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FINAL CONTRACTOR'S REPORT

IMPROVED EFFICIENCY OF LEARNING (IEL)
PROJECT

CONTRACT NUMBER: AID/AFR-C-1494

by

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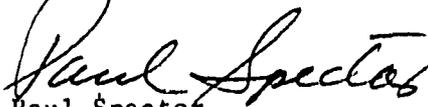
9 August 1985

Dr. Stanley Handelman
USAID Mission
Monrovia, Liberia

Dear Dr. Handelman:

We are submitting three copies of our final report on Contract #AID/AFR-C-1494, Improved Efficiency of Learning (IEL) Project. We are also submitting three copies to Ms. Cari Gaskins in the Contract Office and to Mr. George Hazel, the Technical Officer.

Sincerely yours,


Paul Spector
President

tlp

Enclosures

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. GOALS AND OBJECTIVES.....	1
1.1 Overview of the IEL Project.....	1
1.2 Criteria for Project Effectiveness.....	3
1.3 Standards for the IEL Instructional System.....	3
1.4 Procedural Objectives.....	5
2. PROJECT PROCEDURES.....	6
2.1 Preliminary Activities.....	6
2.1.1 Administrative Logistics and Support Plan....	6
2.1.2 Initial Collection of Background Data.....	6
2.1.3 Conference on Instructional Technology.....	6
2.1.4 Four-Week Writers' Workshop.....	8
2.1.5 Conference on Instructional Systems.....	9
2.1.6 Three-Month Training Course in the U.S.....	10
2.2 Staffing and Organizational Design.....	11
2.2.1 Executive Unit.....	11
2.2.2 Instructional Design Unit.....	11
2.2.3 Production Unit.....	11
2.2.4 Implementation Unit.....	13
2.2.5 Evaluation Unit.....	13
2.2.6 Administrative Support Staff.....	13
2.3 Instructional Materials Development.....	14
2.3.1 Curriculum Analysis.....	14
2.3.2 Instructional Design Workshop.....	14
2.3.3 Initial Curricular Activities.....	15

2.3.4	Module Development.....	15
2.3.5	1980 Lesson Specifications.....	16
2.3.6	Revision of the IEL Curriculum.....	16
2.3.7	The IEL Curriculum Seminar.....	17
2.3.8	Overview of Curriculum-Related Procedures and Products.....	18
2.3.9	Instructional Design Process.....	22
2.3.10	Overview of the IEL System.....	24
2.4	Production and Distribution of Instructional Materials.....	34
2.4.1	Workflow.....	34
2.4.2	Offset Printing.....	35
2.5	Implementation and Teacher Training.....	37
2.5.1	Teacher and Student Guides.....	37
2.5.2	School Monitoring and Supervision.....	41
2.5.3	Management of PT Learning Activities.....	43
2.5.4	Management of PL Learning Activities.....	49
2.6	Teacher Education.....	61
2.6.1	Review and Revision of Teacher-Training Programs.....	61
2.6.2	Liaison with the IEL Project.....	62
2.7	Evaluation.....	63
2.7.1	Formative Evaluation.....	63
2.7.2	Summative Evaluation.....	70
2.7.3	Cost-Effectiveness Evaluation.....	73
2.8	Participant Training.....	78
2.8.1	Overseas Training.....	78
2.8.2	In-Country Training.....	80
2.9	Reporting.....	88

2.9.1	Life of Project Implementation Plan.....	88
2.9.2	Progress Reports.....	90
2.9.3	Other Reports.....	90
3.	RESULTS.....	92
3.1	Mid-Term Evaluation Reports.....	92
3.1.1	Robert Jacobs.....	92
3.1.2	Grant von Harrison and Robert Morgan.....	94
3.1.3	Mid-Term Evaluation Committee.....	98
3.2	Other Results and Outcomes.....	101
3.2.1	Staffing and Institutionalization.....	101
3.2.2	Instructional Materials.....	101
3.2.3	Teacher Training and Implementation.....	102
3.2.4	Teacher Education.....	105
3.2.5	Evaluation.....	105
3.2.6	Participant Training.....	112
4.	RECOMMENDATIONS.....	114
4.1	The Liberian Elementary Education Context.....	114
4.2	Three Major Recommendations.....	115
4.2.1	Accommodating Small-Enrollment Schools.....	115
4.2.2	Integration of IEL and Textbook Systems.....	116
4.2.3	Integration and IEL within MOE.....	118
4.3	Some Specific Recommendations.....	119
4.3.1	Instructional Materials.....	119
4.3.2	Elementary School Children.....	120
4.3.3	Elementary School Teachers.....	122
4.3.4	Elementary Classrooms.....	123

IMPROVED EFFICIENCY OF LEARNING PROJECT

EXECUTIVE SUMMARY

The Improved Efficiency of Learning (IEL) Project is a large-scale elementary education project sponsored by the U.S. Agency for International Development and the Liberian Ministry of Education.

Needs and goals. The IEL Project was initiated by a needs analysis which identified inefficiencies in Liberian elementary education due to the lack of qualified teachers and instructional materials. The overall goal of the IEL Project was to design, develop, and validate an instructional system for untrained and undertaught Liberian teachers using programmed instructional materials to deliver efficient education to elementary school students.

Project procedures. The project began in 1979 and ended in March 1985. During this period, a technical advisory team from the Institute for International Research worked with the Liberian staff to design, produce, evaluate, modify, and implement a total instructional system for grades 1-6.

Outputs. The IEL instructional system is a comprehensive package of products and procedures to provide effective instruction toward the goals and objectives of the Revised National Curriculum for Liberia. The package includes 380 core instructional modules for the elementary grades in language, reading, mathematics, science, and social studies; 120 enrichment modules; reading booklets; practice booklets; review booklets; module, block, and semester tests; and packaged workshops for training teachers and principals. Management procedures in the IEL system organize programmed teaching (PT) activities in the first three grades and programmed learning (PL) activities in the upper three grades. In PT, the performances of untrained teachers are programmed to yield reliable learning on the part of the students. In PL, the performance of groups of learners are programmed.

Evaluation results. In four external evaluations, the IEL Project was judged to have high potential for reducing the inefficiencies in Liberian elementary education through the use of best available educational technologies for developing nations. Independent cost-effectiveness analysis and summative evaluation of the project led to these conclusions:

The IEL system is uniquely effective in improving the academic performance of Liberian elementary school students.

With no increase in the number of teachers, enrollment in IEL schools increased by 71% (while enrollment in control schools declined by one percent) providing highly desirable student-teacher ratios.

IEL costs have been shown to be the lowest of any available alternative.

In the words of an evaluator, "based on the evidence available, when the IEL system is appropriately implemented and assessed against measures that are valid, it demonstrates achievement outcomes that are superior to those in traditional elementary schools in Liberia. This finding, when combined with other evidence descriptive of the IEL's increased student enrollments as well as its cost savings, clearly support the continuation and expansion of the program in Liberia."

Recommendations. Three major recommendations are offered toward improving the IEL system prior to wider dissemination:

Minor adjustments should be made to better accommodate low-enrollment rural schools in Liberia.

The system should be integrated with conventional textbook-based systems so that they are not perceived to be in competition with each other.

Supervision of IEL schools should be brought within the existing MOE administrative structures.

1. GOALS AND OBJECTIVES

The overall goal of the IEL Project was to design, develop, and validate an instructional system for untrained and undertrained Liberian teachers using programmed instructional materials to deliver efficient education to children in Liberian elementary schools.

1.1. Overview of the IEL Project

Project Paper 669-0130, which provides the basis for the IEL project, gave the following Project Description on pages 2-4:

"One of the two USAID/Liberia EHR sector goals is the provision of adequate, relevant and effective learning opportunities for all who want to learn at a cost commensurate with available resources. At the present time, the GOL formal school system reaches slightly over 50 percent of school age population but forms the major instrumentality for achieving this sector goal. One of the major deficiencies in this system is poor quality instruction in the classroom. In 1975, 75 percent of teachers at the elementary level were academically and/or pedagogically unequipped to teach effectively. Also there continues to be a glaring scarcity of textbooks and learning materials which impedes optimum teaching effectiveness of even the better trained teachers."

"The purpose of this project is to develop and establish systems to increase the effectiveness of instruction by elementary teachers. The specific aim is to improve the performance of unqualified and underqualified elementary teachers in a timely and cost effective manner."

"The nucleus of the project is an experiment in Programmed Instruction which consists of the design and evaluation of two teaching/learning procedures. These procedures are based on Programmed Teaching (PT) and Programmed Learning (PL) in forms which can be taught to underqualified and unqualified teachers in a 4-week workshop. At the output level, the project will [a] produce complete sets of prototype instructional materials (i.e., PT for grades 1-3 and PL for grades 4-6) for all core subjects in grades 1-6 and practical skills courses for grades 4-6; [b] develop procedures for training teachers with no previous pedagogical training in the use of those materials."

"PT and PL materials and procedures will be designed and validated in 20 selected schools located in rural Liberia. Each school will contain a minimum of 6 elementary teachers and 240 elementary pupils, involving a total of 4,800 students and 120 teachers."

"Validation of the materials and procedures will be based on a comparison of the results of achievement tests administered to students in 10 schools where traditional materials and teaching procedures are used. Sampling, data collection and analysis for control and experimental groups will conform to state-of-the-art research procedures. The focus will be on identifying and comparing actual learning achievement of students."

"The project will be sited at Gbarnga, the county headquarters of Bong County. Gbarnga is located in the center of rural Liberia and is situated equidistant from the two Rural Teacher Training Colleges at Kakata and Zorzor. Cuttington College near Gbarnga has a strong research-based program in teacher education. Thus, the site at Gbarnga ensures easy access to typical rural schools and sufficient liaison with all rural based teacher training facilities."

"Recognizing that the technology of Programmed Instruction is experimental and developmental in nature with potential benefits which have not been demonstrated in Liberia, an important tangential project component consists of direct assistance to the Teacher Education Division of the Ministry of Education (MOE). This assistance is designed to help the MOE systematize and rationalize all pre-service and in-service teacher training programs. Overlap of project personnel at the MOE level will prove beneficial to the project experiment and will serve to pave the way for replication of the benefits upon completion."

"By the end of the project, improvements of both a quantifiable and qualifiable nature should be observable within the overall teacher training program of the MOE. The most outstanding accomplishment at the end of the project will be a validated increase in the teaching performance of elementary teachers utilizing the Programmed Instruction materials and procedures. Personnel trained under the project will be fully capable of continued operation of the program, including the preparation, updating and revision of materials and procedures in line with curriculum changes which may become necessary. By the end of project year 3, there will be detailed administrative, logistical and funding plans in the GOL/MOE for expanding the Programmed Instruction program to reach all underqualified and unqualified elementary teachers."

The United States Agency for International Development contracted with the Institute for International Research (IIR) to provide technical advice and assistance to the Government of Liberia in its effort to implement the project. The Statement of Work covered under Contract AID/-afr-C-1494 specifies that IIR will "work in a joint relationship with Liberian team members in a style that ensures full participation of all GOL project personnel." The basic functions were:

- a. Design and test student learning materials and develop materials and procedures for training teachers in their use.
- b. Develop and implement evaluative instruments for validating the impact of these materials and procedures (i.e., actual performance of teachers as evidenced by achievement of students).
- c. Explore alternative strategies for replicating the project and develop a detailed plan determined to be the most feasible.
- d. Develop a comprehensive and coordinated strategy for conducting all MOE teacher education activities.
- e. Identify actual outputs and assess total impact of the project.

1.2 Criteria for Project Effectiveness

Throughout the project, the technical assistance team and the members of the IEL staff frequently reviewed the goals and purposes of the project with a focus on defining the criteria for effectiveness of the total IEL instructional system. The following is a list of criteria established by the project staff at various times:

1. Learning gains. Children learn as measured by criterion-referenced tests based on the Revised National Curriculum.
2. Motivation. Children enjoy the process of learning and enthusiastically participate in the instructional activities.
3. Level II learning. As a long-term outcome, children acquire various cognitive strategies, cooperative learning structures, and independent study skills.
4. Teacher competence. Teachers are able to teach more effectively by applying specific competencies related to the use of PL and PT materials.
5. Usability by teachers. The system is easily usable by typical Liberian teachers without the need for any lengthy preparation or complex decision making.
6. Rapid training. Inservice teacher training can be provided in a short period of time using prepackaged materials.
7. Teacher acceptance. Teachers are willing and eager to use the IEL system in a reliable fashion.
8. Teacher independence. The system can accommodate frequent and/or lengthy absences by individual teachers.
9. Community acceptance. Parents and other members of the local community accept the IEL system.
10. Cost effectiveness. The recurrent costs to maintain the IEL system compares favorably with the cost of the conventional system. All parental costs are affordable by typical rural Liberians.
11. Maintainability. The system can be maintained, updated, and improved by Liberians without any major need for continuing financial or technical-assistance support.

1.3 Standards for the IEL Instructional System

The project staff and the technical advisors also established various standards for the IEL instructional system. Here is a set of standards reproduced from various project documents:

1. Total system. The IEL system should be a total package of materials, methods, and management components.

2. Grade levels. The IEL system should encompass grades 1 to 6. (Full cost-effectiveness of the system is realized only if and when it is applied to all six grades.)

3. Self-contained nature. The system should not require any additional instructional materials or extensive lesson preparation or complex decision making by the teacher.

4. Replicability. The system should be adoptable by different schools in Liberia with a high degree of reliability. It should be capable of being disseminated to typical teachers by typical members of the existing educational administration.

5. Affordability. The recurrent cost of the system should be within the present and projected educational budget allotments. All costs to parents should be within the reach of typical rural Liberians.

6. Basic-skills approach. The focus of the system should be on basic (rather than enrichment) learning. Language and reading will be stressed in the first two grades; science and social studies may receive lesser emphasis.

7. Target population. The basic system should be designed to cater to the needs of the "normal" majority rather than to the needs of the atypical minority (e.g., the retarded or the gifted). (However, the system should have sufficient flexibility to be adapted to the other groups at a later date.)

8. Types of schools. The system (and its management component) should be designed for use in a wide variety of Liberian schools (in terms of size, enrollment pattern, number of teachers, number of grades, geographic location, and the availability of physical facilities).

9. Location of schools. While the system should be usable in any Liberian school, the major focus should be on disadvantaged rural schools (rather than the affluent urban schools).

10. Structured peer-group interaction. The system should utilize mutual learning opportunities among students in order to benefit from the empirically-established advantages of small-group learning and to reduce the problems of teacher absenteeism. The undesirable effects of small-group learning should be reduced through careful control of leader and learner behaviors (without the need for constant teacher supervision).

11. Controlled evaluation. Although the IEL system should be designed to permit alternative applications, only one specific version of the system should be tested in at the end of the project. (Other applications will be evaluated later, after we have validated the basic system.)

12. External summative evaluation. The final summative evaluation of the system should be undertaken by an agency external to the project.

1.4 Procedural Objectives

The following chapter describes various procedures undertaken to achieve the goals and objectives of the project. Each major procedure discussed in the next chapter is identified below and its goal is specified:

1. Preliminary activities. To build the technical aspects of the project upon an expert review of the state of the art in programmed instruction and instructional systems design.

2. Staffing. To organize interdependent units of the project staff to facilitate the accomplishment of the goals and to provide smooth technical transfer.

3. Instructional materials development. To design programmed-teaching modules, programmed-learning modules, and arts-and-crafts manuals.

4. Production and materials distribution. To prepare, produce, and distribute multiple copies of all instructional materials (complete with appropriate illustrations).

5. Teacher training and implementation. To design appropriate methodologies for implementing the IEL instructional system in Liberian elementary schools and to train teachers and administrators in these procedures.

6. Teacher education. To review and revise the Liberian elementary teacher education programs and to suggest appropriate accommodation of the IEL system in existing teacher education programs.

7. Evaluation. To undertake various types of formative evaluation to improve the instructional and motivational effectiveness of the IEL system and to coordinate the summative evaluation to validate the system.

