citizens.

Phase III, one year. Throughout this phase, the change agents would continue to work on a part-time basis. During this period the instructional TV program would be introduced in each community and data collectors would again test attitudes in the communities by means of interviews and surveys.

Phase IV, six months. This would be a period of data analysis and report writing. From this would result a book that would be designed to help developing nations with problems of introducing this and other technological innovations.

Estimated costs. The estimated amount of labor of the necessary specialists is 17 man-years. Most of them might come from less developed countries. To that must be added the labor of the change agents, data collectors, and secretaries, all of whom will be recruited locally. The costs would be:

Phase I	24 man-months	$ 48,000
Phase II	60 man-months	120,000
Phase III	180 man-months	360,000
Phase IV	72 man-months	144,000
TOTAL	336 man-months	$672,000

PROJECT NO. 4: COMPARATIVE EFFECTIVENESS OF TEACHERS VS. PARAPROFESSIONALS

This is a comparison of the cost-effectiveness of instruction by fully trained teachers vs. that by paraprofessionals, with and without the aid of instructional technology.

Objectives. The objective of this study is to derive cost-effectiveness ratios for several different systems of instruction in order to help educators in less developed countries select a suitable system for use in their schools.

Recent interest in teaching innovations has concentrated upon the use of instructional technology to supplement what a professionally trained teacher traditionally does. It is generally conceded that this is an effective way to teach. It is particularly suitable for professional or scientific education, in which a high degree of excellence is required. It is costly, however, since the costs of hardware and software for instruction by mass media are almost always simply added to current operating costs such as the salaries of trained teachers. Consequently most of the world's less developed countries either could not afford such instruction or would find it necessary to limit it. In some of these countries the shortage of fully trained teachers is great. As a consequence paraprofessionals, some of whom have a background of only a few years of primary school, must carry most of the teaching load. They may be called teachers, but they are not journeymen. The proper term for them is "paraprofessionals." They cannot be content experts, but must rely on some medium to present the subject-matter. They can, however, possibly learn how to manage the learning situation.

It is important, therefore, to explore alternatives by which educators in less developed countries can improve the quality of instruction they offer and remain within budgetary limits. These alternatives include not only ways paraprofessionals can be made effective as instructors, but different combinations of teachers and paraprofessionals with instructional media. An innovation in teaching method is another alternative -- the use of behavior modifications based on operant conditioning theory.

The research design. This project would compare the cost-effectiveness of eight different teaching methods. There would be three major variables: (a) The training of the teachers would be varied by using fully trained professional teachers in some classes and paraprofessionals in others. (b) Teaching methods would be varied by using traditional teaching methods in some classes and behavior modification teaching techniques in others. (c) Use of instructional aids would be varied

by using them in some classes and not in others. Such aids might be texts and workbooks, printed programmed instruction, radio, TV, or almost any other particular medium included among those discussed in the preceding section. Obviously the cost and effectiveness of these different media differ, but it is not proposed to make differences among media variables of the present study. Rather, a medium available in the country in which the experiment is conducted would be selected. If results justify it, a similar design could be applied in other countries at a later time, using another medium or other media.

Experimental conditions in this project would be:

Fully trained teacher

Without instructional aids

1. Traditional teaching

2. Behavior modification

With instructional aids

3. Traditional teaching

4. Behavior modification

Paraprofessional

Without instructional aids

5. Traditional teaching

6. Behavior modification

With instructional aids

7. Traditional teaching

8. Behavior modification

It is proposed that four classes be assigned to each condition, for a total of 32 classes. The four classes for any particular condition would be in a different school. Any school could have two or more classes participating in the experiment just so long as there were no multiple classes in it assigned to any given condition.

The experiment would take pl hree phases:

Phase I, six months. An initial planning period and training period for teachers and paraprofessionals who will use the behavior modification technique. The two types of teachers could be trained together since the techniques would presumably be new to both and both would have to change established teaching habits. The training would be conducted by an expert in the technique and he would use it in the training sessions. The intensive training course would last three months and include opportunities for practice teaching using behavior modification.

Phase II, approximately nine months. Instruction would be given in a selected course (e.g., 6th grade science) for one school year. The course should be one for which objective criteria of success and failure are available. The grade and average age of the students should be the same for all the classes. Cost considered in comparative cost-effectiveness calculations about the eight experimental conditions would include media costs, if they applied; teachers' and paraprofessionals' salaries; costs of traditional materials; and costs of a consultant to give the training in behavior modification and to supervise teachers and paraprofessionals using it. Effectiveness would be measured by pretesting of attainment in the subject-matter and regular monthly and final tests would be carried out. In addition, teachers and students would be given opportunities to express their satisfaction or dissatisfaction with the method by which they were taught.

Resistance to this project might be encountered by principals, teachers, parents, or political figures. In the United States, an attempt to use behavior modification experimentally in a suburban community did meet with popular resistance.

Phase III, six months. The final phase would be a period of data analysis and preparation of a written report. A major question would be whether paraprofessionals, likely to be less idiosyncratic than fully trained teachers, could adhere more closely to a behavior modification teaching schedule. Another question would be whether the lower costs of paraprofessionals' salaries could make up for the extra costs of instructional aids.

Estimated costs. It is assumed that all teachers and paraprofessionals as well as all media operating personnel in the project will be paid by the

host country. In addition the project would need a total of 10 man-years of personnel and the costs would be:

Phase I, six months	36 man-months	$ 72,000
Phase II, one year	48 man-months	96,000
Phase III, six months	36 man-months	72,000
TOTAL	120 man-months	$240,000

PROJECT NO. 5: INTRODUCING USE OF INSTRUCTIONAL TECHNOLOGIES

This is a management study analyzing alternative strategies for introducing use of instructional technologies in educational systems.

Objectives. The chief objectives of this study are to identify a number of strategies for facilitating introduction of educational technologies into less developed countries and to determine what is the optimal "mix" of them for a particular country.

The major problem in beginning to use instructional technology in any education system, whether in an established or in a less developed country, is the unavoidable initial expenditure which is required if the ultimate benefits are to be achieved. Since the costs of innovations of this sort are often greater than the costs of existing programs, the changes will usually not be undertaken unless the present programs are clearly less advantageous. Even then they may not be undertaken because the necessary funds cannot be obtained. Costs include those of discovering and developing the new course of action and obtaining whatever new artifacts such as buildings or equipment, or new employees are required. Other costs are the expense of training teachers, paraprofessionals, and other personnel in the new procedures, and the changeover costs from old to new procedures. Some of the resistance to change observed in educational systems arises from the greatly increased costs which initiation of innovations will incur. These costs may commit the educational system over long periods to the new methods of instruction and significantly reduce the funds available for capital investment and operation of the system.

Instructional technologies require specific sorts of hardware, as well as kinds of specialists who are ordinarily not parts of traditional educational systems. Programs must be developed. The society may have to expand or alter the equipment in its channel and net subsystem to provide more TV or radio channels and to extend them into towns and villages that have not previously had these media. Many more TV or radio receivers would be needed. Any textbooks in use throughout the system would have to be replaced with workbooks or other printed materials related to the new programs. Other technologies have other expensive requirements, such as slides or audio or video tapes, and machines to use them.