8. Participant training. To provide appropriate on-site and formal training to various Liberian participants to create a local cadre of technically competent specialists capable of implementing and institutionalizing the system.

9. Reporting. To prepare and present timely reports to facilitate communication among the sponsors, Liberian MOE, the project staff, and the research and development community.

2. PROJECT PROCEDURES

2.1. Preliminary Activities

Several activities were undertaken as prerequisite to those in IIR's Technical Development Plan. These included: (1) administrative and logistics preparation in Liberia, (2) initial collection of background data in Liberia, (3) a preparatory conference on instructional technology in the U.S., (4) a one-month writers' workshop in Liberia, and (5) a three-month course in the U.S. to train writers in programmed instruction. In addition to these, a conference on instructional systems was held in April 1979 in Monrovia.

2.1.1. Administrative Logistics and Support Plan

This plan was proposed by IIR so that the project could function efficiently and place minimum administrative demands on USAID and MOE. It covered relationships of the contractor with the GOL, AID/Washington, and USAID/Monrovia. It also detailed a number of contractor responsibilities, including (1) personnel policies, (2) participant training, (3) communications, (4) travel, (5) procurement, (6) shipping and storage, (7) documentation, (8) reports, and (9) finances.

2.1.2. Initial Collection of Background Data

The Principal Investigator, Chief of Party, and other members of the Project staff conducted an informal survey in some schools in Gbarnga City in March 1979. The information collected included: (1) general characteristics of elementary school children, (2) vocabulary and language (English) proficiency at different grade levels, and (3) average age, sex, and number of students. The data collected were utilized in the learner analysis stages during the writers' workshop and the three-month training course in the U.S.

2.1.3. Conference on Instructional Technology

The Conference on Instructional Technology was held in Bloomington, Indiana, from January 8 to January 11, 1979. Three copies of the conference report dated August 8, 1979, was submitted to the Contracting Officer as required by Clause 16(a) of the General Provisions of our contract for the Improved Efficiency of Learning Project.

The primary purpose of the Bloomington Conference was to explore a wide range of programmed instructional techniques as a means for implementing Programmed Teaching and Programmed Learning in rural Liberian elementary classrooms. The main constraint upon which conference attendees focused was the need to provide unqualified teachers of 40 or more children with programmed teaching techniques. A second purpose was to arrive at a first approximation of programmed instructional techniques to be included in the four-week Writers' Workshop to be held in Gbarnga in March of that year.

Below is a list of IIR staff and consultants who participated during the conference:

Douglas Ellson	Indiana University
Robert Jacobs	Southern Illinois University
Darlene McSoley	Indiana University
Daryl Nichols	Institute for International Research
Jean Osborne	University of Illinois
Jerry Short	University of Virginia
Paul Spector	Institute for International Research
Harold Stolovitch	University of Montreal
Sivasailam Thiagarajan	Instructional Alternatives

Following a presentation and discussion of what was known about the IEL Project, conditions in Liberian rural schools, and the purposes of the conference, the participants explored a variety of techniques with which they were familiar, drawing upon that knowledge in determining what approaches might be most fruitful for use of programmed teachers in Liberia.

The following approaches to programmed teaching and learning were explored: Madras or monitor system; Winfield system; Nesbit system; Rosenbaum's peer-mediated instruction; Harrison's system; Ellson's approaches to programmed teaching and tutoring; the IMPACT system; and DISTAR. After much brainstorming, the participants came up with the following possible scenario for IEL:

A Possible Scenario for IEL

<u>Grade</u>	<u>Learning Mode*</u>
1 (1st week)	Large Group Script Programs
1 (Thereafter)	Programmed Teaching in Small Groups Peer Tutoring Cross-age Tutoring
2	Programmed Teaching in Small Groups Peer Tutoring & Teaching Cross-age Tutoring
3	Programmed Teaching in Small Groups Simple Peer-Group Learning
4, 5, & 6	Programmed Learning: Peer-group Learning Self-instruction

It was the consensus of the Conference that:

The project should begin with the 3rd and 6th grades

Conduct of the experiment in the schools should be delayed from a start of 1980 to a start of March 1981. With the

project being initiated later than planned, there will be insufficient time to prepare quality learning materials and procedures.

If necessary, combine the 5th and 6th graders under one teacher in order that one teacher can be freed to assist in the lower grades.

2.1.4. Four-week Writers' Workshop

Planning meetings for the Workshop were held in Bloomington the week of 26 February through 2 March 1979. Dr. Thiagarajan, IIR's Chief of Party beginning in September 1979, was at that time serving as the Training Consultant. He, Dr. Stolovitch, University of Montreal, and Dr. Ellison, Indiana University, worked with IIR Staff Members, Aida Passigna and Rebecca Belleza in outlining a preliminary design for the workshop.

* As each new method is introduced, the teacher will have to demonstrate before the class with a small group, or a pair, or an individual. After demonstrating, there should be guided practice in the learning technique before they are released to do it on their own.

Dr. Thiagarajan, Miss Belleza and Mrs. Pasigna arrived in Liberia on 12 March and began the Workshop on the 14th. Thirty-four potential writers and staff members took part in the Workshop in Gbarnga over the next four weeks. They were introduced to a variety of simple programming techniques and were guided through a series of practical exercises. In addition to the purpose of providing preliminary training, the Workshop also served as a vehicle for practical on-the-job evaluation of each person's capability and potential to function as project writers. At the end of the Workshop, the Project Director recommended to the Ministry that 11 writers and 2 project staff members be retained for further training.

2.1.5. Conference on Instructional Systems

This conference was held at the Baptist Youth Camp outside Monrovia on 25-26 April 1979. Its purpose was to present to the Liberian Executive and Steering Committees (and to other interested educators) alternative classroom management systems for the implementation of PT and PL in project schools. Project staff and IIR counterparts prepared working documents in three volumes describing alternative systems. Three short-term consultants assisted in conference deliberations and presented separate summary papers. The consultants: [1] Dr. Robert Jacobs, Southern Illinois University, [2] Dr. Paul Spector, President, IIR, and [3] Dr. S. Soemitro, Ministry of Education, Indonesia. Recommendations of the conference were as follows:

Programmed Teaching for Grades 1 through 3. Programmed Teaching should be conducted with groups of approximately 15 children. Each PT session should last for 15 minutes with one group, before the teacher begins PT for a second group of 15 children. With three groups of 15 students (45 in a classroom), a teacher, thus, would hold three PT sessions of 15 minutes each on a single lesson. S/he would then return to the first group and initiate a new PT session on a new lesson.

After a PT session, student groups would split into smaller groups of about five children for peer-group practice sessions to insure mastery of the objectives of the previously concluded PT lesson.

A few children with identified learning weaknesses during the earlier PT session would stay with the teacher during the practice period in order that they would be able to take part in a repeat of the PT lesson with him or her.

Following practice, children would participate in a variety of review activities, many of which would be in the form of games. Content of the review period would be not only that of the previous PT and practice sessions, but also that of earlier lessons so that essential skills and knowledges could be continually reinforced.

One full 45-minute period would be made available each school day for remediation, individual projects, make-up for absences, music, art, etc.

Programmed Learning for Grades 4 through 6. Learning would take place primarily in peer groups of 5-8 children, although opportunity would be given at various times for independent self-learning.

The sequence of learning for a single module would require 7 periods of 45 minutes each as follows:

Period 1:

Lesson 1 (Introduced by a 15-minute PT session with the teacher)

Periods 2-4:

Lessons 2, 3 & 4 (Usually in peer groups with students taking turns leading the group)

Period 5:

Module review of all four lessons, and of previous learning from earlier modules.

Period 6:

Module Post Test taken individually under the monitoring of the teacher.

Period 7:

Individual Pursuits for independent study and projects, for remediation, making up of studies missed during absences, etc.

Conference attendees recommended that this sequence be tried out in two ways for Programmed Learning:

- 1] Have children complete all 7 segments of a single module before starting a new module in a different subject matter.
- 2] Have children spend the same period each school day on a given subject matter, switching modules each period.

2.1.6. Three-Month Training Course in the U.S.

The success of the I.E.L. Project depends to a large extent upon the effectiveness of its programmed instructional materials. As one of its first activities, I.I.R., in collaboration with Delta Associates of Bloomington, Indiana, conducted a three-month course on the Systematic Development of Programmed Teaching and Programmed Learning Materials.

2.2. Staffing and Organizational Design

The organizational structure adopted for the IEL project is shown in Figure 1. This structure incorporated mutual decisions between the Liberian Project Staff and their counterparts from the IIR technical assistance team.

The basis of this organization was the identification of six interdependent units: executive, instructional design, production, implementation, evaluation, and administrative support. Details of each of these units are given below.

2.2.1. Executive Unit

The executive unit coordinates all other units and plans, monitors, and manages the project activities. It allocates resources to different functions and makes policy decisions on the project level. It supervises all the other units.

The head of the executive unit is the Project Director, Mrs. Janice M. T. Vani, and her technical advisor/counterpart is IIR's Chief of Party. The heads of all the other units and their counterparts provide technical information and suggestions to this unit.

2.2.2. Instructional Design Unit

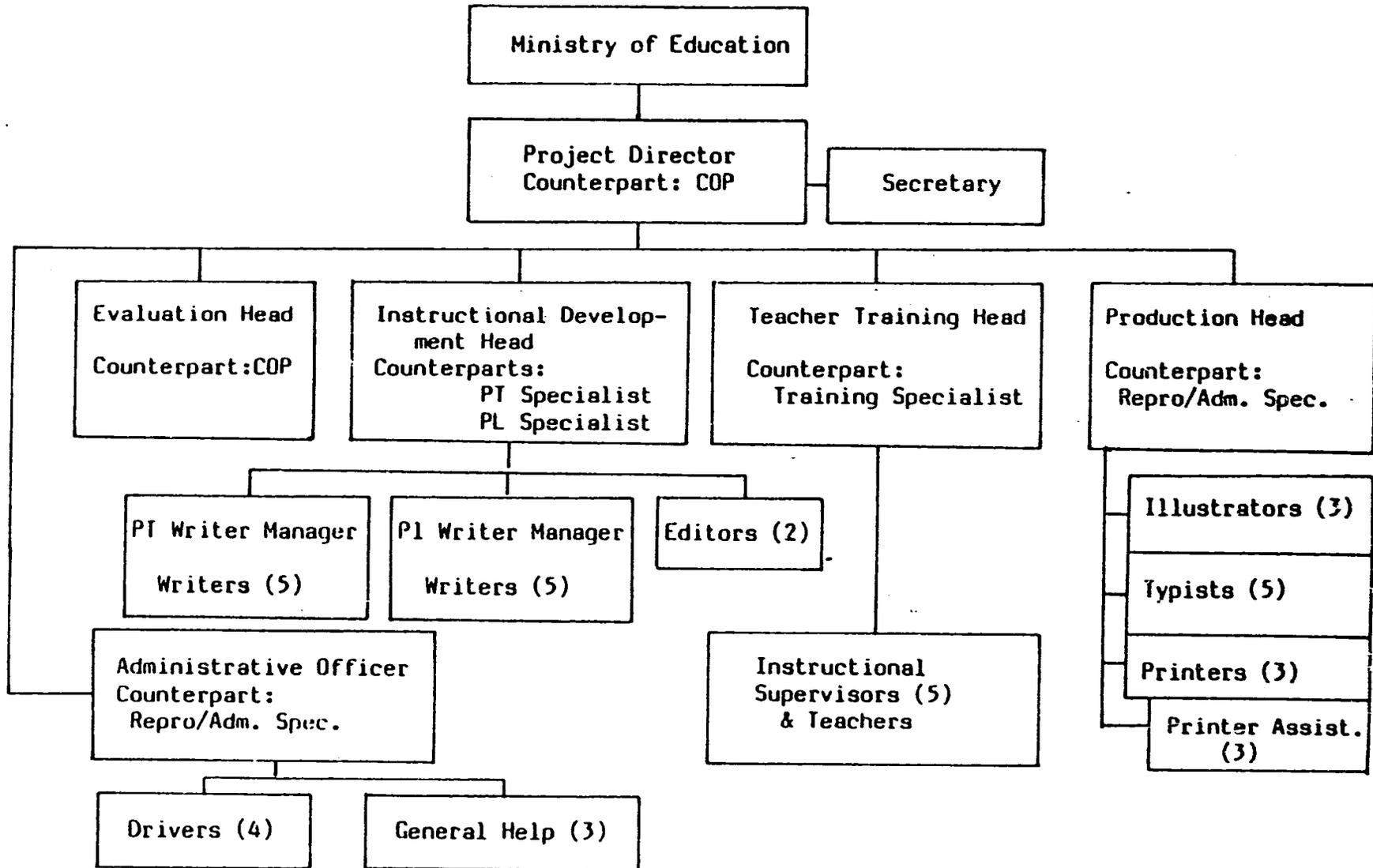
The Instructional Design Unit is responsible for the development of instructional materials and methods to improve the performance of unqualified and underqualified teachers in rural Liberian elementary schools. Materials and methods designed by this unit are produced by the Production Unit and transferred to schools by the Implementation Unit. These materials and methods are evaluated by the Evaluation Unit.

The head of this unit, Mr. Edwin J. Clarke, has for his counterparts and technical advisors the PL Advisor and the PT Advisor of the IIR technical assistance team. The other members of this unit are the PT and the PL instructional designers or module writers for each of the core subjects in all of the six grades.

2.2.3. Production Unit

The Production Unit designs formats for and produces prototypes and revised versions of instructional materials, teacher training materials, and reports and brochures. This unit receives the content for instructional materials and prescriptions for illustrations from the Instructional Design Unit; content for teacher training materials from the Implementation Unit; and the content for reports and brochures from all units.

ORGANIZATIONAL CHART



The head of the Production Unit, Mr. F. Karlee Kennedy, has for his counterpart the Production Advisor from IIR's technical assistance team. The other members of the unit are the word processing operators, printers, typists, and illustrators.

2.2.4. Implementation Unit

The Implementation Unit transfers the instructional methods and materials to rural Liberian elementary schools through appropriate teacher training and supervision. The instructional methods and materials are obtained from the Instructional Design Unit. This unit assists in the collection and transmission of formative evaluation feedback to the instructional designers in collaboration with the Evaluation Unit.

The Implementation Unit head, Mr. S. Boniface Nah, has for his counterpart IIR's Implementation Advisor. The other members of the unit are the instructional supervisors.

2.2.5. Evaluation Unit

The Evaluation Unit coordinates the formative and summative evaluation of the project through the design of suitable evaluation instruments and strategies. This unit works with the Instructional Design Unit in constructing suitable test instruments and with the Implementation Unit in collecting field-based data. It also provides background information on the rural Liberian elementary schools to all units.

2.2.6. Administrative Support Staff

The Administrative Support Staff provides logistic and administrative support to the project in the areas of personnel, financial records, travel and transportation, and building maintenance.

The head of this unit is the Liberian Project secretary whose counterpart is IIR's Administrative Officer. The other members of the unit are the drivers, the general office help, the librarian and her assistants, and the night guards.

2.3. Instructional Materials Development

The IEL project has developed and currently employs a combination of programmed teaching materials (grades 1 - 3 1/2) and programmed instructional materials (grades 3 1/2 - 6) designed to instruct elementary students in five content areas: reading, language arts (English), mathematics, science, and social studies.

Development of the IEL materials has proceeded systematically, and the selection of content for instruction was based on the scope and sequence of the Liberian national curriculum. A series of content reviews and related revisions of the IEL materials are part of the history and cost of the project up to this time. These reviews have been conducted in order to establish that the materials are representative of Liberia's national curriculum on which they are based.

2.3.1. Curriculum Analysis

The original designers of the IEL Project emphasized that this was not to be a curriculum development project. Rather, they indicated that the IEL Curriculum should be based on the 1979 Revised National Curriculum (RNC) of Liberia. IEL advisors assumed that the RNC would supply broad goals and general objectives, specific objectives, scope and sequence, content and activities.

2.3.2 Instructional Design Workshop

Thirteen IEL Project personnel (team heads and writers) attended a three-month training workshop on instructional design procedures. Among the training exercises in the workshop were those dealing with the analysis of the RNC. The goal was to convert the curriculum into a lesson specifications which could provide a sound basis for the instructional design and development of programmed modules for the six grades covered by the IEL Project. Insofar as this goal goes, a number of problems were identified during the summer training session:

- o The RNC was not a tightly written document. It lacked consistency across broad goals and general objectives, specific objectives, scope and sequence, and content and activities.
- o Although some of the personnel trained in the summer workshop had acquired the skills necessary for doing adequate task analysis, some had not. Hence, analysis of the entire RNC document was slow and often ineffective.
- o Although personnel had been assigned partially on the basis of their content expertise, it became evident that their range of expertise was wide, with some far below minimum requirements.

- o The curriculum in some subject areas (e.g., mathematics) was easier to analyze. Other subject areas (e.g., social studies) required a significantly larger period of time.

2.3.3. Initial Curricular Activities

Soon after the IEL staff became functional in Gbarnga, it was obvious that if the RNC were to be adequately analyzed to provide the basis for a comprehensive and consistent IEL Curriculum, the production of IEL modules would have to be drastically delayed. For a number of reasons (personnel skills development, productivity, morale; community commitments and credibility; political realities), it was decided to go ahead with module design and development.

Out of the total pool of ten writers, five were selected to be task analysts and were asked to continue the conversion of the RNC into a usable IEL Lesson Specifications (LS). They completed the task for all subject areas in Grade I. This document was presented to the IEL Review Committee and, although the hoped-for feedback was not forthcoming, approval was indicated. However, before LS could be fully developed for the other grades, it was decided to give priority to module development.

2.3.4. Module Development

Module design and development proceeded. It was based on the analyses already done and on module topic lists generated by Liberian and counterpart members of the instructional design staff. In March, 1980, the five task analysts were moved to other responsibilities and, hence, were no longer available to work on curriculum analysis. At that time the responsibility for specifying the content and the sequence for Programmed Teaching (PT)* modules fell to the Head of the Instructional Design Unit, and his technical advisors.

2.3.5. 1980 Lesson Specifications

Near the end of 1980, the Lesson Specifications for all PT materials was excerpted from the tables of contents of the PT modules. The Instructional Design Unit would have preferred that the Lesson Specifications be written first and instructional development of the modules be based on the LS. In fact, it was the other way around. The PT modules Edition A, were designed, and approximately seventy percent were produced and tried out in the Project Laboratory School and the LSs were excerpted. Although it was a post hoc document, the LS proved to be valuable in revealing both weaknesses and strengths in the modules, in the RNC, and in the LS itself. For example, among the weaknesses noted were the following:

- o external consistency: The LS did not in every instance reflect the RNC.

- o internal consistency: The LS revealed some gaps, inefficient sequences and redundancies in each subject area. In addition, there was very little integration across different subject areas. The same topic was retaught in two subject areas (e.g., color in language and in science). Concepts and skills in language and in reading were frequently developed in isolation from those needed in science and in social studies.
- o inaccuracies: Information presented in the modules, as reflected in the LS, was sometimes inaccurate.
- o controversies regarding content: Discussions centering on the LS revealed controversial issues regarding some content areas (e.g., how the Liberian family should be characterized in social studies) even among the IEL Instructional Design staff.
- o controversies regarding instructional approach: Discussions among Instructional Design staff and other IEL staff (e.g., Instructional Management Systems Advisor Corene Casselle and Teacher Education Advisor Chris Agbenyega) revealed disagreements regarding the most appropriate or effective approaches within certain content areas (e.g., the phonics vs. look-see approach in reading and the integrated vs. departmental approach in social studies).
- o prescriptions: Prescriptions at the lesson level in the LS were specific and coherent. But prescriptions at the module level were frequently missing and did not hang together.

Various strengths in the PT modules were also revealed:

- o The module content was clearly Liberian, especially social studies, and also all the other subjects.
- o The subject approach was deliberate and consistent throughout, e.g., a cognitive-development approach had been used in language arts, a phonics in reading, a new math approach had been used in mathematics, a process approach had been used in science, and a basic concepts approach had been used in social studies.
- o While the 1980 LS was far from the basic IEL Curriculum document wanted, it seemed to be a useful guide for materials development and for evaluation.

2.3.6. Revision of the IEL Curriculum

At first, it was thought that a revised LS would serve as the basic curriculum document for further module revision and development (Edition B). However, it was soon determined that any direct effort to revise the LS was going to create as many problems as it solved. For example, any lesson which was added or omitted threw all the succeeding lessons off--sometimes in content, sometimes in sequence. At this time, it was suggested that returning to the 1979 RNC for the big picture (i.e., a

macro analysis) might be a more effective way to go. The reasons for the subsequent decision to do this were many:

- o The IEL curriculum needed to be more firmly based on the RNC.
- o The earlier efforts at RNC analysis and developing modules had been carried out only on Grades I, II, and III. However, the IEL Project necessitated a comprehensive and cohesive curriculum for all six grades.
- o The original macro-level analysis of the RNC could now be implemented by a tested set of analysts (e.g., the Instructional Design Head and Coordinators).
- o Once a macro-analysis was done and a new IEL Module Specifications (MS) written, the micro-level (or lesson level) information from the LS could be utilized to provide the necessary details for revision or writing programed teaching modules Edition B.

The end of 1980 and the beginning of 1981 represented a significant transition period in the IEL project. The majority of PT modules (Edition A) had been developed, produced, and tried out. Laboratory school data were available. The second edition of the IEL modules (Edition B) could and would involve major revisions. However, the scope of the IEL Project suggested that these be the last major revisions. This was a critical period for developing a solid curricular basis - one which had both internal consistency (matching goals, objectives, scope, sequence, content and activities) and external consistency (optimally correlated with the RNC).

2.3.7 The IEL Curriculum Seminar

By the first of December, the Head of the Instructional Design Unit and the Chief of Party met and decided the following:

- o A comprehensive, consistent IEL Curriculum was essential if Edition B modules were to be maximally effective.
- o At this critical transition period, the development of the IEL Curriculum must take precedence over other instructional design activities.
- o For many reasons, the most effective and efficient way to go was to organize the administrative members of the Instructional Design Unit as a problem-solving group which would meet daily in seminar fashion until an adequate IEL Curriculum was produced.

These decisions were implemented and, beginning in early December, the following instructional design personnel met together (at first, they met on a daily basis, subsequently in various sub-committee configurations).

Edwin J. Clarke - - - - - Head of ID
 Nathaniel S. Samba - - - - - PL Coordinator
 Joseph Kolubah - - - - - PT Coordinator
 Aida L. Paigna - - - - - PL Advisor
 Rebecca Belleza - - - - - PT Advisor
 Sivasailam Thiagarajan - - - - - Chief of Party

2.3.8. Overview of Curriculum-Related Procedures and Products

Figure 2 shows the products (circles) and procedures (rectangles) which the IEL Curriculum Seminar used or developed. The two major inputs were the Revised National Curriculum (RNC) and the 1980 IEL Lesson Specifications (LS). These are shown at the top of Figure 1. The LS was reserved for later use when it would provide details for the micro-level of module lessons.

Procedures and their related documents are described below:

Reviewing RNC Philosophy, Goals and Priorities, Curriculum Objectives. The first task of the Curriculum Seminar was an analysis task on the broadest level--that of reviewing the philosophy, broad goals and priorities, and curriculum objectives as stated in the RNC. These broad statements-- "Philosophy of Liberian Education", "Goals and Priorities of Liberian Education", and "The Revised Curriculum Objectives for Elementary Schools"--may be found in the first few pages of each of the curriculum documents in Appendix A. The members of the seminar agreed that, whatever the weaknesses of their materials development in the prior period of the IEL Project, all IEL efforts seemed compatible with and supportive of these statements.

The next phase necessitated that each member play, in addition to a general role, a more specific role as well. This second role was that of a subject matter expert. Each of the members accepted primary responsibility for subject matter areas as follows:

Edwin J. Clarke - - - - - Social Studies (Grades 1-6)
 Nathaniel S. Samba - - - - - Mathematics (Grades 4, 5, 6)
 Joseph Kolubah - - - - - Mathematics (Grades 1, 2, 3)
 Aida L. Paigna - - - - - Reading & Language (Grades 4, 5, 6)
 Rebecca Belleza - - - - - Reading & Language (Grades 1, 2, 3)
 Sivasailam Thiagarajan - - - - - Science (Grades 1-6)

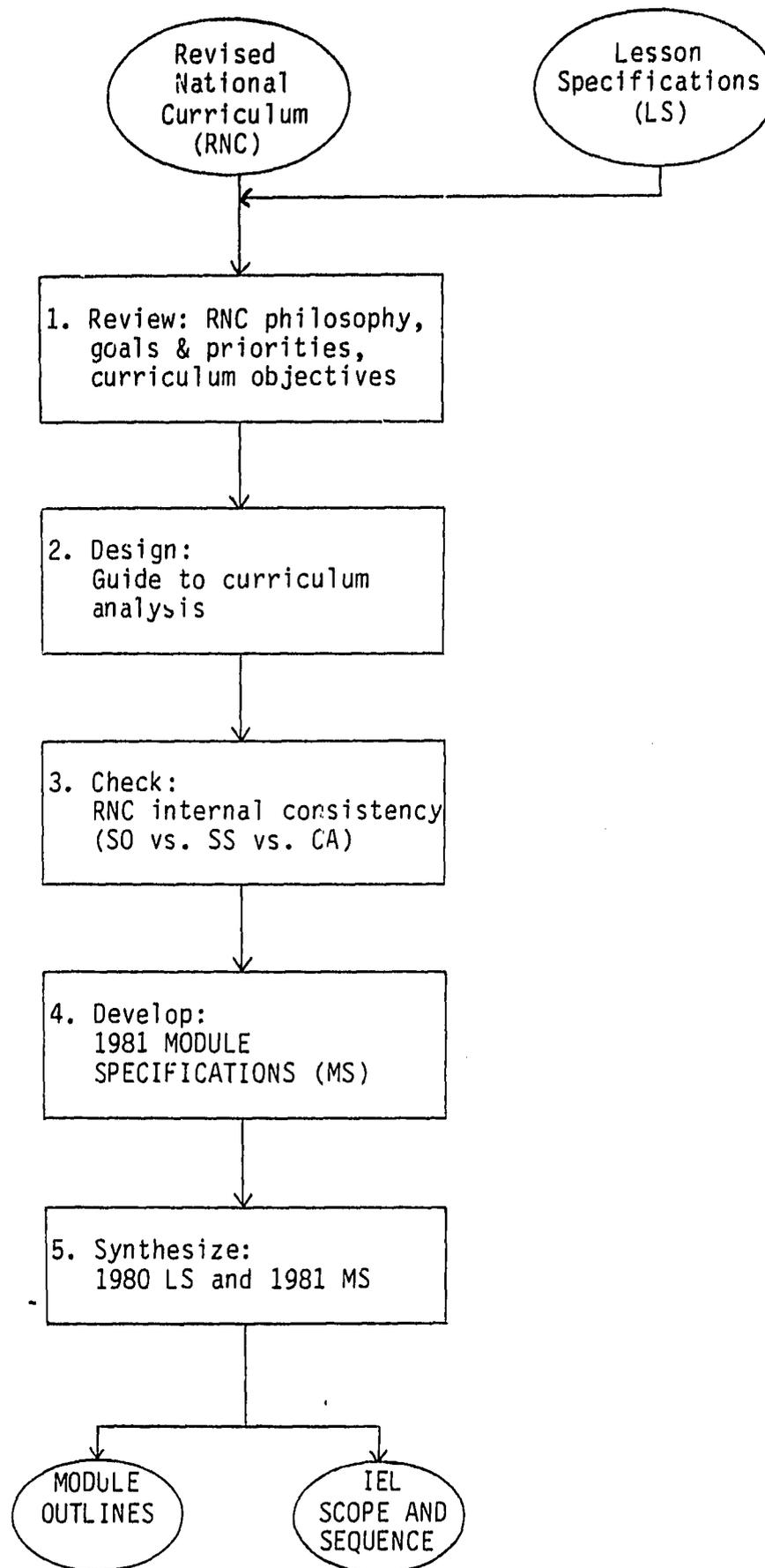


Figure 2. Overview of Curriculum-Related Procedures and Products

Designing "A Guide for Curriculum Analysis." The second task was to devise a guide for all subject matter experts to follow as they analyzed, discussed and modified relevant sections of the RNC and specified IEL module topics and sequence. The Chief of Party produced a rough draft which, after group discussion and modification, resulted in "Guide for Curriculum Analysis" as shown in Figure 3.

The documentation indicated in the "Guide for Curriculum Analysis" was suggested as a maximum. That is, if time allowed, each level of documentation could guide not only the IEL module development but also any external agencies who might want to replicate the process. Because of practical constraints of personnel and time, many of these documents were only informally and sketchily prepared. Nevertheless, the analytical activities underlying such documentation produced positive and useful results. In particular, checks for internal consistency (Figure 2, Activity 3) were especially useful in determining what, if any, modification should be made in the curriculum.

It should be noted that each RNC guide provides three sections of direct and immediate relevance to the design and development of Liberian instructional materials: Specific Objectives (SO), Scope and Sequence (SS) and Content and Activities (CA).

Checking Internal Consistency of RNC. Each subject matter expert did a comparative analysis for his/her subject between SO and SS, between SO and CA, and between SS and CA. As consistency checks were done, potential IEL module goals and topics were listed in each subject area. Although sequencing differed from that of the RNC, these items were directly related to items specified in the RNC guides.

Producing the 1981 Module Specifications. Once each content expert had a specific, sequenced list of module goals and topics, it was discussed and modified in the following ways:

- (a) omission. Topics or objectives were omitted if they were found to be redundant (e.g., in another subject), trivial (e.g., lacked significant importance or relevance to whole), or requiring prerequisites not taught.

Activity	Documentation
1. Review of philosophy, goals and priorities, and curriculum objectives for elementary education in Liberia.	
2. Design of a procedure for the curriculum analysis activity	A checklist for curriculum analysis.
3. Internal consistency check of the Revised National Curriculum	Three matrices matching the specific objectives (SO), scope and sequence (SS), and content and activities (CA) with each other
4. Development of module specifications	Module specification for each subject area in each grade listing the content and the goals
5. Synthesis of module specifications with lesson specifications	<p>Module outlines for each PT and PL module</p> <p>IEL scope and sequence charts for language, reading, math, science and social studies</p>

Figure 3. A Checklist for Curriculum Analysis

- (b) addition. Topics or objectives were added if they were obvious omissions in a sequence (e.g., if A and C were taught but B left out), if they provided necessary prerequisites to other topics or objectives, or if they balanced a sequence or content.

Because the RNC is somewhat unspecific, every item in the MS can be shown to exist in the RNC. The opposite, however, may not be true, but any omissions is believed to be insignificant.

Synthesis of Lesson Specifications and Module Specifications. During this phase (which still goes on), the members of the curriculum seminar worked alone as content experts and together as a check on each other and on the curriculum as a whole. Their task was to synthesize the newly developed Module Specifications (MS) and the earlier Lesson Specifications (LS) and to produce two kinds of documents: (1) Module Outlines (See sample in Appendix E) to be used as a major guide in writing the PT modules, Edition B, and (2) Scope and Sequence chart to be used especially by educators who will select and implement IEL materials for Liberian schools, but also by educator everywhere with an interest in the IEL Project and materials.

In March, 1981 the IEL Project moved into the critical phase of system tryout. Under the supervision of the Implementation Unit, learners in five schools utilized the equivalent of one new PT module every day. At the same time, fourth grade learners in the Project Laboratory School used one new PL module every day. Thus, the Instructional Design Unit had to produce at the rate of one PT module and one PL module every day. Under this tight schedule, curriculum development (writing of module outlines) and instructional development (writing of modules) had to proceed in a parallel fashion. Near the end of the year detailed curriculum (both module and lesson specifications) for the first four grades were available.