A further problem in installing a new instructional technology program is the resistance of teachers and local administrators who often believe they would be disadvantaged or inconvenienced by it, or who fear that the untried programs may be worse than the present one. Teachers do not take kindly to innovations which they fear would down-grade their profession or threaten their jobs and this is probably just as true in countries experiencing an extreme teacher shortage as anywhere else.

Moreover, educational administrators usually lack the time and/or the planning expertise to bring about a major instructional change. They do not, therefore, introduce instructional technologies at all or they do it in insignificant ways that do not increase student-teacher ratios or reduce the number of fully trained professional teachers needed. Or a restricted experiment may be tried which proves meaningless for real innovative change. Under those circumstances, the long-range potential of instructional technologies for greater cost-effectiveness cannot become apparent.

The research design. This study would take place in two phases.

Phase I, one year. A management research team that included an expert in educational technology, an educator, an operations researcl and a communications engineer would be sent to a less developed country that wished to introduce instructional technology into its educational system. This team would familiarize itself with current state of the educational system. They would concern themselves with the present budgets, the problems faced by the teachers and the administrators responsible for the system, and the number of schools or other educational programs included in it. They would also investigate the special problems of the country in relation to education, such as extremes of climate, transportation difficulties, economic weakness, or internal dissention. Then they would recommend a ten-year plan for the country's educational system, including a detailed budget which indicated how it would be feasible and economically practical to phase in widespread use of instructional technology, if that appeared desirable.

This plan would represent the optimal mix of possible solutions, some of which are as follows:

- Since the initial costs are probably the greatest obstacle to starting innovative systems in less developed countries, borrow money or obtain a grant. El Salvador, for example, obtained a loan from the United States to help it initiate its instructional TV program at the seventh through ninth grade levels.

- Temporarily cut the budget for new school building construction and repair.

- Temporarily cut the budget for some other less crucial part of the national economy.

- Take advantage of normal turnover to replace employees that will not be necessary in the new system with equipment, technicians, or trained paraprofessionals to function in the new system.

- Take advantage of the growth in demand for education that exists in most less developed countries, meeting it with technology rather than trained teachers.

- Use only technologies that increase effective student-teacher ratios.

- Instead of adding teachers, add paraprofessionals and technicians who are paid less and use media to present curricular content.

- Profit from advantages of scale by using mass media for the entire country or even share media when feasible with other countries, coordinating activities by electronic networks, rather than relying solely on independent instruction in individual classrooms.

- Have instructional information transmitted over mass media electronic channels and nets instead of transporting teachers, books, and equipment over the distribution network, which can be more expensive and less reliable.

Phase II, six months. If the proposed plan were accepted -- perhaps with modifications -- by the officials of the host country, Phase II would be undertaken if they should wish it. It would be directed toward decreasing probable resistance to the new plan by a public education program to explain it and facilitate acceptance of it by administrators, teachers, parents, students, and the general public.

Estimated costs. A total of 4.5 man-years and the monetary expenditures indicated below:

Phase I, one year	36 man-months	$ 72,000
Phase II, six months	18 man-months	36,000
TOTAL	54 man-months	$108,000

PROJECT NO. 6: TEACHER TRAINING WITH TV AND VIDEO TAPES

This is a pilot study of a nationwide teacher-training program using TV and video tape recordings in a less developed country.

Objectives. The objective of this project is to plan and carry out a pilot operation of a training program for teachers using TV primarily, rather than teachers in direct face-to-face contacts, to provide the instruction. Video tape recorders would be used to provide feedbacks in microteaching situations. This approach is novel because nowhere has an entire teacher training program based on instructional media been implemented and evaluated. A program of this sort with both radio and television is just beginning in Rio Grande do Norte, Brazil. However, the idea needs evaluation in other places. TV is proposed as instructional media.

Trainers of teachers have three important functions for the people they are training. First, they are a source of information on the various disciplines they are training people to teach. Second, they provide a role model of what an instructor does. And, third, they must act as counselors to the teachers in training as these people have their first opportunities to teach.

Because the training of people to manage the learning process, whether they are called teachers or not, is crucial to the success of an educational system, the problems associated with the training of instructors (or managers of the learning process) are critical. For example, in El Salvador the educational reform using television that is underway has as one of its basic activities the retraining and improved pretraining of teachers. This is a basic requirement for an increase in educational effectiveness, whether it be for an innovative media-based system or for the expansion of an existing educational system.

It is not hard to understand why the present training of teachers needs improvement. The average teacher-training institution--and its staff--in a less developed country is a place of low prestige, poor motivation, and second-class students. As in established countries, capable students prefer other institutions of higher learning. According to Coombs, the lack of first-rate trainers in teacher-training institutions "is the blistering rub in many countries."

Outside the formal education system the problem is not much better. Agricultural extension workers and community health workers are neither the best-paid nor the most prestigious employees of the agricultural and health ministries in less developed countries. The people who train them, if they are trained to be educators at all, rely much more on transmitting the basic skills required for the job than on the human requirements for persuading people to alter their traditional life

patterns. New skills are needed both by the trainers and by those they train if informal educational programs are to have an important impact.

Teacher training in less developed countries is often hampered by a shortage of capable instructors. In some such countries, many of the educators responsible for training teachers are themselves poorly trained but are still expected to give classroom instruction, supervise practice teaching, and provide individual guidance to teacher trainees.

The proposed program could capitalize on the strengths of the available instructors. They could continue and even expand their supervision and guidance activities while academic subject-matter and teaching of methods would be supplemented by information received by TV and video tape recordings.

The research design. This project requires intensive work in one less developed country. The country that is selected should already have some educational TV. Its officials responsible for education and communication must be committed to expanding the use of TV and other media in education. A need for improving quality of teaching should be recognized and a number of citizens of the host country should be capable of microteaching methods with audiovisual aids.

Phase I, two years. The first step is to find such a country and arrange to work with its educational administrators. Since the needs of each country are different, a teacher-training program must take account of the special educational requirements of the country for which it is designed. In each nation the training system in use will have special characteristics, the needs for teachers will vary, the stage of development of educational TV and its current use in education will be different. In addition, the country will have its own special cultural characteristics, political climate, and social structure that must be taken into account in designing a system. The country in which the project is carried out will also have specific requirements for numbers and professional attainments of teacher graduates.

After the country is selected and its needs determined, a planning team should work with representatives of the educational system of the country, talk with teachers and teacher trainers, and visit teacher-training schools. They should also study the communications facilities of the country, to determine what educational uses are feasible.

On the basis of intensive interviews with these representatives of the educational system, and applying research results and experimental findings from other places, they should then be able to plan the nationwide teacher-training systems they propose to implement. This plan would describe specific interactions of the various components of the system: teachers, trainees,

communications personnel and facilities, and educational administrators. It should be specific about the courses and other training experiences to be offered, their sequence, and details of the use of TV, video tape recordings, and other media. It should be possible, on the basis of the plan, to determine the qualifications and training of the instructors: the relations among all components of the proposed teacher-training system: and the bases upon which trainees would be evaluated.

Then instructional materials for TV, along with coordinated student workbooks and teacher manuals, would be prepared. Situations in which the students would carry out microteaching practice using video tape recorders to provide feedbacks would be described. Also the tests and other evaluation instruments to be used would be prepared.

Phase II, two years. For two years the TV curriculum planned would be tried on at least 200 teachers in training. Another set of 200 trainees instructed by traditional means would be compared on comparable measures of progress.