The Director of the Project believes that this document, reflecting IEL's operationalization of the Revised National Curriculum, will result in the further refinement of the RNC. Many Liberian educators within and outside the project shared this view.

2.3.9. Instructional Design Process

The design of IEL instructional materials followed these stages:

Learner analysis.

1. Determine the learning needs of a given group of learners.
2. Determine the level of vocabulary and language usage suited to the grade.

Instructional analysis.

1. Determine the skills and concepts to be developed in a grade using the MOE curriculum and learner analysis data.
2. Specify in clear behavioral terms the main objectives and the sub-objectives for a given subject area and grade.
3. Sequence the objectives in an appropriate order and organize them into modules in the learning continuum.
4. Prepare the module specifications.

Writing.

1. Conduct the task analysis.
2. Prepare the module outline.
3. Select the most appropriate strategy that can be used to attain the objectives.
4. Select appropriate visuals for explanations and enrichment.
5. Write the module.

Editing.

1. Subject-matter editing
2. Instructional design editing
3. Language editing
4. Lay-out editing
5. Proofreading

Learner verification and revision.

1. Try out the first few lessons/modules with a group of learners.
2. Review/rewrite modules and other instructional materials on the basis of formative feedback.

The content of the modules is based on the 1979 Revised National Curriculum which the ID Unit subjected to a thorough review and analysis resulting in the IEL working curriculum - the IEL Module Specifications. After a module is written and edited by the ID Unit, it goes to the Production Unit for typing, illustration, and printing. Copies are then delivered to the Implementation Unit for use in the schools. The modules are tried out in the Project Laboratory School and System schools. Based on the feedback from these schools and from other sources, the modules are revised.

2.3.10. Overview of the IEL System

IEL is a complete educational system; it is not simply an instructional technique. The system is one in which all participants (students, teachers, principals, and education officers) work together to create a supportive atmosphere for effective and enjoyable learning. Children learn together in small groups, and teachers share responsibilities across grade levels.

The primary modes of learning in IEL are forms of programmed instruction. The ways that children are taught and the ways that they learn are not left up to the teacher as in a conventional classroom, learning is programmed by the IEL staff - a group of dedicated and experienced professionals in instructional design.

The form of programmed instruction used in the first two and one-half years of school is called Programmed Teaching (PT). Children learn in PT classrooms in the following two-step instructional sequence:

Direct Instruction
Review

Each of the above steps takes 20 minutes. Allowing for a five minute break between steps, the full sequence requires 45 minutes. The PT instructional sequence is repeated four times each school day, once for each of four subjects (i.e., Language, Mathematics, Reading, and Science or Social Studies).

In a typical PT classroom, children are divided into two groups of up to 30 students each. At any one time the two groups are engaged in different PT learning activities. While one group is learning in Direct Instruction, the other is learning in Review.

In direct instruction, students are taught directly by the teacher. While conducting direct instruction with one group of children, the teacher monitors, but does not direct, the review activities of the other group.

During direct instruction, teachers use PT Modules. Both the content of what is to be taught and the methods of how it is to be taught are contained in the PT Modules. The teacher is helped by the module in presenting the content to be learned, in eliciting student responses, in reinforcing correct responses, and in making corrections for faulty responses. These activities are programmed by the PT modules for most effective teaching - hence the title "Programmed Teaching."

The use of hand signals by teachers is very important to the success of direct instruction. Teachers use hand signals both to indicate what material is to be learned and to inform students when to respond. The material to be learned may be presented in the module as pictures or letters or numbers. The module is held up by the teacher so that all children can see it clearly. The material to be learned also may be written on the blackboard by the teacher. In whatever way the material is presented, the teacher uses hand signals to indicate which items of the material are to be responded to.

The teacher's hand signals also are used to insure that children respond exactly on cue. In direct instruction the majority of responses are made by all the children together. It is vital to the effectiveness of direct instruction that responses of all children be made at exactly the same time so that the teacher can identify and help any students giving incorrect or hesitant answers. Because children are taught to respond precisely at the time the hand signal is given, the teacher is able to detect students who need special attention. Individual responses in direct instruction are used to identify individual needs and to give remedial help. Hand signals also are needed to elicit individual responses. The use of hand signals gives both structure and control to the teaching/learning process of direct instruction.

A single session in direct instruction lasts for about 20 minutes. This amount of time has been found to be ideal for permitting the extremely rapid stimulus-response pace of direct instruction without losing the concentration of students. It is fast-paced learning that is within the attention span of small children.

Although the teacher's primary attention must be given to students in direct instruction, he or she also monitors the activities of the other group engaged in review. If any corrections have to be made for those in review, the teacher stops direct instruction for the short time needed to make the correction.

After students have completed a 20-minute session in direct instruction, they move to a different part of the classroom for review. At the same time, the group that was in review moves into direct instruction.

There is a five-minute break between learning activities. The teacher uses this time to inform the children how to do the required review activities. The PT module contains the instructions which the teacher follows in letting the new review students know what they are to do.

For Review, the PT groups divide into smaller groups of 3 or more students. These small "PT peer groups" are made up of friends who enjoy studying together. The children are given a copy of a Review Booklet, told what pages to review, and informed how to review the materials in the booklet together. These review activities cover the same material that was learned in direct instruction during the previous 20 minutes. There are ten copies of the review booklets, and children share them. (In large classes, there can be as many as 30 students in review at one time, and three children may share a single booklet.)

Review activities include (a) asking and answering questions of each other, (b) reading aloud, (c) holding "show and tell" sessions in which students take turns showing each other something they have done, (d) having team games among PT peer groups, (e) following directions, (f) copying from the Review Booklet, (g) tracing letters or words, (h) drawing, (i) writing from dictation, and (j) writing answers to questions contained in the Review Booklet.

When children studying in review sessions have any difficulty, they raise their hands. The teacher, who would now be conducting direct instruction for another group, stops direct instruction for the short time required to help the review group.

At the end of 20 minutes, PT groups again change activities. The children who were in review now move back to direct instruction in a new subject, and the group in direct instruction moves on to review.

The above two-step PT instructional sequence of Direct Instruction and Review is repeated four times each school day - one time for each of four subjects. Thus, 45 minutes is spent in the study of each subject. At the end of the day, the teacher writes practice problems on the blackboard taken from the teacher's Practice Booklet. Children copy the problems in their notebooks so that they can be taken home for self study of basic skills

The activities outlined above are for the first two and one-half years of school. They are all included under the general heading of "Programmed Teaching." PT activities are concluded at the end of the first semester of Grade 3.

Programmed Learning (PL) begins in the second semester of Grade 3 and extends through the remainder of primary school. Whereas programmed teaching (PT) directs teaching behaviors, programmed learning (PL) specifies behaviors of learners.

The majority of PL learning takes place in PL peer groups of 3 to 7 students. There is little or no direct teacher instruction. Students study together, helping each other, and the teacher monitors, corrects, and reinforces positive learning behaviors.

PL modules are used. Students complete one of these modules in two days or less.

Each peer group has three copies of the same module, and two students may share a single module. While one peer group of 3-7 students is studying one module, other peer groups are studying different modules. The modules, thus, are reusable - when one group is finished with a module, a second group checks it out to study. The savings in materials costs by IEL are substantial even though each child is able to study daily from modules. Only few copies (three or four) are needed at any one school, yet they can be used by as many as 70 students.

Within PL peer groups, students take turns being the group leader. PL modules contain specific instructions to be followed by the leader. The instructions prescribe how the material in the modules is to be

studied. One instruction, for example, is "Take Turns Reading Sentences." Other instructions include "Take Turns Answering," "Answer in Notebook," etc.

There is a set of behaviors practiced by students in PL peer groups:

- o Take turns being the leader.
- o Follow leader instructions.
- o Help the leader if he/she has difficulty understanding the instructions.
- o Help each other.
- o Ask others for help.
- o Accept help from others.
- o Avoid criticizing others.
- o Speak up. Don't be shy.
- o Use blackboard whenever needed.
- o Ask teacher for help when needed.

One module in one subject is studied in two days or less. At the end of the first day, the students copy questions into their notebooks from a "basic skills practice" page in their module. They then can take their notebooks home for self study of basic skills.

At the end of the second day, the children take module tests. They are seated slightly apart, and the teacher gives each of them a test booklet. The items in the booklet cover the material in the module. The students then exchange notebooks and check each other's answers. The teacher follows up to help with any problems the group may have had. Items missed are recorded by the teacher as a basis for more extensive remediation at the end of the next school day. Students are assigned different remedial activities depending upon individual needs identified by the module test results.

The IEL school schedule below shows both PT and PL learning activities during a typical school day. Abbreviations are used for the subject areas as follows: (L) for Language, (M) for Mathematics, (R) for Reading, and (S/SS) for Science or Social Studies. Abbreviations for Programmed Teaching activities are: DI for Direct Instruction and Rev for Review.

PROGRAMMED TEACHING Group A Group B		PROGRAMMED LEARNING
8:00 - 8:15 Opening Ceremonies		
(L) DI	8:15 - 8:35 (S/SS) Rev	8:15 - 9:50 Module Learning in Peer Groups
(L) Rev	8:40 - 9:00 (L) DI	
(M) DI	9:05 - 9:25 (L) Rev	
(M) Rev	9:30 - 9:50 (M) DI	
9:50 - 10:20 RECESS		
(R) DI	10:25 - 10:45 (M) Rev	10:25 - 12:00 Module Learning in Peer Groups
(R) Rev	10:50 - 11:10 (R) DI	
(S/SS) DI	11:15 - 11:35 (R) Rev	
(S/SS) Rev	11:40 - 12:00 (S/SS) DI	
12:00 - 12:45 Remediation Period		12:00 - 12:45 Remediation or Module Testing
12:45 - 1:30 Homework Assignments & Dismissal		12:45 - 1:30 Homework Assignment or Test Scoring

NOTE: * Grades 1, 2, and 3 are in Programmed Teaching.
* Grades 4, 5, and 6 are in Programmed Learning.
* Grade 3 begins Programmed Learning the Second Semester.
* The last two periods of Programmed Learning each day are
for Remediation and Homework Assignment on one day and for
Module Testing and Test Scoring on alternate days.

PL peer group learning, as described on the previous pages, is followed for only four days of each school week. The fifth day, Friday, is used by PL students for a variety of other activities including (a) Arts and Crafts, (b) Science Experiments, (c) Agriculture, and (d) make up of any missed module tests.

PT Instructional Materials. Programmed Teaching utilizes five different types of instructional materials:

1. PT Modules
2. Reading Booklets
3. Review Booklets
4. Practice Booklets
5. Semester Test Booklets (1)

PT modules are used solely by the teacher for direct instruction, and only one copy is required. There are 20 modules for each semester. There are five modules each in Language, Mathematics, and Reading. Science has two modules the first semester and three the second semester. Social Studies has three the first semester and two the second semester. PT modules average 80 pages in length. Each module is divided into three five-lesson booklets for ease of handling.

Reading Booklets are used only during some of the direct instruction lessons. Contents of the booklets cover all subjects and only one original reading booklet is used each semester. These booklets are not used in Grade 1. In Grade 2, a booklet averages 40 pages for each of the two semesters. For a single PT semester of Grade 3, the reading booklet is approximately 80 pages.

Review Booklets are used in all PT semesters immediately after direct instruction period. There is a separate booklet for Language, for Math, and for Reading. There also is a single booklet containing review for Science and Social Studies combined.

Practice Booklets are used by teachers in assigning homework. Teachers write practice lessons on the blackboard, and the students copy them in their notebooks for homework. Each assignment covers one-half page. Homework feedback covers another one-half page of the Practice Booklet.

Semester Test Booklets are used solely by the teacher, and only one copy is needed. The test booklet also includes scoring keys and instructions for administration.

Early in the development of the IEL Project PT learning was determined inadequate with regard to the conduct of practice and review by peer groups following direct instruction. Three mid-year evaluations pointed to revision of practice and review as a prime need requiring attention by the Project staff.

Initially, practice and review groups were distributed single sheets of materials, one per student. Cost and management analyses indicated that "throwaways" such as these could not only cause a significant and major increase in learning costs, but also would be difficult to manage by

teachers because of the difficulties of storing and retrieving single sheets. "Throwaways" were also difficult to manage by the MOE because of logistical demand of distributing new materials to all schools each year. The project, in keeping with the concept of making IEL self-contained within schools, eliminated throwaway consumable materials and has consistently insisted that all materials be bound for ease of storage and retrieval.

Evaluators were most concerned, however, with student and teacher behaviors during practice and review sessions. It was clear that teachers and students did not know what was expected of them. Guidelines were unclear, and training and supervision were spotty. In April 1982, therefore, guides for practice and review were prepared for use with the Phase B PT materials and inservice training of both teachers and students was conducted.

The full set of practice and review activities was re-examined in 1983, both conceptually and based upon formative feedback gathered through 1982 and in 1983 from the Laboratory, Systems, and Experimental Schools. The April 1982 specifications of practice and review behaviors, although eliminating weak procedures and standardizing a set of fifteen instructions, required additional revision.

In June and July, 1983, a second major effort was made to examine the IEL materials and learning systems. The objective was to further reduce materials production costs while maintaining or improving the effectiveness of learning. This effort resulted in further changes in programmed teaching. From field observation and the comments of teachers and principals, it was clear that major difficulties were still being encountered with the practice groups with regard to management of materials and group activities. It was decided by the Project Staff and consultants that practice groups should be eliminated and the multiple practice booklets condensed into a single booklet to be used by the teacher in assigning homework and/or remedial activities. A second major cost reduction resulted from the distribution of review booklets. The ratio for distribution was changed from one booklet per student to one booklet for two or three students (maximum of three). These PT system modifications were tried out during the second semester of 1983 in all IEL schools. The try-out proved satisfactory.

PT materials now consist of the following:

Programmed teaching modules are used by teachers in Grades 1, 2, and the first semester of Grade 3 in conducting direct instruction. The modules make explicit both what to teach and how to teach. They present content that directly reflects the 1979 National Curriculum.

There are 20 modules for each semester. Each teacher has a single copy. There are five modules (Levels 1-5) each in Language, Mathematics, and Reading. Science and Social Studies in Grades 1 and 2 are combined. (For example, in Grade 1 semester 1, Levels 1, 3, and 5 are Social Studies and Levels 2 and 4 are Science.)

Each module has 15 lessons. One lesson is covered each day in a 20 minute direct instruction session. The first 13 lessons are instructional lessons. The 14th lesson is an individual test usually given orally. The 15th is a group module test, and students write their responses in their notebooks.

A module comes in three separate booklets which are labeled "A", "B", and "C". Five lessons are bound together in a single booklet for ease of handling. The three booklets, thus, provide a total of 15 lessons for each module.

Review booklets are used in all PT semesters during review sessions. These booklets are designed to reinforce the learning of the previous direct instruction session. The content of review is taken directly from the lesson in the module just completed. However, the review booklets are designed to be sufficiently different from direct instruction to avoid boredom. Most typically, the content of review booklets applies the skills and knowledge gained in direct instruction to new contents.

There is a separate booklet for Language, for Mathematics, and for Reading. There is also a single booklet containing review for Science and Social Studies combined. There are thus, four separate booklets each semester. Each semester package contains 10 copies of each booklet. Two or three students share a single booklet.

Reading booklets are used in conjunction with PT modules in direct instruction for Grades 2 and 3 only. Students use these booklets under the direction of the teacher in direct instruction. Contents of the booklets cover all subjects. Reading booklets are also distributed 10 per class or one booklet for two or three students.

Practice booklets are used by the teacher in assigning basic skills practice as homework. These booklets contain practice lessons in reading and arithmetic skills. Teachers write these lessons on the blackboard, and the students copy them in their notebooks for homework. One practice booklet is provided to each teacher.