Phase III, one year. During the third year a final report on the pilot project would be prepared. If the approach appeared to be significantly more cost-effective than previous practices, it would be recommended for expanded application.

Estimated costs. The total estimated manpower needed for the project, excluding operating personnel from the host country, is 32 man-years. Assuming the TV facilities are available, the costs would be:

Phase I, two years	180 man-months	$360,000
Phase II, two years	132 man-months	264,000
Phase III, one year	72 man-months	144,000
	Video tape equipment	10,000
TOTAL	384 man-months	$778,000

PROJECT NO. 7: COMPARISON OF ALTERNATIVE FEEDBACK TECHNIQUES FOR THE USE OF RADIO IN NONFORMAL EDUCATION

This is a study to compare the efficiency of alternative feedback techniques for the improvement of nonformal educational programs in the rural areas of LDCs.

Objective. The problem addressed by this study reflects a widely evident need in LDCs, as well as several significant gaps in their educational systems. The overall objective of the study is the expansion and improved effectiveness of nonformal education in rural areas, for instruction having to do with agriculture, nutrition, health, of family planning. In evolving programs, the greatest amount of care must be given to drawing on the counsel and aid of village residents themselves, and shaping the materials to acknowledge their needs, customs, dialects, and attitudes.

The medium for this project would be broadcast radio. Perhaps no other technology is more prevalent in LDCs. Yet, with notable exceptions (Radio Sutatenza), radio is infrequently used for systematic education of rural citizens.

Where radio has been used, however, there is little or no efficient feedback mechanism. It is of the greatest importance for program planners to know as quickly as possible whether a whole range of factors (content, program tone, time of broadcast, frequency of broadcasts, degree of localism) meets with listeners' favor and needs. How can this be accomplished? The project will seek to capitalize on the existing strucure of leadership and existing communication network in the villages. No village exists without its leadership, its teachers, its senior citizens. These individuals will be encouraged to form the nucleus of the feedback system as such leader-figures already form the core of the village communications system. The project would face the problem of guiding them toward a new dimension of their normal communications ability.

The research phase would involve three steps:

Phase I, nine months. After forming a project team, invite a developing country with existing radio capability to participate.

In that nation, identify several communities in different parts of the country, yet within reach of the network radio signal. At the same time, select an equal number of communities as controls; they too should be within signal range. Within each of the experimental communities, an alternative mode of feedback will be developed for comparison.

Make contact with leader-figures in the test communities. Involve them in deciding on appropriate areas for nonformal educational broacasting, and invite their participation as feedback agents. Work out training programs for them, and develop a system for

expediting transmission of feedback to central points for transmission to program producers.

Begin production of suitable broadcast materials.

Phase II, one year. Conduct broadcasts to test and control communities. Use feedback to revise programs, as appropriate.

After six months, send evaluation teams to both sets of communities to determine the effectiveness of the broadcasts, and the attitudes of those (a) involved as feedback agents, (b) listeners in villages where feedback has presumably reflected their reactions to programs, and (c) listeners in communities which have had no feedback option.

Phase III, six months. Assemble data from field staff, village feedback agents, and production personnel. Write a final report.

Estimated costs. This project is designed to test the effectiveness of alternative feedback systems. To accomplish this in a reasonable period of time, it would be conducted in conjunction with an existing radio based information system, the costs for which are not supported by this project. The funding requirements for the feedback system are as follows:

Phase I	18 man-months	$ 36,000
Phase II	36 man-months	72,000
Phase III	9 man-months	18,000
TOTAL	63 man-months	$126,000

PROJECT NO. 8: SCHEDULING OF LEARNING SESSIONS

This is a study of the comparative cost-effectiveness of various time schedules involving more or less intensive interaction of students in less developed countries with instructional materials.

Objectives. The primary objective of this study is to determine the most cost-effective scheduling of learning sessions of students of different ages, using instructional TV, or instructional radio. A second objective is to discover whether the course of learning is significantly different with each of two instructional media. (An alternative project or projects would focus on only one medium).

The research design. Groups of adults and regular primary and secondary school classes will be assigned to one of four experimental conditions: (a) 50 minutes of instruction by one of the media five days a week, either with only students present or with a paraprofessional acting as monitor; (b) 100 minutes of instruction by one of the media five days a week under similar circumstances; (c) 20 minutes five days a week, with an additional 30 minutes taught by a trained teacher; and (d) 50 minutes of instruction by one of the media one day a week, the additional four days being taught by a qualified teacher. The subject-matter to be taught should be readily testable. English as a foreign language, and nutrition and health are suggested as content fields.

It is proposed that TV and radio be used in Mexico, and that in addition TV be used in Cambodia and radio in Sierra Leone. Use of both media in Mexico will control for contamination of media variables by cultural variables in the research design, which would exist if only one instructional medium were used in each country. This research design yields three categories of students x 4 learning conditions x 2 media, or 24 cells representing different variations in Mexico. At least 25 classes would hopefully be used in each cell, or a total of 600 classes. In Cambodia and Sierra Leone, since only one instructional medium would be employed, only 300 classes would be required unless more classes were desired in each cell of the research design. It is important to note that fewer schools than classrooms need be involved in the study since in a single school several classrooms could be used and the same rooms would be employed for nonformal education after regular school, in the afternoon or evening.

Costs would include the expenses of developing and producing programs and of transmitting them over the different media, as well as teachers' and paraprofessionals' training and salaries. Costs would perhaps best be calculated in terms of monetary units per student hour.

Effectiveness measures would include formative evaluation and summative evaluation at the beginning of the experimental period, monthly during it, at its end, and a year later. Tests would include measures of cognitive knowledge and of attitudes. Graduates' performance in the society would be measured a year later.

With these measures it would be possible to compare costs and effectiveness of the different media and various schedules for three levels of students in different countries.

Estimated costs. The estimated amount of labor for the necessary specialists, who would probably come from a foreign country like the United States, over the 3 1/2 years of the project, would be a total of 26 man-years, 10 in Mexico and 8 each in Cambodia and Sierra Leone. In addition, 12 man-years of specialists and secretarial and clerical personnel would be required in Mexico and 8 each in Sierra Leone and Cambodia. In Mexico the first year the project team would be made up of the principal investigator (who would coordinate the entire project and also direct the Mexican portion of it), an expert in research design and statistics, a radio-TV engineer, and two media programmers. These would all probably come from a foreign country. In addition, there would be two Mexican media directors, two actor-teachers, and a secretary. The team in Cambodia would consist of a research administrator, an expert in research design and statistics, and a media programmer, all from abroad. In addition, there would be a media director, an actor-teacher, and a secretary, all of whom would be citizens of the local country. A similar team would be used during the first year in Sierra Leone. For the next 2 1/2 years the team in each country would be reduced to the administrator, an expert in research design and statistics, a clerk, and a secretary.

The costs, then, would be as follows:

1.	Personnel recruitment, study design, and program development	250 man-months	$ 500,00
2.	Implementation of experiment	130 man-months	260,00
3.	Data processing and follow-up	130 man-months	260,00
4.	Data analysis	36 man-months	72,00
5.	Report writing	36 man-months	72,00
	TOTAL	582 man-months	$1,164,00

PROJECT NO. 9: METHODOLOGICAL STUDY OF EDUCATIONAL COST-EFFECTIVENESS EVALUATION

This is a methodological study of how best to carry out cost-effectiveness evaluation of formal and nonformal education, when utilizing educational technology and as a means to determine its cost-effective use. The magnitude of need in this area necessarily means that any one project is only part of the research effort which must be mounted by a number of agencies and countries during the next few years.

Objectives. The aspect of education using instructional technology which most urgently needs exploration is how its cost-effectiveness can be systematically and rigorously evaluated. Methods for measuring the costs of a given educational activity--which make up the numberator of the cost-effectiveness ratio --in such units as amount of money spent, number of personnel employed, or time required, are fairly well understood. But methods for quantifying effectiveness--which is the denominator of the ratio--are in early stages of development. More research to improve these methods is essential.

There are two sorts of educational evaluation, formative and summative. The former is a rather new concept; the latter has been employed for centuries. Formative evaluation, according to B. Bloom, is: "the use of systematic evaluation in the process of curriculum construction, teaching, and learning for the purpose of improving any of these processes." Summative evaluation is: "the type of evaluation used at the end of a term, course, or program for purposes of grading, certification, evaluation of program, or research on the effectiveness of a curriculum."

Both of these kinds of evaluation represent the use of negative feedbacks by the educational system with the objective of maintaining a high quality of instructional information flowing through the system in ways that will best facilitate student learning. Formative evaluation is a comparison of inputs (costs) with outputs (provision of effective or quality services or products) of a part of the total system. It is carried out during the preparation of instructional materials before they are transmitted to any of the students (except a small sample used as a population on which to pretest them). It is conducted by curriculum developers, teachers, and paraprofessionals who report pretest results or provide other feedbacks. On the other hand, summative evaluation is a comparison of the inputs (costs) with the outputs (provision of effective or quality services or products) of the total system. Ordinarily it takes longer than formative evaluation because the system must finish its services to the student, test him before graduation, and then follow him as an alumnus performing in the society for some time before it can complete a summative evaluation. This is done by (a) spokesmen that request informational feedbacks about the performance

of graduates or alumni, and (b) others that complete the feedback loop by transmitting to the educational system from its environment information about the performance of its alumni in the society.

The first objective of the proposed project is to improve the procedure for formative evaluation of various sorts of formal and nonformal education, both those involving teachers and traditional classroom procedures and those involving paraprofessionals or instructional technology. Such evaluation must make allowances for the particular characteristics of the society and culture in which the education occurs. Employing feedbacks in the creation of curricular materials assumes that the instruction can be more successful when the program format and schedule are modified by user reactions. For example, an artistically designed set of lecture-demonstrations may be pedagogically inappropriate for some students. Unless the staff has some way of both testing the effects of the program and modifying it in the light of these data, the instruction will not be optimally effective. To achieve the best possible performance, one must employ feedback loops including program development, followed in order by program presentation, student reception analysis of student reaction data, and consequent modification of program development.

It is common practice for curricular materials to be used in such media as face-to-face lectures, instructional radio, instructional TV, or cassettes, to be planned to extend over some given time span in a set manner. The plan decided upon at the beginning of the course is followed as program after program is produced. No effort is made to improve the lessons on the basis of reactions of a sample of learners, at least until the end of a formal course when some revisions may occur as the next year's course is planned. It is particularly hard to feed back results of instruction to teachers or curricular planners who use media that do not provide them direct access to their students. It is worthwhile to try to render the TV instructor, for example, as responsive to learner needs as the traditional face-to-face instructor can be.

The second objective of the proposed project is to improve summative evaluation of formal and nonformal education. This should involve development of reliable methods of quantifying the various sorts of inputs and outputs of the total system, as well as all its component subsystems and technological additions. The usual procedures of engineering evaluation should be applied to the technological aspects, but educational evaluation is more than that. It must measure the joint impact of the human and other components of the entire educational system.

The research design. It is proposed that a five-year activity be undertaken to develop each aspect of the science of evaluation of educational programs until a rigorous, reliable, and valid procedure is worked out which has general acceptance by a range of experts in the field from various nations. This procedure should be detailed in such

a way that it is applicable to a wide range of formal and nonformal educational programs, from the primary grades through graduate and professional schools and continuing education. It should be applicable to both formal and nonformal education. It should be sensitive to social, cultural, and ethnic differences among students. Also it should allow for the introduction of instructional technologies of any sort that potentially could improve the program under consideration.

Many of the other proposed projects which are outlined here include cost-effectiveness analyses. All of these can be carried out more adequately if the state of the art of educational evaluation is improved. If this project accomplishes its goals, its findings can be used in many subsequent researches and applications.

The application of educational technology to the improvement of cost-effectiveness in formal and nonformal education depends on the development of procedures to (a) clearly specify purposes, goals, and objectives; (b) design instructional experiences to achieve these purposes, goals, and objectives; (c) evaluate the extent of accomplishment of these purposes, goals, and objectives; and (d) use the evaluative data as a basis for altering and improving the instructional experiences.

It is desirable insofar as possible to introduce technology into a system only after cost-effectiveness analyses are made and reviewed. Sometimes these can be quite precise and quantitative, particularly if management information systems exist in the educational system which provide data relevant to these decisions. Under other circumstances, only a rough calculation of costs and benefits or effectiveness is possible by present methods, either because the relevant data are not available or because so many variables are involved that it is not feasible to measure them or to collect information about them. Below is a series of fictional examples of how such an approach might be taken to decisions on whether to use new instructional media in educational systems at various levels. Some of these examples may not be applicable to less developed nations because they are too costly, but others concern systems like some now operating in less developed countries. The evaluation methodologies illustrated are applicable in every nation.

(1) A school. An elementary school which has a large number of underprivileged children concludes that it may be desirable to use carrels in its first grade classrooms. Its purposes in using such carrels include: (a) To socialize children to the learning environment of the school by giving them periods when they are isolated from most extraneous information inputs and can carry out independent learning experiences. (b) To prepare the children for independent study in automated carrels which the school expects to introduce within two years at grades 3 and above.

Carrels are booths which constitute an interface between the student and some artifact from which he can receive information inputs. They

can be classified into two general types: general space carrels, an enclosure with a door by which the student may isolate himself from the environment for periods of self-initiated study; and multimedium carrels, which include in the booth a typewriter on-line to a computer terminal, a source of auditory inputs, a screen capable of showing letters or figures, graphic materials or television pictures, and a light pencil with which the student can respond to inputs by pointing to any part of the screen, which signals the computer where he is pointing.