PL Instructional Materials. Programmed Learning utilizes seven types of instructional materials:

1. PL Modules (Core)
(Optional)
(Enrichment)
2. Student Guides
3. Module Test Booklets
4. Module Test Answer Keys
5. Block and Semester Test Booklets

6. Block and Semester Test Answer Keys

7. Arts and Crafts Manuals

PL Modules are used by students for peer group learning. The modules contain explicit instructions to the groups for studying each portion of every module.

Student Guides are reminders of appropriate peer group behaviors. Students answer questions from Module Test Booklet, and they exchange and score each other's test by using Module Test Answer Keys. The three block tests and one semester test are contained in Block and Semester Test Booklet. Answers to these questions are found in the Block and Semester-Test Answer Keys.

The Arts and Crafts Manual provides instruction for doing ten projects each semester. Arts and Crafts is conducted only in Grades 4 through 6.

Programmed Learning (PL) is the primary mode of learning beginning with the second semester of Grade 3. PL is conducted in peer groups of 3 to 7 students. A maximum of two students share a copy of the module that the group is studying. They take turns acting as a leader of the group. The leader of the group has his/her own copy of the module. The teacher is a manager and facilitator of PL learning and does no direct instruction.

Learning in peer groups can be a dynamic and enjoyable interaction if done right. It also can be boring and competitive if done wrong. These facts are being learned in several other countries as well as in Liberia. What has been learned is that students sitting together silently studying their own modules are bored when done day after day, that a few of the faster students proceed much faster than the norm, that a few of the slower students make little progress and often drop out of school, and that the teachers have a difficult time managing because every student is in a different place on the learning continuum and demands testing and feedback at different times. Also what has been learned is that if the group behavior is sufficiently structured and students receive adequate training they can learn as an interactive group, that fast students are not held back as much as was predicted, that all students progress at a faster rate, that post test scores are higher on their first administration, that students enjoy learning much more, and that teachers prefer this kind of structured peer-group learning.

As with programmed teaching, modifications were made in programmed learning in 1983 to save production costs and strengthen learning. Again these changes were the result of field observations by Instructional Supervisors and feedback from teachers, principals and IEL staff. These changes included reducing the size of the PL group to range from three to seven, reducing the number of PL modules provided, and reorganizing PL modules into "core", "optional" and "enrichment" modules.

The maximum PL group size is still seven, but teachers are given the option of more flexible grouping. A group size of three students, however, is suggested for classes of up to 30 students. The maximum PL

class size is 70 students, i.e. seven students in ten different groups. In extremely large classes, such as this, four copies of each PL module are provided, but in normal or small classes three copies of each module are contained in semester boxes and two students share a module. This modification resulted in substantial cost savings. Comments from teachers indicate their satisfaction with the smaller, more flexible grouping.

The second major modification to PL was based upon an analysis of the actual number of days available for study in a typical elementary school. Given holidays, work days and market days, actual days available for study varies from 50 to 90 days per semester with the mean likely on the lower end of the range. As originally designed, PL calls for 60 modules to be studied per semester on a basis of one per day. However, feedback from schools indicated that most learning groups could not complete study of a module each day and the norm was 1-1/2 to 2 days required to complete a module.

To accomodate this range of available study time and in view of the normal time needed to complete a module, a more flexible system was designed and tried out in the second semester of 1983. The results were again favorable. This new system calls for allowing a maximum of two days to complete a module and reordering the modules so that the most important material is covered first in what are called the "core" modules. There are three levels of core modules with two modules in each level (six core modules) in every subject each semester; a total of 60 modules that must be studied by students in one year. The next two modules in the series are called "optional" modules. There is one level (two optional modules) per subject for a total of 10 per semester. The last two levels (four modules) per subject or 20 per semester are "enrichment" modules which are studied only if time allows after completion of core and optional modules. PL modules are normally distributed on a basis of three copies of core and optional modules and one copy of enrichment modules per class. This modification of PL allows for substantial cost savings as well as providing a more realistic schedule for learning.

Arts and Crafts Manuals. Arts and Crafts Manuals are used by the teacher to give instructions to the students on how to do a certain project. The manual contains ten lessons, each of which is presented in a step-wise fashion and well illustrated. All projects in the Arts and Crafts Manual can be conducted with the materials and equipment available in any village of the country.

Arts and crafts instruction is a non-modular activity. It took place every Friday. It begins with the first semester of Grade 4 and continues through Grade 6. One manual is used each semester, and there is one copy in each semester package.

2.4. Production and Distribution of Instructional Materials

The Production Unit produced all the printed materials for the project. Its functions included the following:

- o type all versions from initial drafts through final copy
- o produce graphics for modules, training materials, teachers' manuals, etc.
- o produce multiple copies for use in schools.

2.4.1 Workflow

The production unit became involved with the development of instructional lessons and modules when a writer submitted the initial draft to the section for typing. After the initial draft was completed, copies were given to the writer manager, editor and production head who met with the writer to design the initial layout.

The design elements that were incorporated into the initial layout were:

- 1] objectives of the writer
- 2] content of illustrations as determined by the writer
- 3] size and format of illustrations
- 4] predetermined graphic standards for copy and illustrations
- 5] technical requirements of the printing process.

Once the initial layout had been established, the Production Head assigned the illustrations to the artist(s), explaining in detail the style, format and content required. If questions arose at this time which the Production Head could not answer, the artist was referred directly to the writer manager or to the appropriate writer.

After the style and skills of each artist became known, a specific artist was requested to produce illustrations for a particular subject or series of modules. If this assignment of artists was done routinely, they would be asked to attend the review of the draft with, or in place of, the Production Head. Lettering was standardized as much as possible so that a selection was made at the time of initial review. Special size lettering for charts and flashcards were done with a LeRoy or equivalent lettering sets.

Whenever possible, a standard format for illustrations and general layout of modules were followed. The need to reduce or enlarge illustrations to fit formats was met by use of a copy camera and

photochemical transfer materials (PTM). The artists supplied the illustration to be enlarged or reduced to a camera man and specified the area which the illustration will fill by the technique of "boxing." This area was specified earlier in the instructions resulting from the joint review of the initial module draft.

Copy also was needed to be enlarged or reduced on the camera when the same copy is used in different sizes in the same module. An example of the need for several sizes of the same copy would be the use of a large size display for Programmed Teaching and smaller copies of it for peer group practice. The use of the camera equipment thus eliminated some of the redundancy of preparing originals in different sizes.

In order to reduce drawing time, artists tried to incorporate elements of pre-existing illustrations or to use drawings from our "clip art" file whenever possible. The copy camera and the PMT materials were used to enlarge or reduce these composite drawings to the correct format size, a process much less time consuming than producing new illustrations.

The completed illustrations and the copy for the module were incorporated into a camera-ready layout by a layout man. He used a Goodkin waxer to coat the graphic with adhesive and used a light table and T-square to insure proper alignment of the inserted material. In doing this, he followed the layout blocked out earlier and submitted the composite to the Production Head for approval. This layout was used for tryout copies and then filed for use in subsequent revisions and printings. Only when the segment was revised or reprinted was this layout removed from its file. In the case of a revision, the original was replaced in the file. The layouts were filed by code numbers developed for module sequences.

The file of camera-ready layouts in their final version was an important legacy of the project since they can be used for any subsequent printing at any time. Legal size filing cabinets and metal shelvings safely stored these masters.

Copies of the materials were made on a Xerox machine (Xerox 9400) which photocopied the original and collated copies as they were produced. The use of Xerox was dictated by the large number of originals and revisions and the small number of copies required for each, particularly during the development of materials for the formative and system tryouts.

The completed modules were stored by code number until they were distributed to the schools. A continuous inventory control system helped track materials from the writing stage through final production and distribution.

2.4.2. Offset Printing

Late in 1983 and in 1984, a major effort was made to decrease reliance on the Xerox 9400 photocopier for printing of IEL materials. Although this method of printing was effective in the early years of the

object, due to local power , and ever increasing printing requirements, this method of production is no longer satisfactory and has resulted in delayed distribution of IEL materials to schools. In October 1983, a materials production consultant from the World Bank Fourth Education Project technical assistance team prepared a report on printing alternatives available locally, and in November we began to print IEL materials for the 1984 school year at commercial offset printers in Monrovia. Costs have proven lower than those of the Xerox 9400.

2.5. Implementation and Teacher Training

Teacher training and implementation was the responsibility of the implementation unit. The design of the training and implementation procedures were done in several stages including a conference on the IEL management system, development, and revision activities.

The conference on the IEL Management System, which was held in Gbarnga, focused on how best to manage instruction in schools of varying student and teacher populations. Whereas the April conference dealt with instructional system management within the classrooms, this conference dealt with instructional system management at the school level. Two consultants, a ranking Liberian educator and an external consultant, assisted in the deliberations and submitted their respective recommendations.

The development of prototype instructional materials for the first three grades (PT) and corresponding teacher training materials started immediately after the writers' return to Gbarnga from the three-month course in Bloomington. PL module writing was started six months later.

A complete updated Teacher Training Package for the experimental year was planned jointly by the Project staff and their advisors. Components of this package were prepared by various members of the staff and the technical assistance team.

2.5.1. Teacher and Student Guides

In a system as tightly designed as IEL, providing the schools of only instructional materials and training is not sufficient. Teachers, administrators, and students all need a ready reference whenever they are in doubt about or forget a procedure. Teacher and student guides and manuals, therefore, were part of the "package" introduced into schools.

In PT, the project has been providing teachers with copies of the training manual, and recently provided a list of behaviors to be followed in practice and review. In PL, schools are being provided with both a teacher's edition and a student guide for learning in PL groups.

All of the above were revised based upon the 1982 and 1983 experience and included in the guides and manuals for teachers, administrators, and students. There are, thus, a number of activities important to the functioning of IEL which are covered in the guides and manuals and are also included in the revised training course. A partial list follows:

Programmed Teaching

Direct Instruction:

- Giving the Instructional Task
- Signaling
- Giving Reinforcement
- Correcting by Modeling
- Correcting by Analysis
- Correcting by Blackboard Follow-up
- Identification of Remedial Needs

Review:

- Organizing Peer Groups
- Providing Review Materials
- Instructing Students on Review Behaviors
- Monitoring Review Groups During Direct Instruction
- Correcting Review Behaviors without Disrupting Direct Instruction
- Identifying Groups and Individuals Needing Special Remediation
- Correcting Group Behaviors in the Following Modes:
 - Tracing
 - Copying
 - Drawing
 - Writing from Dictation
 - Writing Answers
 - Show and Tell
 - Reading or Checking Answers
 - Answering Questions
 - Reading
 - Group Discussion
 - Team Game
 - Read and Copy
 - Read and Complete
 - Read and Answer

Test Administration:

- Reading/Reporting Items
- Monitoring Oral Responses
- Monitoring Written Responses
- Scoring
- Giving Feedback
- Identifying Students in Need of Remediation
- Recording Student Progress

Remediation:

- Determining Specific Remedial Needs of Students
- Repeating PT Direct Instruction
- Reviewing Difficult Lessons
- Tutoring Returned Absentees
- Preparing Transfer Students for PT Instruction

Provision for Student Absences:

- Identifying Absences of Students
- Determining Appropriate Strategies
- Tutoring by Peers on Student Return
- Use of Remedial Period

Management:

- Storage and Retrieval of Materials
- Organization of Classroom
- Maintenance
- Homework

Programmed Learning

Monitoring Peer Group Learning Activities:

- Helping Each Other
- Agreeing on Answer
- Reading Answer (Leader only)
- Using Blackboard as Needed
- Not Writing on Modules (Using own Copybooks)
- Participating in Group Learning Activities
- Asking Teacher for Help Whenever Needed
- Cooperating with each Other and not Disrupting Group
- Giving Positive Feedback to Each Other

Following Leader Instructions:

- READ TOGETHER
- READ ALONE
- TAKE TURNS READING
- GROUP ANSWER
- TELL EACH OTHER
- TAKE TURNS ANSWERING
- ANSWER IN NOTEBOOK
- MAKE UP QUESTIONS
- LEADER COPY
- FOLLOW DIRECTIONS
- NEW LEADER

Test Administration:

- Determining Readiness of Group for Post Test
- Administration of Test
- Maintaining Independence of Responses Among Students
- Insuring that Students do not Write on Test
- Scoring of Test
- Giving Feedback to Students
- Identifying Students in Need of Remediation
- Recording of Test Results

Remediation:

- Identifying Specific Remedial Needs of Each Student
- Assigning Peers or Peer Groups to Assist in Remediation
- Use of Remedial Period
 - Remediating Group Deficiencies
 - Remediating Individual Deficiencies
 - Remediating Deficiencies of Students Who Have Been Absent
 - Retesting

Management:

- Storage and Retrieval of Materials
- Organization of Classroom
- Maintenance of Records

The above list provides only a partial outline of the content of teacher guides. There were also specific items which administrators must have in their guides, usually related to management and supervision of the total school. (An aside: One of the difficulties encountered with the previous materials management system was that there was no formal responsibility in the schools for the maintenance of their supply of materials. Principals, teachers, and parents have subsequently been made responsible for materials in their care and sign a statement to that effect.)

All guides and manuals were prepared in December 1982 to be the basis for the new training course to be conducted in March 1983. They were further revised in December 1983 for use in the final year of Phase One of the Project.

In February 1983 approximately 90 teachers and principals from 15 schools were trained in the IEL system. The initial IEL training design had called for one four-week training period after which teachers and principals would be ready to implement the IEL system in their schools. However, based upon extensive observations by IEL Instructional Supervisors and feedback from schools, this training system was modified.

The IEL training design now called for a three phase training system. The first phase was an initial three-week pre-service training where all major aspects of the IEL system are introduced and practice teaching conducted (principals receive four weeks of training, the last week concentrating on management and supervision). The second phase consisted of visits to schools by Instructional Supervisors and/or District Education Officers at least twice a month for the first semester to provide on-site monitoring and additional training based upon classroom performance of teachers. The final phase was a mid-year one-week followup training workshop for teachers and principals.

In March 1984, IEL expanded to 30 new schools. Two IEL branch offices were established within the Regional Education Offices to oversee IEL operations in ten schools in upper Lofa County and ten schools in Grand Gedeh county. The IEL Central Office in Gbarnga monitored

operations in ten new schools. The IEL Project was, therefore, implemented in 45 schools in Bong, Nimba, Fofa, Montserrado (Gibi Territory) and Grand Gedeh Counties. Training of approximately 200 teachers and principals from these schools was done. It is hoped that this expansion effort will provide a basis of experience for planning and implementation of IEL dissemination in Phase II.

2.5.2 School Monitoring and Supervision.

The original design for IEL called for Instructional Supervisors to be key components of the system with one Supervisor for each group of 4-5 schools. A major question concerned whether or not this design should be maintained. Again the answer came from the feasibility of maintaining the design in later years after the expansion to a large number of schools. It seemed unlikely that the use of external Instructional Supervisors can remain part of the IEL system. The most likely scenario is: (1) a central MOE management unit, (2) a training cadre as part of this unit, (3) overall supervision by the District Education Officers, and (4) self-contained learning systems within each school with the principal trained as an Instructional Supervisor to provide the immediate supervision and monitoring needed within each school.

During the first three years of the project, the monitoring and supervision function of IEL had been the weakest component of the Project. To develop the needed "package" for monitoring and supervision, the Project Staff (1) defined the instructional system and teacher/student behaviors and communicated this design to all units, (2) provided first semester materials on a more timely basis during the 1983 school year, (3) provided transport to the Implementation Unit by assigning several vehicles, (4) implemented the feedback system described in Appendix F, (5) coordinated the activities of evaluation and implementation, and (6) strengthened the teacher and principal training design to allow for more effective implementation.