Inside the general space carrel the student could use a book, a television set, a projector showing slides or movies on a little screen, or a record player with headset. In terms of effectiveness in learning how to carry out tasks in multimedium carrels, such a carrel would probably be best for the first grade, even though the students could not yet type, although they might push a few keys to send a limited repertoire of signals to the computer. They easily could look at the screen, use the light pencil, and listen to the auditory inputs. On the other hand, both the general space carrel and the multimedium carrel would accustom the student to a period of independent activity each day separated from the other students and inputs from them. In this latter learning experience they would probably be equally effective, and in the first grade this type of effectiveness would probably be more important than the other. The difference in cost of the two sorts of carrels is great. In calculating the costs of the carrels, the following considerations must be included: The purchase cost of each carrel and the rate at which it must be depreciated. The number of carrels for each classroom of 30 students; this might be either five carrels (each student spending one hour out of the six hours in the school day in a carrel) or ten carrels (which would permit each student to spend two hours a day). Maintenance costs of the carrels. Costs of supplies and equipment used in the carrels. Maintenance of equipment used in the carrels. Payment for extra time of teacher aides for using the carrels and supervising students in them. Even with extra equipment in the general space carrel, the average cost per student hour in each carrel if there are five carrels per room would be 25 cents in the general space carrel but at least $1.25 per hour in a multimedium carrel. In a school that has 300 first grade students the difference in cost would be $7,500 a year for the general space carrels versus $37,500 a year for the multimedium carrels. The costs of the latter would be far too great for the benefits obtained, so the former must be chosen. This is particularly true since adding these carrels would relieve no teacher time. It would simply improve the quality of education of the underprivileged children who had not been used to solitary activity before coming to school. By the time the pupils got to third grade, the amount of individualized instruction that could be obtained from a multimedium carrel and the saving in teacher time might well be enough to justify the relatively high expenditure for such carrels.

(2) A School system. This particular school system has already installed a closed-circuit television system connecting all of its high

schools. It now is trying to decide whether or not to buy video tape-recording equipment. The purposes and benefits which it expects such equipment to achieve are as follows: (a) To be able to develop special instructional programs that can be reused at various times of the day or week for different sections of the same class as well as in subsequent years. (b) To be able to use in the training of teachers video recordings of student-teachers operating in classes and of experienced teachers operating in the classes. (c) To be able to produce for commercial television special public service programs about the school system. (d) To increase the student-teacher ratio in some courses by having classes given by video tape lectures rather than by live teachers.

Among the alternative procedures to be considered are live teaching in traditional classrooms and moving pictures.

The costs of this proposed innovation include the money expended to buy the new equipment; teacher time used in learning to use the new medium and in taping materials; as well as lowered morale of those in the teaching staff who oppose the new procedure.

An analysis of cost-effectiveness ratios relevant to the decision to introduce the tape recorder is shown in the table below.

For the video tape-recording system, we assume that the probability (P_i) of it being accepted is about 50-50 (.5). This is determined by the school system management that makes the decisions whether to purchase the equipment, usually based primarily on attitudes of the teachers. Compared to movies or live teaching, its utility (U_i) may be rated relatively high (10) because of its convenience to the teachers. Its cost will be $10,000, and so C_i in the quotation is 10,000. This is the cost-effectiveness measure for the teacher and we will add to it a cost-effectiveness measure to the students based on the same formula, as follows: To the students it may not seem especially helpful compared to live teaching, so its utility to them is relatively low (2). The price is $4,000 for the year, which is the cost of the machine plus some technician time to operate it. It is an identical cost for teachers and students because it is the same equipment for both of them. The live performance on the television has a much higher probability of being effective (.9). The cost of $10,000 is the same in both cases, and high, because one or more live persons must be involved. It is highly acceptable to the teachers because they do less work than if they prepare television tapes (50). The students like to participate in a live professional teaching performance, so their rating is 10.

The moving picture has the lowest probability of success (.1) because it is difficult to find films that will do the job. On the other hand, films, when they are available, are cheap ($2,000). For the teachers the film has a low utility because they have to choose the film, load the projector, and show the picture. The students prefer films over black and white television because they like the color and the high

quality of production. They find there is generally better entertainment value in films than in television broadcasts (20). Finally, looking at the cost-effectiveness ratios, the decision is to invest in the video tape recorder.

Obviously the alternatives are close enough that other factors might decide. If a grant were offered to create a film library, so that the operating budget did not need to support it, that would swing the decision to moving pictures. On the other hand, if some of the best teachers enjoyed live teaching so much that they would leave if taped television or moving pictures were used, the wisest decision might be to raise the teachers' salaries and forget the video tape-recorder.

(3) A university. A private university over a period of 15 years had grown from 4,000 to 15,000 students. Most of the buildings used by the College of Arts and Sciences had been designed before this period of rapid growth. They had been built an average of 44 years before. A few large classrooms in the buildings could accommodate a maximum of 80 students but most of them could accommodate no more than 40 students. Small classes had been universal at the university until ten years before. It now became clear to the administration that if tuition were to be kept low enough that most of their applicants could afford it, they would need to raise the student-faculty ratio and have larger classes. Two alternatives were considered: (a) To build a new building including two classrooms capable of holding up to 500 students each, at a total cost of $2,500,000, or (b) To install closed-circuit television in all the buildings of the College of Arts and Sciences.

The goals which the college's president wished to accomplish were: (a) To increase the student-faculty ratio from 20 to 1, to 28 to 1, in order to keep tuitions down within a range students could afford. (b) To maintain or improve the quality of instruction as reflected by students' performance on various tests. (c) To minimize expenditures for capital construction and equipment.

The cost of the new building had been set at $2,500,000. Of this $1,000,000 was available in cash and the rest could be obtained from long-term loans from the World Bank or the United States Export-Import Bank. The building could be depreciated over at least 50 years. Maintenance costs for the building would be $9,000 a year. With interest charges included, the cost per year for the building would be $88,000.

A closed-circuit television system for all the buildings in the College of Arts and Sciences would have the following costs: Laying of television cables between all the buildings, $83,000; interconnecting all rooms with television cables and installing black-and-white television monitors in each room, $680,000; television studio, tape banks, and tape recorders, $128,000. Total $891,000. This cost could reasonably be depreciated over at least a 20-year period, so the cost per year would be $45,000.

Faculty | Students

$$E = \sum \frac{P_i \times U_i}{C_i} \qquad E_i = \frac{P_{fac,i} \times U_{fac,i}}{C_i} + \frac{P_{stu,i} \times U_{stu}}{C_i}$$

$$E_{vtr} = \frac{.5 \times 10}{4,000} + \frac{.5 \times 2}{4,000} = 15:10,000$$

$$E_{live} = \frac{.9 \times 50}{10,000} + \frac{.9 \times 10}{10,000} = 13.5:10,000$$

$$E_{film} = \frac{.1 \times 5}{2,000} + \frac{.1 \times 20}{2,000} = 12.5:10,000$$

E_{vtr} = effectiveness of video tape recorder

E_{live} = effectiveness of live teaching in traditional classrooms

E_{film} = effectiveness of moving pictures

Cost-Effectiveness Evaluation About Use of Tape Recorder

Research on live as compared to televised instruction suggests that students like televised instruction less but that it is not less effective. Use of televised instruction would make possible an average student-faculty ratio of 35 to 1, so that if the college were to achieve an overall 28 to 1 ratio, one quarter of the faculty time could be devoted to small group discussions and individual conferences as a result of savings by using closed-circuit television. This would also be true if large classrooms were used.

For a time it appeared that the nature of loans available meant that the administration could obtain capital funds but not equipment funds. Finally an agreement was reached, however, whereby the money could be used for either purpose. The management decision was then made to install the closed-circuit television. At the same time that this decision was made, the hiring rate of all departments in the college was slowed down over a four-year period so that gradually over that time the college would increase from its former 20 to 1 to the desired 28 to 1 student-faculty ratio. Costs were cut significantly and there was no clear indication that the effectiveness of education suffered. It might even have been improved. At the very least, tuition rates were kept down in an inflationary period.

The above three fictional examples indicate that rational cost-effectiveness analysis of educational systems are currently possible, even if the ultimate decision is political in nature, taking other considerations into account, as it should. The examples also illustrate the weaknesses of the present state of the art, particularly the difficulties in providing rigorous quantification of the effectiveness of system outputs. To this whole issue the design of the proposed project addresses itself.

Phase I (2 years). The following major methodological issues will be studied in this project with the purpose of developing specific procedures and instruments to deal with them in evaluating educational programs:

- Methods for setting explicit objectives (purposes and goals) of educational programs. Numerous approaches to this problem exist, some mentioned above. These will be compared in an effort to produce a standard methodology.

- Methods for measuring inputs or costs. These include such various elements as personnel, information, money, and time. Both capital and operating inputs must be considered. Many sophisticated and useful measures of monetary costs have been developed, but they are not enough. No single measure of inputs is adequate since the various kinds of inputs differ so greatly.

- Methods for developing agreement on what are the main subsystems or components which all organizational systems, and in particular all educational systems, have in common.

- Methods for measuring the important variables in the processes of each subsystem or component of an educational system. This is much more complex than simply testing students on their progress or providing other internal feedbacks.

- Methods for measuring outputs--quality or effectiveness. As we have indicated, this field is much less advanced than the measurement of inputs. Since outputs of educational systems are complex and vary along many dimensions, no single measure of them is adequate. Measures must be taken not only at the time of output (as when students graduate) but also later--measures of the impact of the outputs on the environment, on the suprasystem of which the educational system is a part.

- Methods of determining whether the educational system is meeting its objectives (purposes and goals) with optimal cost-effectiveness.

- Methods of identifying problems in subsystems or components which are decreasing the system's cost-effectiveness.

- Methods of treating critical problem situations in an educational system, by such means as changing the structure of the system, altering its processes, or incorporating the use of prostheses, such as instructional technologies.

- Methods of measuring the cost-effectiveness of systems of instructional technology from an engineering point of view.

- Methods of using computer simulations to evaluate and improve educational cost-effectiveness.

- Methods of reducing resistances to educational innovation and diminishing their threat to the persons involved.

- Methods of measuring cultural, social, and ethnic variables relevant to the evaluation of the educational process.

Phase II (2 years). The evaluation methods devised would be applied to a range of different educational systems in several less developed countries to see if they are satisfactory. Modifications would be made in the light of these trials.

Phase III (1 year). A book describing the new evaluation methods and their application to less developed countries would be written. Also conferences and short courses would be presented in the United States and in less developed countries, to train educators, researchers, and other specialists to use the methods.

Estimated costs. Estimated amount of labor for this study is 10 man-years a year for 5 years, or 50 man-years. This includes full-time and part-time professional, data analysists, secretarial, and clerical personnel, and consultants.

Phase I, 2 years.	240 man-months	$ 480,000
Phase II, 2 years.	240 man-months	480,000
Phase III, 1 year.	120 man-months	240,000
TOTAL	600 man-months	$1,200,000

PROJECT NO. 10: MAKING INEXPENSIVE TV RECEIVERS

This is a study of how to make inexpensive black and white TV receivers available in less developed countries so as to cut costs of formal and nonformal educational TV.

Objectives. The effectiveness of television for mass instruction has been demonstrated. At present, however, most of the estimated two billion potential buyers of TV receivers throughout the world cannot afford to obtain sets.

Development and marketing of black and white television receivers to sell at low cost would make possible mass instruction by TV in addition to recreational, political, and other uses of TV. If a sufficient market could be proved to exist, manufacturers or governments would probably undertake the necessary research to provide such low-cost sets.

The dual objectives of this study are, therefore: (a) to collect and analyze data concerning the number of prospective buyers of black and white television receivers during each year of the 10-year period 1973-1983 at several different costs in selected less developed countries; and (b) to determine the costs of manufacturers of the level of demand needed to induce them to enter the market at each of the different prices. Additional and important objectives will be to determine the appropriate conditions necessary to stimulate LDC production of inexpensive TV receivers and to stimulate an awareness on the part of potential manufacturers concerning necessary criteria for production of receivers for LDC use (e.g., material ruggedness, ease of repair and availability of power.

The research design. It is proposed to approach objective (a) by analysis of the market for TV in Asian, Latin American, and African countries. Objective (b) is to be furthered by contacting manufacturers to determine the market size at which they would be willing to invest in the necessary research on black and white TV.

Phase I, four months. The initial phase of the market study would be a review of existing statistics concerning population, income, availability of power, number of existing TV sets, and present use of the surplus income, to determine how much of the surplus is being spent on recently introduced products like cars, scooters, movies, and radios. Three to five of the less developed countries in Asia and similar number of Latin America and Africa would be studied. The sample would be selected to include countries of different sizes, stages of development, and developmental potential. Larger nations such as India, Zaire, and Brazil, which are now making or contemplating major investments in televesion, would be particular interest.

A market survey procedure would then be pretested by questioning small samples of potential buyers in different income groups in at least 3 less developed countries. After indicated revisions the survey would be administered to large samples in all the selected countries.

Phase II, four months. Japanese, American, and European TV manufacturers would be interviewed to secure their opinions as to the market potential and their estimates of the amount of research and development money they would be willing to invest for different projected demands. These would not, of course, be firm commitments but they would permit an estimate that could be used in conjunction with consumers' cost-demand curves.

Phase III, four months. The final part of the project will be data analysis. This would be expected to yield:

(a) A cost-demand curve for each selected country.

(b) An aggregated cost-demand curve for the total market in the less developed countries under consideration.

(c) Estimates of research and development costs for reducing the prices of TV receivers to a number of selected prices.

(d) Information as to the potential availability of research and development funds at different projected costs and amounts of demand.

Estimated costs. The estimated amount of labor for the necessary specialists is 5 man-years. To that must be added the local costs of the survey teams that are to be engaged in each country. Figuring on four people working for 3 weeks in each country, the total labor requirement for each country will be 3 man-months. If ten countries are surveyed, the total additional labor, beyond that supplied by the prime contractor, will be about 2 1/2 man-years.

1. Initial data collection and sample selection	2 man-months	$ 4,000
2. Survey design		
(a) Demand curve	9 man-months	18,000
(b) Manufacturers' opinions	6 man-months	12,000

3.	Test and revision of instruments	6 man-months	$ 12,000
4.	Field work		
	(a) Arranging survey and subcontracting	9 man-months	18,000
	(b) Survey	44 man-months	50,000
5.	Data analysis	9 man-months	18,000
6.	Report writing	5 man-months	10,000
	TOTAL	90 man-months	$142,000

This gives a total labor requirement for the project of 7 1/2 man-years for a survey that includes market studies in ten countries. A different sample size would obviously have different labor requirements.

PROJECT NO. 11: THE USE OF RADIO TO EXTEND FORMAL EDUCATION TO RURAL AREAS

This is a study to determine how radio may be used to extend a country's formal school system to the rural areas where little or no formal school infrastructure may exist.

Objectives. In Mexico, radio has been used to increase primary education in rural areas, while TV has carried secondary-level instruction into the countryside. The objective of this study is to draw on the Mexican experience to determine whether similar applications of radio can be made in developing countries.