The Ministry of Education stressed the importance of incorporating IEL with the regular educational administration structure and shifting primary supervision responsibilities to the District Education Officers. This was a major objective of the IEL Project for 1984. To this end all Chief Education Officers and District Education Officers throughout Liberia received a four-day training in IEL systems, procedures and materials. In addition, IEL Instructional Supervisors in the two new branch offices of IEL, in Zwedru and Voinjama, worked in concert with the regional education officials and especially District Education Officers so that after the first semester of 1984 they were able to gradually assume full responsibility for supervision of IEL schools.

IEL teachers must follow exact program sequences if learning is to be effective. The training of IEL teachers, thus, was primarily directed toward insuring that their teaching behaviors follow precisely those designed by project staff to support programmed instruction of students in project schools. What teachers do in the schools is what ultimately will lead to efficient student learning, and if teachers can be taught to practice consistently those behaviors which support learning, IEL children

will learn, and they will learn more efficiently and more effectively than children in conventional classrooms. This is the basic premise of the IEL project.

The project staff has identified four distinct teacher roles:

1. Programmed Teaching of children in Grades 1 & 2: Four basic programs were developed which encompass the full range of learning objectives in these two grades.
2. Transition Teaching of students in Grade 3: Children in this grade will begin to develop more independent learning habits in preparation for their moving into Programmed Learning in the upper three grades. Grade 3 youngsters will continue to learn under PT programs during the early part of the school year, will be introduced to simple PL programs under the guidance of the teacher about mid way in the year, and will be functioning as programmed learners by the end of that grade.
3. Programmed Learning Supervision in Grades 4 through 6: Students at these upper levels will be learning primarily in peer groups and by self instruction. There were very definitive teacher behaviors required to monitor, guide and support these more independent modes of learning.
4. Master Teachers were expected to supervise the activities of all other teachers in a school. They must know what behaviors are expected of those they supervise and must be able to give them guidance and support.

In addition to the above four teaching roles, there was one other that is essential to project success: that of the Instructional Supervisor.

5. An Instructional Supervisor was responsible for conduct of the IEL instructional system in four schools. All teachers in the schools will be under the IS's direction and guidance. The appropriate behaviors of the IS must be specified no less clearly than those of teachers in the schools. The IS has one additional responsibility: assisting the Teacher Training Head in conducting the training program.

In developing training course materials and procedures, the training staff examined the role of each participant, from Instructional Supervisor down to the Program Teacher, and listed a comprehensive description of all effective and ineffective types of behavior. Course procedures attempted to develop effective skill and avoid ineffective behavior. Observational checklists were developed from these sets of behavioral descriptions for use by the TT Head, IS's and Master Teachers in the supervision of teacher activities throughout the implementation of the IEL system in the schools.

2.5.3. Management of PT Learning Activities

Programmed Teaching (PT) begins the first day of Grade 1 and extends through the first semester of Grade 3. The activities of the teachers at these grades were planned in detail to promote optimal learning. Each lesson is thoroughly planned, the materials for each lesson printed and distributed, teachers trained, and teaching methods programmed in detail. PT teachers in IEL schools did not have to develop lesson plans; they had been incorporated in the learning materials and procedures. They did not have to develop achievement examinations each marking period; all tests had been preprinted. The responsibilities of PT teachers and the learning activities at the lower grades are the subjects of this chapter.

The PT Instructional Sequence. There is a cycle of learning activities that fill the day of youngsters in PT learning. Each day of the school year, except for the testing days, these children study four subjects. The subjects are:

LANGUAGE
MATHEMATICS
READING
SCIENCE or SOCIAL STUDIES

Language, Mathematics, and Reading are learned every day. Only one-half the time is spent in the study of Science and one-half time in the study of Social Studies.

The primary instructional sources for PT learning are the PT Modules. They will be described in the next section of this Handbook. For now, it is important for an understanding of the PT sequence to know that one module in each of four subjects was covered in three weeks.

Four subjects were included in the instructional sequence at any one time, and it required three weeks to complete them. If Science was included among the four subject, Social Studies was not included until the next three-week period. The content of IEL instruction is based upon the 1979 National Curriculum. The IEL Steering Committee had wisely insisted that more learning time be given to basic communications and computational skills than to other subjects.

This concentration on basic skills continued throughout the two and one-half year PT period. For the remainder of the primary years, however, Science and Social Studies were given equal instructional time with the other subjects. IEL students, thus, were given the basic skills early so that they could benefit more from learning opportunities in the later years.

Within a school day there was a definite and unvarying sequence of learning. The basic sequence is:

Direct Instruction
Review

Students first learned new content from the teacher in direct instruction. After 20 minutes of direct instruction, students were

provided with materials and procedures for a review of the material just completed in direct instruction. With five-minute breaks between direct instruction and review, the total sequence above took forty-five minutes of school time. This amount of time every school day, therefore, was spent on each of four subjects.

There was a 15-minute period at the start of each day for opening ceremonies, a 45-minute period toward the end of the day for remediation, and a final 45 minute-period for homework assignments and dismissal. The total school time, ignoring recess, therefore, was five hours each day. Please refer to the daily schedule of IEL activities given on page 5 of this Handbook. That schedule shows the maximum of two "PT Groups" under the management of a single teacher. Some teachers, in small groups, had only one group in a grade, but they might have a second group in a different grade.

The basic PT instructional sequence was maintained for each group. For every subject, a group first had direct instruction, followed by review. Group A in the schedule on page 5, for example, had the following sequence:

Language: Direct Instruction> Review

Mathematics: Direct Instruction> Review

Reading: Direct Instruction> Review

Science or
Social Studies: Direct Instruction> Review

This sequence did not vary. It was the basis of the instructional management system for PT learning. Materials and procedures both were geared to making this sequence of learning activities most effective.

There were times when school was let out early. For example, there was a teachers' meeting or heavy rains that forced the school to close early.

Whenever PT learning was resumed after a break such as this, it was always begun where it was left off. Several Examples:

If a group of students had finished direct instruction in Language before the break, they would resume the next school day with a review of the same lesson in Language.

If a group of students had finished review of Mathematics before the break, they would resume with direct instruction in Reading.

If a group of students had finished a review of Social Studies before the break, they would resume the next day with direct instruction for the next lesson in Language.

The sequence of subjects always remains the same:

LANGUAGE

> MATHEMATICS

> READING

> SCIENCE

-or-

> SOCIAL STUDIES

The schedule on the next page was followed except when there had been a break. After a break, the same periods were kept, but the subjects studied by the two groups changed.

The schedule on the next page is an example how the schedule changes after school was let out early. It shows how the learning sequence remained unbroken even though school was let out at 9:50 on Day #1.

Providing Remediation. The IEL system for programmed teaching is intentionally redundant in that it covers the same learning content repeatedly. This redundancy is especially evident in direct instruction lessons. Redundancy also occurs with each review which covers the content of the preceding direct instruction lesson. The purpose of repeated exposure to the same materials is to insure that PT students approach mastery in their learning. It is far better to learn fewer things well than it is to learn many things poorly.

As an example: IEL had to develop a remedial reading transition course of 40 PT lessons to be used with 4th through 6th graders who transfer from conventional schools into IEL schools. This same course was part of the procedures for installing IEL into a new school. The reason for the course is that IEL students in Grades 4 to 6 must be able to read in order to benefit from PL peer group learning. Children in conventional schools typically are woefully unprepared whereas IEL children moved from PT instruction into PL learning with a minimum of difficulty. What IEL students learn, they learn well.

It was not sufficient, however, to simply plan for redundant learning. Some children still fell behind their peers. Those who were absent needed special attention. And students newly transferred into an IEL school most often needed to be given sufficient upgrading to be able to participate as normal PT students.

Four kinds of remediation for PT instruction were provided by the IEL system. They were (1) repeating PT direct instruction, (2) reviewing difficult lessons, (3) tutoring of returned absentees, and (4) preparing transfer students.

Repeating PT Direct Instruction. (Note that this method of remediation is possible only in schools with two direct instruction groups in a grade.)

DAY #1		DAY # 2		
Group A	Group B	Group A	Group B	
8:00 - 8:15 Opening Ceremonies				
8:15 - 8:35 (L) DI	(S/SS) Rev	8:15 - 8:35 (R) DI	(M) Rev	
8:40 - 9:00 (L) Rev	(L) DI	8:40 - 9:00 (R) Rev	(R) DI	
9:05 - 9:25 (M) DI	(L) Rev	9:05 - 9:25 (S/SS) DI	(R) Rev	
9:30 - 9:50 (M) Rev	(M) DI	9:30 - 9:50 (S/SS) Rev	(S/SS) DI	
SCHOOL NOT IN SESSION	9:50 - 10:20		RECESS	
	10:25 - 10:45 (L) DI	(S/SS) Rev		
	10:50 - 11:10 (L) Rev	(L) DI		
	11:15 - 11:35 (M) DI	(L) Rev		
	11:40 - 12:00 (M) Rev	(M) DI		
	12:00 - 12:45			REMEDICATION PERIOD
	12:45 - 1:30			HOMEWORK ASSIGNMENT AND DISMISSAL

Even though there was a break in the school day, the students in both groups began the next day exactly where they left off.

Group A left off in Day #1 with Mathematics Review.
It began Day #2 with Reading Direct Instruction.
There was no break in the sequence.

Group B left off in Day #1 with Mathematics Direct Instruction.
It began Day #2 with Mathematics Review.
There was no break in the sequence.

In establishing direct instruction groups, teachers assigned the one or two least able students to the first group. If any students in the first group had difficulty, they were then kept over to repeat direct instruction with the second group. On those days when a child was held over, he or she did not participate in the peer group review of the materials.

Teachers stayed alert to the capabilities and deficiencies of all their students. Occasionally, they moved a child from the second to the first direct instruction group so he or she could be in a position to repeat direct instruction.

Reviewing Difficult Lessons. All direct instruction lessons were not of equal difficulty. The most difficult one or two lessons given over the past day were repeated for the whole class during the remediation period. Direct instruction for these lessons was carried out rapidly without stopping to assist individual students (difficult to do in any case with a large class). Tasks were repeated until the teacher was satisfied that all children were responding correctly on cue.

If there were students who had absent or students who were new to the IEL system, some of the more able students were held out of the above group session to give tutorial assistance.

Returning Absentees. Students returning to school after an absence were placed in the first direct instruction group and seated in front of the teacher. The teacher was better able to identify any deficiencies when a child was sitting directly in front. When errors were detected, the teacher could ask for and correct individual responses. If necessary, the returned student was held over for a second direct instruction session.

During the remediation period, the returned absentee was given one-on-one tutorial help on those lessons missed because of absence. One of the more able students in the class tutored by going over the lessons missed in the review booklet.

As soon as the teacher was convinced that a returned student had caught up with his or her peers, the student was returned to his or her normal group.

Preparing Transfer Students for PT Instruction. Students from conventional schools who transfer into an IEL school were placed in the normal PT instructional sequence. As with the returned absentees, these students were seated directly in front of the teacher for direct instruction. They also were placed in the first direct instruction group so that they could be kept over, if needed, for a second session of direct instruction.

The teacher also used the remediation period to help the transition of new students. If the teacher determined that the new student would benefit more from a repeat of one or two of the most difficult direct instruction lessons of the previous day, the child was kept with the class for a repeat of direct instruction of the more difficult lessons.

If the teacher decided, however, that the child would benefit more from one-on-one tutorials of previous lessons, one of the more able students was assigned to give tutorial help. Review lessons were chosen for use in tutorials which would overcome identified difficulties. These deficiencies most typically were in language and reading.

This process of preparing the transferred student was continued until the teacher decided that the new child could function alongside other students without additional support.

IEL schools, in these beginning grades, have not had particular difficulties in preparing transfer students for PT learning. At this level, concepts are fairly simple, instruction was repeated many times, and learning was reviewed systematically. Transfer students were expected to function normally within the first two weeks of their entry into an IEL school.

Testing. There are three kinds of PT tests: Individual Module Tests, Group Module Tests, and Semester Tests.

Individual Module Tests. The 14th lesson in a PT module is called an individual test. It covers the content of the previous 13 lessons. The individual tests were conducted in the normal direct instruction groups. Administration of individual tests was very similar to the procedures followed in the other PT lessons except that there was no correction procedure and no positive feedback for correct answers.

The teacher asked for individual responses to test questions, going around the group until he or she was certain which children were progressing satisfactorily and which needed additional remedial attention. Because there were no correcting procedures, the teacher was able to cover most of the items with all the students.

During the five-minute break following the test, the teacher made notes as to which children needed additional help and in what areas.

The review session which followed individual testing was a team game in which children asked each other questions taken from the previous 13 review lessons. The questions asked by children in the team game very often were the ones that were found difficult during the individual testing.

Group Module Tests. Group tests were given to the whole class. They followed individual tests. Answers were written by students in their notebooks. Group tests required two hours to administer - 30 minutes for each subject. Results of group tests were used for grading.

Group tests were administered after all groups had finished direct instruction through lesson 14 (individual testing). All students thus had equal exposure to direct instruction.

The majority of test items were printed on the blackboard by the teacher, but the questions usually were given orally. Printing by teachers was the same in all IEL schools. All printing was in capital and lower case block letters. Beginning in the second semester of Grade 2,

level 2, teachers wrote on the board in script. This change in writing styles parallel the learning sequence of PT modules.

At the close of the two-hour testing period, the students were dismissed for the day. They returned home or stayed at the school for an extended recess. The teacher spent the remainder of the day scoring tests and entering grades in student records.

Semester Tests. A comprehensive test was given at the end of each semester. It was administered to all students in the class at the same time. It was administered as was the group module test: the teacher wrote items on the blackboard, and students wrote answers in their notebooks. One hour was required for each subject: Language, Mathematics, Reading, and Science/Social Studies combined. Total testing time was thus four hours. Results were entered in the individual student records.

Semester tests covered only the material covered by the teacher in direct instruction. If a teacher, for whatever reason, has had to omit one or more lessons, test items on those lessons were not administered as part of the semester test. It was the responsibility of the teacher to omit the items of the test which had not been covered in direct instruction. (The table: "Student Scores on Tests" which is given later in this chapter was used to obtain percentage test scores that were comparable among all schools even though the number of test items in the semester test varied.)

2.5.4 Management of PL Learning Activities

Programmed Learning began the second semester of Grade 3 and extended through Grade 6, the final year of primary school. The majority of learning during these 3 1/2 years took place in small peer groups. These groups studied PL modules fairly independently. Teachers monitored, guided, and assisted PL learning groups, but the constant direct lecturing of conventional schools was not required. Teachers were freed from the need to "teach" so that they could provide individual and group guidance and remediation. Teachers did not have to develop either lesson plans or achievement examinations; learning materials and procedures were made available to the teacher by the IEL system. A single teacher was able to monitor and assist the learning of as many as 12 separate PL learning groups, and the groups could be in different grades. The responsibilities of PL teachers and the learning activities of students at the upper grades are the subjects of this chapter.

The PL Instructional Sequence. The daily sequence of PL learning activities can be seen in the schedule given on page 5. The school day started with opening ceremonies at 8:00 o'clock in the morning. For the remainder of the morning, except for a half-hour recess period, the time was spent in peer groups studying PL modules. A module usually required two days for a group to finish. At twelve o'clock, on the day a module was finished, the students took a module test. This same time period (12:00 to 12:45) was used the days on which the module was not finished for remediation of deficiencies found in the previous day's module test.

At 12:45 on the days that module tests were given, the tests were scored. On the days that tests were not given, this period was used for assigning homework. School finished at 1:30.

The above sequence was repeated daily Mondays through Thursdays. Friday, however, was "activities day." On Fridays, students undertook projects in Arts and Crafts and Agriculture, made up module tests missed during the week because of absences, and conducted a Science experiment whenever the Science module studied that week included an experiment.

At the end of every six weeks, PL students took block tests on the twelve modules studied during the marking period. At the close of each semester, a comprehensive test was given covering the 30 "core" modules. More explanation of core modules will be given later.