The nature of the problem is suggested by the situation in rural Mexico, for which radio instruction was to become a solution. It is indicative that the nation's 1971 Constitution promises a primary education to everyone. Yet, of the 32,855 existent primary schools, only 6,400 offer all six grades of a standard primary-school education. In the state where the experiment was to be conducted -- San Luis Potosi, 260 miles northwest of Mexico City -- most children do not finish the primary level. Figures for 1968 showed, for example, that 68,342 pupils were enrolled in Grade I -- but only 14,155 were listed in Grade VI. Some drop out because they fail. Others have to work. Still others aren't interested. A 1973 AID study reports, " a major reason for the decreasing enrollment is simply the lack of school facilities." Mexico decided to put radio to work, to fill the gap. Planning began for a "radioprimaria" project in August 1969, and broadcasting started in the school year of 1970-71.

In 1972, a study of the new technological system was undertaken by Stanford's Institute for Communications Research. Among many conclusions, it found through testing that children taught by radio "were receiving an education comparable to that of the children in the traditional system. Original goals were not being observed religiously, but even so, "some basis was found for being confident that radio can be used to increase education in these rural areas." True, there were haphazard aspects. For one, less than half the radio schools had "an audible, functioning radio" on the day the evaluator visited. Teachers often provided the radio themselves. No new personnel had been hired to supervise the radio project, it turned out. It was not surprising, therefore, to find that the project differed considerably from school to school. Perhaps these growing pains are inevitable -- and soluble, in time.

The research design of this proposal recommends a period of four years and four phases of activity.

Phase I, six months. Analyze thoroughly the exact experiences encountered in launching and conducting the "radioprimaria" in Mexico. Summarize all appropriate conclusions as they might relate to initiating a similar project in another LDC.

Undertake to select a developing nation committed to the uses of technology in education, equipped with a radio system, and enthusiastic about emulating the Mexican project. Start initial field work.

Phase II, one year. Select an appropriate area in the host country for the project (state or region). Establish liaison with school officials there and in the national ministry.

Begin the development of formal education program materials for the eventual radio broadcasts. At the same time, develop relevant printed materials, and conduct training of teachers, project supervisors, and field trouble-shooters. Initiate a community information program to explain the intended project in all its dimensions.

Phase III, two years. Continue the broadcasts on a regular basis. Conduct periodic mid-stream evaluations, making necessary revisions. Hold bi-monthly meetings of key officials to analyze and respond to problems which have evolved.

Phase IV, six months. Through tests of pupils and interviews with teachers and officials, assemble data for a final report. This should include recommendations on (a) possible changes in the project, and (b) how the nation might extend the venture into other states or regions.

Estimated costs. Support required for the research and evaluation aspects of the project are as follows:

Phase I	9 man-months	$ 18,000
Phase II	36 man-months	72,000
Phase III	30 man-months	60,000
Phase IV	12 man-months	24,000
TOTAL	87 man-months	$174,000

PROJECT NO. 12: INCREASING IMPACT OF NONFORMAL INSTRUCTIONAL TV

This is a study of how to make nonformal instructional TV programs more relevant and interesting so that rural students in less developed nations are motivated to learn and continue their educations.

Objectives. The objectives of this study are to determine the effectiveness of locally prepared and presented TV programs in increasing the impact of nationally televised informal educational TV programs to which they are directly related. The study would test the hypothesis that active participation by rural people, including the opportunity to see people they know in broadcasts and to hear local problems discussed, would act as feedback and reinforcement in their learning process and would increase their motivation to learn and to adopt the innovations suggested by the programs.

A continuing problem for nonformal educational programs designed to teach such practical subjects as public health, nutrition, or agricultural methods has been that the rural populations to which they were directed have made only little use of them. People in these areas tend to follow traditional behavioral models and to be slow to adopt innovations. They may see little relevance to their own lives in the course content and therefore find it of little interest.

The research design. This study is planned to test the hypotheses that broadcasting motivates learning better:

- When examples are drawn from the local environment, community people participate in the programming and the broadcasting, and when the information very specifically relates to the day-to-day life of the community.
- When the programming reinforces each message through repetition.
- When coordinated printed materials are available as adjuncts to the broadcast and to help the listener evaluate his understanding of it.
- When there is feedback from students to the broadcaster.
- When there are concrete incentives to learning, such as access to jobs or services that were previously unobtainable.

The project can be carried out only in a less developed country in which rural areas have access to televised instructional programs and in which a network of local TV stations capable of initiating local programs exists. It is proposed that in one such nation, 12 experimental communities and 12 controls be matched insofar as possible on social and economic

variables such as population number, average income, occupations, educational attainments of adults, and access to television broadcasts.

The communities selected as controls would have their usual access to nonformal instructional TV programs. Both conditions would have available printed materials coordinated with the programs which would include periodic tests, similar to the madureza (8th grade equivalent test) materials in Brazil. The subject-matter of the experimental courses would be public health, nutrition, child care, or other courses considered by educators in the country to be important to improving the lives of rural people.

Prior to the initiation of the study, one or more government experts would visit all 24 communities to rate them on variables related to the course materials. If they were to deal with improved agricultural methods, a government agricultural expert armed with an interview schedule could visit, interview farmers, and observe both their attitudes and practices. If they were to deal with health, a public health nurse could interview people and observe the community. Relevant facts such as crop yields or infant mortality could also be learned for the 24 communities.

In addition to the programs and printed materials used in the control communities, the experimental communities would receive reinforcement and feedback intended to increase their interest in the TV programs and to facilitate their learning and acceptance of the ideas presented. A group worker would make regular visits to these communities to organize activities related to the televised courses. These would include one or more of the following, depending upon the interests and capabilities of the people involved:

(a) Clubs or organized small groups which would discuss the content of the instructional programs at regular intervals, expressing opinions, relating relevant experiences, and bringing up questions. Some or all of these discussions could be taped for broadcast from the local station.

(b) Clubs or groups which would create programs relevant to the course material, such as short plays, songs, case studies, or opinion surveys. The most interesting of these would be selected for broadcast.

(c) A visiting government expert, such as a doctor, public health nurse, sanitary engineer, or agricultural expert, could hold discussions or question periods with leading citizens of the community in which the particular problems

of the locality would be related to the content material of the couses -- such problems as special climatic conditions or insect pests. Also local superstitions or prejudices could be discussed at such sessions. Some of these sessions could be televised live in local studios or taped by portable TV tape recorders for later broadcast.

Feedback would be provided in these communities directly through information given in the local broadcasts as to the conditions in the community as compared to others in the country -- their crop yields, for example, or the number of cases of certain diseases. Feedback is provided also when people hear themselves or those they know or respect expressing positive attitudes. Members of the community not in sympathy with the ideas embodied in the instructional TV programs would tend to bring their beliefs into conformity with those of their neighbors, often but not always supporting the position taken by the majority of the group. The group meetings would continue during the entire peiod of the course.

Evaluation of the results of the experiment, comparing experimental and control communities, would involve several measurers:

(a) Periodic evaluations by the public health nurse or other expert, disclosing any change in the conditions or attitudes in the community.

(b) The amount of demand for printed course material.

(c) The number of people completing the course, as shown by the number of tests taken.

(d) Objective indices such as decrease in morbidity or increase in crop yields.

Estimated costs.

1.	First year	108 man-months	$216,000
2.	Second year	108 man-months	216,000
	TOTAL	216 man-months	$432,000

PROJECT NO. 13: INCREASING ACCEPTANCE OF INNOVATIONS IN RURAL AREAS IN HEALTH, NUTRITION AND FAMILY PLANNING USING RADIO AND LOW-COST MEDIA

This is a study to test the use of low-cost media for national programs of continuing education outside the formal instructional system directed to rural populations.

Objectives. The objective of this study is to determine the effectiveness of low-cost media in bringing about change in attitudes, knowledge, and practice with respect to the rural family's nutrition, health, and family growth. While a number of programs with similar objectives have been attempted in the past, those programs have not included adequate research and evaluation to determine the effects of the many variables which may enter into the improvement of a rural family's well-being. In Guatemala, beginning in 1973, an experimental program has been initiated to determine the effectiveness of alternative media systems for improvement of agricultural knowledge, attitudes, and practices of the small, rural farmer.

In this project the program is directed toward the family as a whole, integrating information which may have impact on the several principal problem areas emphasized by AID in its current development programs, namely health, nutrition, and population.

Families would be reached primarily through radio, with audiovisual aids and visual printed materials. Trained monitors would be used at the village level to heighten audience reception and participation in programmed activities. Then, teams of extension agents would reinforce the programs, helping residents directly, or staging demonstrations; they would also work to assure the availability of services described in the programs. The program would require integration of the several ministries normally providing services in their respective areas.

The research design recommends that the project be carried out in one country over a period of three years. Research would begin with data collection -- attitudes and practices in family nutrition, health, and education, per capita income, and related matters. Then, up to five communities of about 100 families each would be chosen for intensive evaluations. A system of experimental controls would be established, including (1) individuals in communities with the program activities and support services from the several ministries; (2) individuals in communities with the services, but without access to the education program; and (3) individuals in communities without programming or services.

At the end of the project, these conditions would be expected:

1) A report on the relative cost-effectiveness of various mixes of mass media to help formulate policy for national programs.

2) An administrative unit organized, staffed, and in operation, with staff members trained on the job, and an evaluation staff trained and in operation.

3) A materials production unit in operation, its staff trained through experience with production and evaluations of inexpensive materials and programs.

4) A suitable arrangement made for coordination among all ministries connected with the project.

Estimated cost. The program cost will be dependent on the availability of the personnel for program production and the adequacy of the radio broadcast infrastructure of the country chosen for the experiment. Ideally such a program would be mounted in a country where a single emphasis program has already been implemented, such as that in Guatemala. The cost for external assistance is estimated at $650,000.

PROJECT NO. 14: USE OF THE "OPEN UNIVERSITY" CONCEPT FOR SECONDARY-SCHOOL EDUCATION IN NONFORMAL SETTINGS

This is a study of one alternative means to extend formal education to different groups in nonformal environments.

Objective. The objective of this study is to investigate possible application of "Open University" principles and practices to high school level education in nonformal LDC environments.

The problem has been that in certain LDCs, such as Mexico, there are parts of the country without any high schools at all. It is possible that a specially adapted mix of media, mailed materials, and tutorial guidance can provide a remedy. But it will require an extraordinary amount of cooperation and intensive field work to safeguard investment in the research. Clearly, a tightly controlled, small-area project should be undertaken before any national efforts are contemplated.

The background for this proposal is, of course, Britain's "Open University" and the information now becoming available from similar programs. This enterprise provides adults in the United Kingdom with an opportunity to complete college-level studies by a novel kind of educational experience. Every week, each student is obliged to watch a TV program, listen to a radio show, and do a certain amount of home-based reading. Then, at periodic intervals, he has an opportunity to consult with a tudor at a regional learning center.

America's recent pre-occupation with so-called "non-traditional study" at the college level has been stimulated, in good part, by the advent of this novel British enterprise. Certain colleges in the United States already are experimenting with the packet of materials prepared by the "Open University" for use in Britain. In a word, it represents an intriguing effort to create a "university without walls".

There would be no easy, automatic transfer of the concept to a developing nation. Careful study of the British and other approaches would have to be appraised for application to a particular LDC situation and how "Open University" might become "Open High School".

The research design. The research design suggests a project running for three years and taking place within one nation. That country must have in place a means of networking radio and/or TV to urban and non-urban areas, and also must lack an adequate pattern of high schools.

Initially, the research would concentrate on assessing the "Open University" formula and its counterparts in other areas. Time would be invested in a theoretical adaptation of the general concept to a particular LDC, through cooperative involvement of outside experts with educational planners in that nation. This process, including selection of the host country and project team, would occur one year.

In the second year, broadcast and printed materials would be prepared and evaluated in pilot tests. A system of correspondence feedback and tutorial availability would be designed; its personnel would need special training. On a limited trial basis, the proposed educational communications linkage would be exercised, evaluated, and revised.

The third year would set the formal project in motion. Broadcasts would begin. Student responses, mailed or delivered to central points, would be graded and returned. Tutors would meet with students at predetermined places and intervals. Tests would be administered to assess progress and evaluate the whole system. In the final three months, a report would be prepared, to enable the education ministry to extend the project, with appropriate modifications.

(No cost extimate is available at this time)

PROJECT NO. 15: USE SMALLER, LESS EXPENSIVE MEDIA TO PRESENT LIFELONG LEARNING OPPORTUNITIES IN URBAN COMMUNITY CENTERS

This is a study of the use of educational technology as a means for carrying out the concept of lifelong learning.

Objectives. The objective of this study is to promote and offer opportunities for lifelong learning, using less costly media. The experiment would be undertaken in newly created urban community centers in one developing nation.

The problem behind this proposal has to do with a phenomenon of many LDCs, the rural migrant who comes to the city. Invariably, this individual needs a wide assortment of information. He wants a job. He must find a place for his family and himself to live. He wonders about health services and encounters new health problems. Basically, he is a person without a community and, very probably, with little or no education or skills for city life.

The establishment of urban community centers may meet this man's needs in many ways. There, he could get answers to his questions. In the process, he might find that the center itself is the beginning of "community" for him. And in the course of his visitations, he could be led to try the center' educational service to equip himself more soundly for urban life. At the location he could take advantage of literacy training, and if he started to think of the facility as a second home, he might be persuaded to return at regular intervals to continue his education -- at higher academic levels, in new job skills.

The research design calls for creation of a pilot project in one country's largest city, over a span of three years. Initially, a city has to be selected in which at least two urban centers have been set up. One would serve as the "lifelong learning" installation, the other, as control.

Because the project depends so heavily on winning the migrant's confidence and meeting his sharply defined needs, a period of extensive interviewing and research will be mandatory. What are the most general questions perplexing the newly arrived citizen? And, importantly, what are his attitudes about education -- about renewing his own education?

Once these questions have been answered, media materials can be prepared, tested, and presented in one center. Personnel would have to be trained in advance to work the various media (audio and video cassettes, for example), to encourage the migrant to persist and to return, and to respond to his questions about facts and concepts.

While the program is being offered in one center, research should be initiated at the control facility. Among other points of comparison would be the relative "holding power" of the centers, that is, can the agency with a learning component keep its visitors coming back over periods than its parallel?

Clearly, the project will require close supervision, regular evaluation, and undoubtedly frequent revision. It must be fluid and responsive. To engineer this will require the application of an array of talents on the part of host country center staff and their project collaborators.

(There is no estimate of cost at this time).

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