The sequence for one semester follows. There are several things to note:

- a. The sequence shown is hypothetical only. It has a neat six weeks of five school days each - something that was never possible because of holidays. The actual sequence, therefore, was worked out each year after the marking period dates has been posted by the Ministry of Education.
- b. The last week of each six-week marking period was for review and testing. In all three marking periods, the final week was for "block tests." The final week of the third period also included "semester tests."
- c. There were ten Arts and Crafts (A/C) projects to be undertaken in a semester. These projects were done the first four Fridays of marking periods #1 and #2 and the first two Fridays of #3.
- d. There were five days in a semester for "other activities." Included in this category of activities were agriculture, sports, make up for unscheduled holidays, etc. These days added flexibility to an otherwise tight schedule.

Marking Period #1Marking Period #2Marking Period #3

Week 1

Week 7

Week 13

Days 1-4
Study of
Modules

Days 1-4
Study of
Modules

Days 1-4
Study of
Modules

Day 5
Arts and
Crafts

Day 5
Arts and
Crafts

Day 5
Arts and
Crafts

Week 2

Week 8

Week 14

Days 1-4
Study of
Modules

Days 1-4
Study of
Modules

Days 1-4
Study of
Modules

Day 5
Arts and
Crafts

Day 5
Arts and
Crafts

Day 5
Arts and
Crafts

Establishing PL Learning Groups. Three to seven students made up a PL group. Members of a group supported each other in all learning activities. If anyone in the group had difficulty, others helped by prompting, demonstrating, and explaining. It was important to the effective functioning of PL groups, therefore, that the children in a group represented a range of ability and that they were friends.

When establishing new PL peer groups, the teacher first asked each student to say who his or her two or three best friends were. The children told the teacher one-by-one so that others in the class did not know the choices given. The teacher then used this information to make a tentative makeup of peer groups. An attempt was made to put as many friends together as possible.

The number in each group was entirely up to the teacher, but having 4 or 5 worked best in the past; there were enough students in a group of this size to be fairly sure that there was the necessary mix of abilities so that the more able could assist the less able. This size group also was small enough so that all children would participate. Larger groups of 6 or 7 were quite all right, particularly if the teacher had a large number of students to supervise. It was easier to supervise fewer groups.

After setting up groups of friends, the teacher now had to be sure that there was a mix of abilities in each group. A check was made with the children's previous teacher or an examination was made of any pretest scores available. The teacher used this information to insure a mix of

Several children had to be reassigned (on paper) before the final groups were formed.

Once established, the groups were considered relatively permanent. Children were moved from one group to another only for some specific reason. It was important that children identified themselves with "their" group. Examples of valid reasons for a teacher to move a student to another group were: (1) a student did not get along with the members of one group, but was more likely to get along in a different group, (2) a more able student was needed in a group which was falling behind, or (3) a less able student could benefit more from a group in which some of the more able took the lead in assisting others in their learning activities.

Because groups were relatively permanent, teachers encouraged all groups to select or make up names for themselves. Children and teachers alike referred to the groups by name. This naming of groups added to the identification of students with their groups and led to more cooperative learning behavior.

Managing Peer Group Learning. Learning in the upper grades took place in peer groups of 3 to 7 students. Two students usually shared one module, although the student group leader had a copy of the module and did not share. The module was used throughout the school day and was not taken home at night. Homework assignments were given that students copied in their notebooks.

a. PL Modules

PL modules have 4 or 5 lessons plus a review section. Within each lesson, demonstration and instructional passages are followed by questions and exercises related to the instructional passage. Answers to these questions are in the back of the module so that immediate feedback or correction is available. Each module also has a single page devoted to basic skill practice - an important activity in the maintenance of skills in Language, Mathematics, and Reading. PL modules contain approximately 24 pages.

b. PL Module Selection

All students in one peer group studied the same module, but no two peer groups studied the same module at the same time. This procedure permitted up to 70 students at one grade level to study modules from one semester package. This number of students was possible even though there were only 3-4 copies of modules in a package. The economy of IEL comes from the reuse of modules many times over. Once one group was finished with a module, it was available to other groups the next day. This exchange of modules was normal because a group studied one module in two days.

Module tests normally were given at 12 o'clock every other day. The next morning new modules were selected by each group. There were only three restrictions on what module a group might select:

- o All modules at a given level number had to be completed before a group could advance to the next level. There were ten different modules at each level, i.e., two (A and B) for each of the five subjects.
- o The same subject could not be studied twice in a row.
- o No two groups might study the same module. The three or four copies were not enough for two groups. Conflicts between groups about wanting to study the same module seldom occurred. When they did occur, the teacher made the selection for them.

A "Record of Modules Studied" was a wall chart showing what modules the members of each peer group had studied. When a module was checked out by a group, the group leader marked an "X" for each student in the group at the time. The chart was referred to by the groups each day in deciding what module to check out next. It also was referred to by the teacher in assigning remediation activities to students who had been absent. A sample of a "Record of Modules Studied" is given on the next page.

c. Learning in Peer Groups

All students in a peer group studied the same module together. They helped and supported each other's learning. Students took turns leading their groups. As group leaders, they followed leader instructions given in each module.

There are eleven leader instructions:

- o Read Together
- o Read Alone
- o Take Turns Reading
- o Group Answer
- o Tell Each Other
- o Take Turns Answering
- o Answer in Notebook
- o Make Up Questions
- o Leader Copy
- o Follow Directions
- o New Leader

Teachers were fully trained in the use of leader instructions and in the monitoring of peer groups using the PL modules. All PL students were fully trained in these behaviors by their teachers. A special training course had been developed by the IEL staff. Training materials used in that course included: (a) Training Manual for Learning in PL Groups, (2) How to Learn in PL Groups (title of a PL module used in the training course), and (c) Student Guide to Learning in PL Groups. This latter document is reproduced on the next several pages. It outlines the steps which groups follow for each leader instruction.

Assigning Homework. PL students had homework every other day. On the days they did not take module tests, the teacher gave homework assignments. On the inside back cover of each module is a single page of

titled "Basic Skills Practice." Children copied the questions and problems from this page into their notebooks which they then took home for self study. A sample of a Basic Skills Practice sheet is given on the next page.

Students did the work at home, writing answers in their notebooks. Those in the same peer group checked each other's work against answers given in the module the next morning. The teacher had to remain vigilant to insure that all students do the assigned homework.

Providing Remediation. A remediation period was held every other school day (on the day that module tests were not given). It lasted for 45 minutes, and was held at 12 o'clock. The importance of remediation cannot be stressed too much. It gave the IEL system the flexibility to attend to individual needs in a way that no conventional system could. Principals had to maintain a strict remediation schedule and insisted that all teachers abide by it.

Remediation corrected deficiencies and upgraded those who were falling behind so that they might keep up with their group. The remediation period was the main time when the teacher, assisted by a few of the more able students, could help students overcome deficiencies. There were three kinds of deficiencies for which remediation was necessary: group, individual, and those deficiencies caused by absences from school.

The students scored each other's module tests the period following the test administration (the last period of the day). Students exchanged notebooks, the leader read the correct answers from the appropriate module test answer key booklet. (There are ten such booklets in each semester package, i.e., two levels - A & B - times the five subjects.) The teacher circulated among the groups during test scoring to make sure that all were following the correct procedure and to determine which lessons were the most difficult. (Each group took a different module test because different modules were studied.) It was possible to pinpoint the most difficult lessons by noting which items in the test gave the most trouble. The module test answer keys showed, for each test item, which lesson the item referred to. He or she also noted if any of the students did so poorly on the test that they required a review of the complete module.

Below is a sample of a basic skills practice sheet. A practice sheet such as this is on the inside back cover of every module.

BASIC SKILLS PRACTICE

Answer in Notebook

1. Add

$$\begin{array}{r} (a) \quad 7 \\ + 5 \\ \hline \end{array}$$

$$\begin{array}{r} (b) \quad 9 \\ + 7 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \quad 10 \\ + 4 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \quad 17 \\ + 2 \\ \hline \end{array}$$

2. Subtract

$$\begin{array}{r} (a) \quad 14 \\ - 3 \\ \hline \end{array}$$

$$\begin{array}{r} (b) \quad 48 \\ - 6 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \quad 12 \\ - 5 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \quad 22 \\ - 4 \\ \hline \end{array}$$

3. Multiply

$$\begin{array}{r} (a) \quad 4 \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} (b) \quad 6 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} (c) \quad 7 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} (d) \quad 12 \\ \times 2 \\ \hline \end{array}$$

4. Divide

$$(a) \quad 4 \overline{) 20}$$

$$(b) \quad 6 \overline{) 36}$$

$$(c) \quad \overline{) 40}$$

$$(d) \quad 8 \overline{) 32}$$

5. Write the correct word.

a. The girls _____ to the party yesterday.

danced
 went

ate
 go

b. He had two _____.

arms
 nose

heads
 foot

c. Please _____ here.

go
 went

have
 come

d. The sun is _____.

shining
 heat

day
 quiet

Remediating Group Deficiencies. The teacher assigned one member of a peer group to lead the other members on those lessons found most difficult on the module test. The teacher distributed the appropriate modules to each group and told the students which lessons to study again. The student leading a group at that time wrote the lesson number(s) on the group's blackboard.

Students turned to the very last set of questions in the indicated lesson. This last set usually was preceded by the instruction, "Answer in Notebook." For this review, however, the students followed the instruction, "Group Answer." To follow this instruction, the students in a group discussed each review question and decided, as a group, on the one best answer. They used the blackboard as much as needed to explain to each other. It was the responsibility of the group leader to make sure that his or her group followed the "Group Answer" procedures. In this way, all students in the group got a clearer understanding of the lesson being reviewed. Only after all students in the group agreed on a single answer did the leader look up the correct answer in the back of the module.

Remediating Individual Deficiencies. Children who had difficulty on the total test were helped by students who scored high on the test. Most often, this individual remediation was not necessary, and all students took part in the group reviews of specific module lessons. When it was necessary to give individual remediation, however, the two or three students involved did not take part in the group session. Usually one student tutored one other student. Occasionally, a single student tutored two others at the same time.

The entire module was reviewed, not just selected lessons. In the 45 minutes available for remediation it was not possible to go over each of the four to five lessons in a module. The very last part of the module was used for this purpose. It is the "review" portion of the module.

To overcome individual deficiencies, the questions in the review portion of the module were answered by the one or two students receiving remediation. The instruction for this review was "Take Turns Answering." Often answers were given orally, but sometimes they were to be written on a blackboard. The student-tutor checked answers against those in the module. Whenever a student missed an answer, the tutor explained by referring to appropriate parts of the module and by using the blackboard.

Remediating Deficiencies of Students Who Have Been Absent. When a student had been absent for a short period of time, the instruction which had been missed could be made up by increased homework and by being given special attention during the remediation period.

Students returning from an absence went back to their peer groups and studied the same modules as others in the group. They were given the modules they had missed to take home and study, and they were helped by their classmates in the group in keeping up with the modules the group was studying.

During the remediation period, a more able student was assigned to assist in the upgrading of those who had been absent. The same procedure of tutoring was followed as with individual deficiencies above, i.e.,

study of the "review" portion of modules which had been missed. It was often possible to complete the review of two modules during the 45-minute remediation period - depending upon the student's achievement level before the absence.

Fridays were spent by PL students in non-modular learning activities. One of the necessary activities was taking module tests that had been missed because of absences. It was important to do so (after the missed modules had been taken home and after individual remediation) in order for the teachers to know whether additional remediation was necessary on some lessons.

Students absent for more than a week presented a more difficult remediation task to the teacher. Whenever a student was absent for that period, the teacher made sure contact was made with the student and that modules were taken to the student's home. This procedure not only allowed absent students a chance to catch up with their peers, it also showed both the student and the parents that the IEL teacher was concerned. There was a chance that potential dropouts could thus be induced to return to school.

On the return of these long-term absentees, they were given the same remedial help as those who had not been absent so long: help by classmates within their peer groups, home study of modules, peer tutoring during remediation, and make up testing.

Testing. Evaluation of student progress important in IEL. It provides teachers with the information needed to insure that individual students are achieving as expected and in what areas special remedial help is necessary. There are three kinds of tests administered to PL students: (1) Module Tests, (2) Block Tests, and (3) Semester Tests.

PL Module Tests. There is a test following each module. The module test was given at 12 o'clock every other day of school. It covered the module studied the previous two days.

In a semester package, there were 5-7 copies of 10 different module tests. There were two test booklets for each subject (A and B). There were six module tests within each booklet, one for each instructional level. Test booklets thus paralleled the modules themselves. (See the sequence of modules listed on pages 49 to 76.)

At the start of the module testing period every other day, the teacher gave one test booklet to each student. Students in different peer groups received different test booklets because they had studied a different module the previous day. For example, if a group had studied an "A" module the day before, the teacher gave out the "A" test booklet in the same subject as the module which the group just completed. If a group had studied a "B" module, they would be "B" test booklet in the same subject. Below is a list of the ten different module test booklets available for one semester.

Language A
Mathematics A
Reading A
Science A
Social Studies A

Language B
Mathematics B
Reading B
Science B
Social Studies B

When told by the teacher, each student moved out of his or her own group to a preassigned seat for taking tests. These seats were assigned at the beginning of the year and were located so that members of the same group could not help each other. No two members of the same group sat together. Students sat with other peer groups. This seating arrangement helped to ensure that students answered module test questions independently. Students answered all test questions in their notebooks.

The teacher monitored test taking activities both to make sure that children answered independently and to assist if anyone did not understand what was required.

(Note: Some IEL teachers were responsible for both PT and PL learning at the same time. This double responsibility was most likely in the first semester when teachers in small schools were responsible for both Grades 3 and 4. When this occurred, the teacher allowed the PT direct instruction group to wait for the short period needed to initiate PL testing. Once PL students began their tests, the teacher began PT learning activities while continuing to monitor PL testing.)

Students scored PL module tests during the last period of the day. The teacher passed out the appropriate answer key booklets to each group leader. Students exchanged notebooks and scored each others test answers. The leader asked for what answers were given in the notebooks before looking up the correct answer in the answer key booklet. Students marked an "X" beside each incorrect and a check mark beside each correct one. Students discussed the reasons for the correct answers whenever there was disagreement. The teacher was asked to help them if they could not agree or did not understand the answer given in the booklet.

In identifying which lessons a group should review during the remediation period, the teachers followed four steps:

1. Note which items are missed by most students.
2. Note from the answer key booklet which module lessons these items refer to.
3. Note which students missed the least number of items for the above lessons.
4. Assign one of these students to lead the group on the indicated lessons during the next remediation period.

A few students in the class required special help because they did poorly overall on the module test. Teachers noted which students need this sort of help, if any, and noted which students in their groups did well on the test. These latter students were assigned during the

remediation period to give tutorial help to those who had scored low on the test. These assignments also were written down.

PL Block Tests. Block tests were given at the end of each six-week marking period. One full day was required for testing. Five separate tests were given, one for each school subject. The contents of two core modules were covered by each test. Ten modules were thus covered by the five block tests.

The testing day was preceded by a day for review of the ten core modules to be covered by the block test. For review, the teacher distributed modules - different module to each group. At the end of each twenty minutes, the groups exchanged modules. They could thus cover the ten modules in 3 1/2 to 4 hours.

Students reviewed modules using the "review" section, i.e., the last portion of each module which is usually titled "review."

The "Group Answer" mode was used in these reviews. In this mode, each question was discussed by the group, and the answer to each question was agreed upon by all members of the group before the leader looks up the answer in the module. Students used the blackboards whenever their use helped to clarify or explain.

There were five different block test booklets for each semester. The total class was divided into five groups for block testing. And each child in the same group was given an identical test booklet. At the end of a half-hour testing period, the booklets were collected by the teacher. They were then distributed to different groups for the second testing period. This process of exchanging test booklets was continued until all five groups had completed all five tests.

During the testing session, lasting usually for one-half hour, students wrote the answers in their notebooks. The teacher circulated and monitored closely to be sure that students did not help each other. Block tests contributed to a student's grade (module tests did not), and it was important that they were taken independently.

On completion of a test, the children were excused from school. The teacher scored and recorded test results over the next week. The form, "Student Scores on Tests," given on a next page was used to determine percentage correct for each student. This percentage correct was the block test score which was entered on the "Record of Student Grades." (See next page after the "Student Scores on Tests".)

Semester Tests. A semester test was administered at the end of each semester. A full week of review and testing was scheduled at the end of both semesters. The first day of the week was set aside for review of the block test (as explained in the previous section). The second day was for the administration of block tests. The third day was used to review all 30 core modules, and the fourth day for administration of the semester test.

Semester tests lasted for approximately 45 minutes. The same system as used in block tests was followed. There were five groups of children, and each group took a test in the same subject. The test booklets were then exchanged among groups until all groups had completed all five tests. Scoring of semester tests was done by the teacher on the final day of the week. Percentage correct scores were determined using the form given on the next page, "Student Scores on Tests."

Standardizing IEL School Schedules. There is little consistency of school schedules across Liberian schools. Starting times, class periods, and ending times differ among schools.

With IEL, the schedule was standardized for all schools:

15 minutes for daily open ceremonies.

Four periods of 50 minutes each per subject; broken down into direct instruction and review sessions of 25 minutes each.

A remedial period of at least 45 minutes.

This remedial period was particularly necessary in IEL schools so that the teacher could organize remedial activities for some of the more obviously less-able students and for those who had been absent. A remedial period also was necessary for optimum operation of programmed learning in the upper grades.

Finally, a 45 minutes period for homework assignment was available at the end of the day.

The schedule for PL was basically the same with each of the four periods consisting of peer group learning and/or module testing.

The minimum school day thus was five and one-half hours, and the maximum day was five hours and forty-five minutes. When school started at 8:00 A.M., it ended between 1:30 and 2:00 P.M.

A Concluding Note

The description of the IEL instructional system consisting of various materials and methods reveals the comprehensive and complex interplay among the various components. This instructional system is a sophisticated one, reflecting some of the best available state-of-the-art technology for the design of low-cost learning systems for developing nations.

2.6 Teacher Education

A major technical assistance activity under the IEL Project involved developing a national plan for improved teacher education at the elementary and junior secondary level. The Teacher Education Specialist was responsible for this effort. The activities undertaken by this specialist included a review of existing teacher training curricula in the Kakata Rural Teacher Training Institute and the Zorzor Rural Training Institute, extension courses for teacher training, and teacher evaluation and certification procedures. In addition, the teacher education specialist acted as a liaison between the existing national curriculum and the various components of the IEL instructional system so that the elements of the new system were compatible with the national educational system.

2.6.1 Review and Revision of Teacher Training Programs

Christian O. Agbenyaga served as the Teacher Education Specialist during 1979-83. Working out of his office at the Ministry of Education in Monrovia, he conducted a series of site visits, faculty seminars, interviews, observations, and analysis of documents to review the curricula for preservice teacher training and extension center activities. He also reviewed the evaluation and certification procedures for elementary school teachers in Liberia.

The major outcome of Agbenyaga's activities was a revised curriculum handbook for rural teacher training programs and extension services. This report included the following two sections:

1. A rationale for the program. This section included an introduction, content definition, approach, scope, and time schedule for the two-year program for training elementary school teachers.

2. Scope, sequence, schedule, objectives, and course outlines for the following subject areas:

- a. Education
- b. Instructional aids
- c. School organization and administration
- d. Guidance
- e. Language arts
- f. Social studies
- g. Science
- h. Mathematics
- i. Agriculture education
- j. Music
- k. Health and physical education
- l. Arts and crafts
- m. Home economics

In the area of inservice training, the extension school program was reviewed, curricula and courses of study for unqualified and underqualified teachers was produced, and assessment procedures for certification were defined. Procedures for evaluation and certification of trainees in preservice and inservice institutions were prepared along with discussions on the test development aspects.

2.6.2. Liaison with the IEL Project.

The second component of the Teacher Education Advisor's assignment involving the IEL Project directly consisted of the following activities:

1. Conducting a short training workshop for the module writers to ensure enrichment of the curricula with African content and materials. This workshop was conducted during the early period of the project so that the writers were able to apply their skills immediately.

2. Providing technical and content expertise for the analysis of the Social Studies curriculum for elementary schools. Agbenyaga worked with the Instructional Design Unit Head. He was heavily involved in the curriculum design and specification of objectives for various social studies modules.

3. Developing achievement tests for summative evaluation in grades 1-6. This work was done in conjunction with the West African Examinations Council (WAEC). This test provided an external check for comparing the achievement of IEL students working through the new instructional system and control group students in traditional classrooms. The test was based on the revised national curriculum. Agbenyaga coordinated a workshop for 10 Liberian primary school teachers who generated items for different grades in different subject areas according to a table of specifications. He also participated in item analysis activities and in the administration of the test.

4. Revising the test administration procedure. Agbenyaga provided technical assistance in improving the test administration procedures for use under the final summative evaluation.

5. A course of study in programmed teaching and programmed learning for the rural teacher training institute. This course was designed to familiarize students of the rural teacher training institutes (and their counterparts in the extension schools) with the use of programmed teaching and programmed learning materials. Trainees were expected to be familiar with the modules used in the IEL system, to have a basic understanding of the relationship between these modules and the national curriculum, and to use the modules in the classroom. The course was primarily a skills training activity in the use of modules and in the ability to manage the IEL classrooms. The course of study provides an overview of the IEL system and lists the components which are to be supplied by the IEL project. Since the focus in this course was preservice and inservice training of teachers, it did not go into additional details provided in the IEL implementation workshops described in the previous section.

2.7 Evaluation

Evaluation has been an integral part of all IEL activities. Evaluation procedures in the project may be broadly subdivided into three major components:

Formative evaluation for the purpose of improving the IEL instructional system.

Summative evaluation for validating the effectiveness of the IEL instructional system.

Cost-effectiveness evaluation to determine the economic feasibility and benefits of using the IEL system.

2.7.1 Formative Evaluation

All products and procedures related to the IEL instructional system were repeatedly tried out and revised. A part of this formative evaluation was in the form of expert appraisal in which editorial feedback was provided on such aspects as the accuracy of the content, appropriateness of the language, and feasibility of the activities. The other part of formative evaluation involved collecting and using student performance data. This type of formative evaluation was conducted at three levels:

- a. Learner verification by the IEL writer to collect informal student feedback and to make immediate revisions.
- b. Lab school testing in which data were collected under controlled conditions to make initial revisions on the product.
- c. System school testing in which more realistic data were collected from representative schools with typical teachers to obtain information about the total system.

A project Lab School was established in Gbarnga and was staffed by Instructional Supervisors. We used this school to conduct the initial tryouts by the writers and preliminary formative evaluation. The rationale for using the Lab School (instead of an existing school) included the following:

- a. The project staff did not disrupt the teachers and learners in the school.
- b. The staff was sure of children having the correct prerequisites.
- c. The staff could control the number of children in the classroom and thus avoid problems related to classroom discipline and focus on the effectiveness of the materials.

- d. The staff could employ teachers who are specially trained and thus eliminate teacher characteristics as a source of variability during initial evaluation.
- e. The staff could modify the procedures without being accused of being inconsistent.
- f. The staff could draw upon individual children for special tryouts by writers.
- g. The staff could get additional interview data from teachers and learners.
- h. The staff could train the teachers to keep logs and diaries related to the use of the materials.

There were two major disadvantages to the use of the project Lab School.

- a. The classrooms were not very representative (in terms of enrollment or types of teachers) of Liberian primary schools.
- b. Writers fell into bad habits of testing sloppy materials because "it's only the lab school".

To avoid these disadvantages, we had to remember that Lab School testing was only one part of the entire formative evaluation. It was followed by more realistic system school testing.

Types of data collected during the system-school testing included the following:

- a. Posttest data. In Programmed Teaching, we had Module tests at the end of each 12 lessons. These tests are based on the same objectives as the instructional materials. They sample the content of all lessons. These data help us pinpoint the areas of difficulty within the module.
- b. Teacher annotations. Teachers were encouraged to note down all the problems and changes in the PT modules. These annotated modules were collected by the Implementation Unit and passed on to the ID unit.
- c. Classroom observation. An Evaluation Assistant sat down in IEL classrooms and observed and recorded student and teacher behaviors. This enabled us to identify problems with teacher training and to suggest better ID approaches.
- d. Classroom observation by the writers. Writers were encouraged to visit the Lab school and see their modules being implemented. These visits provided them with realistic feedback and an orientation to classroom procedures. These visits also gave a clear indication of the skill levels of the learners and teachers.

- e. Interview data. Both teachers and students were frequently interviewed by the Evaluation Unit to collect data on their preferences and problems.
- f. Operational gaming. We used structured small-group procedures such as the Delphi technique and adversary-proceedings model for the evaluation of various aspects of the instructional design.
- g. ID Hindsight. One major source of formative data has been the second thoughts among the instructional designers. In a series of meetings we collected, recorded, and analyzed our own insights in how to do a better job.

Revision Workshop 1983

During June 1983 a special revision workshop was conducted in Gbarnga by Sivasailam Thiagarajan. At this time most of the PL modules (up to the 5th grade) were completed and a considerable amount of formative feedback data had been accumulated. Writers were now able to focus on revising the PL modules.

During this workshop all writers underwent training in the area of converting formative feedback into data-based revisions. Each writer was assigned specific modules in a subject area and a partner to work with.

Four major sources of feedback data were utilized, in this revision activity:

1. Module test data and analysis sheets
2. MOE subject matter expert reviews
3. Feedback from schools
4. Writer's self-appraisal.

The processing of each type of data is briefly described below.

Module test scores. The test scores were collected from the Lab School and System Schools. The scores were based on teacher scoring of module tests. All data related to a particular module were transferred to a special form which was accompanied by a record of student errors.

Module test scores were the most important feedback on the instructional effectiveness of each module. The analysis sheets provided summary information on the relative strengths and weaknesses of different lessons of the module. This information made it easy for the writers to use the data to improve the instructional effectiveness of the module.

The data were primarily analyzed by the PL writer who was assigned the task of revising the specific module. If additional information was needed to clarify the data, the PL writer checked with the Evaluation and Implementation Units. The same data were also used by the senior staff

members for prescribing general system revisions. Later, each PL writer did an indepth analysis of the data on a specific module test as the first step in revising the module assigned to him.

The Evaluation Unit identified and indicated module test items for which fewer than 70% of the students were able to give the correct answer. The PL writer paid particular attention to the pattern of these errors and, with the help of a decision table, identified their probable causes. Since each lesson in the PL module was tested by three items on the module test, PL writers were able to determine whether test errors were due to invalid items or the lesson content. Using various revision checklists, writers rewrote the test items and/or the lessons.

MOE Subject Matter Expert Reviews

The content of most PL modules were reviewed by the members of an MOE Expert Committee. This was our major data source for identifying and eliminating errors and inaccuracies in the subject matter area. The MOE expert comments were used by the senior staff members during their analysis for general system revisions and by the members of each subject matter area team for the next level of revisions. Particular attention was paid to comments on definitions and terminology. Each change in the terminology was applied to all modules in the subject area across different grades to ensure consistency. Some comments dealt with the improvement of instructional design strategies. The PL writer had the option of ignoring those comments. However, many of the expert suggestions were incorporated in the revisions.

Feedback from Schools

Another major source of data was from Instructional Supervisors who made comments based on their observations and interviews in schools where IEL materials were being used. These comments were summarized in two forms: Feedback on Learning Materials and Procedures (FLMP) and Programmed Learning Observations Form (PLOF).

The original source of these feedback data were children and teachers in the IEL Lab School and in the five System Schools. The information was collected and recorded by the Instructional Supervisors and reviewed by the senior staff members (to identify general system revisions) and by the PL writers (to identify specific module revisions).

These comments were reviewed and categorized into convenient groups. Most problems turned out to be general problems in Liberian elementary educational systems: teacher absenteeism from the classroom, lack of supervision by principals, and cancellation of classes due to community activities. While these problems were discussed and attempts were made to reduce their impact, some were beyond immediate solution. Other comments indicated problems related to the general management of the IEL system. For example, students did not use the blackboards; they did not ask teacher for help when needed; and no remediation was given to the students

after they performed poorly in the module test. Solutions to these problems required modifying and strengthening our implementation system and better training of students and teachers on how to use IEL materials. These solutions were incorporated in the general system revision. Other types of problems directly related to specific PL materials. For example, some module tests lasted for more than 45 minutes. Appropriate revisions for these problems involved specific changes in modules.

The Programmed Learning Observations Form contained information related to general group behaviors, following leader instructions, testing, remediation, and management. Data from this form were particularly useful in improving the effectiveness of the implementation system.

Self-appraisal. A significant source of data for revision was the review of each module by the PL writer. Comments were generated by the writer, based on a logical analysis of the instructional design of the module. These comments formed a major basis for instructional design revisions.

This type of review was undertaken at the beginning of the revision of each specific module. The writer worked through the module putting himself in the place of a typical learner. He reviewed the module test to see if each item measured the attainment of a specific objective of the module. Then he compared the items on the review lesson with those on the module test to ensure that they were parallel to each other. The test items at the end of each lesson were then correlated to the module test items. Suitable changes were suggested if there were discrepancies between the items. The writer then reviewed the structure of each lesson. Using an appropriate ID formula and a corresponding checklist, the writer made sure the optimum sequence and strategy were used to effectively teach the type of learning found in the lesson. Particular attention was paid to the questions in the lesson. For example, in an informational lesson the writer used a checklist for different types of initial, processing, and personalized questions. Finally, all information presented to the student in each lesson was reviewed. Appropriate revisions were made in the level of language and in the use of illustrations.

Revisions to the modules were undertaken in four stages:

1. General System Revisions
2. Subject Area Revisions
3. Specific Module Revisions
4. Copy Editing

Each of these four stages revision are briefly described below:

General system revisions. These revisions affected the format of all PL modules and the procedures for their use. For example, a decision that PL modules should have five lessons and that the basic skills practice in language and math should alternate among the modules belong to this category of revisions.

General system revisions were undertaken to ensure that the PL modules had a consistent format and that they helped the students achieve the instructional goals in the most efficient manner. These revisions were agreed upon by the Head of the Instructional Design Unit, the PL Managers, the ID Advisors, the Head of the Evaluation Unit, and the Head of the Implementation Unit. They were also appointed by the Project Director. Some of these general revisions were determined at the beginning of the revision cycle. A few others were identified later.

Various senior staff members used a GSR flowchart and the checklist to independently list general system revisions. They compared the individual lists and worked out a final list. This list was distributed to the module writers. At a later stage, the writers incorporated these general changes in their specific module revisions.

General system revisions were usually based to handle the following types of problems:

1. Problems related to the format of all PL modules
2. Problems related to group instructions in the module
4. Problems related to feedback in the modules
5. Problems related to the number of lessons or to the number of pages
6. Problems requiring a change in the sequence of the lessons
7. Problems related to test formats

Subject area revisions. These were general changes made in all PL modules in a specific subject area (Language, Reading, Math, Science, or Social Studies). For example, the decision to begin science lessons with a glossary and to include reviews in every fourth math module belonged to this category of revisions.

Subject-area revisions were undertaken to standardize the module format within each area. The revisions incorporated basic suggestions from MOE experts. Two writers were assigned to each subject area and these writers independently arrived at the list of revisions after reviewing MOE expert comments and the feedback on individual modules. Then they compared their lists and arrived at a common list. This list was presented to PL Managers and Advisors. After suitable discussions and modifications the subject area revisions were finalized. In the process of revising specific modules, PL writers frequently identified other common revisions. With the approval of the PL Managers, these changes were added to the subject area revision lists.

Specific module revisions. These revisions involved unique changes in each PL module. They included the following:

Instructional design revisions which improved the type of questions, sequence of presentation, and the general formula for the treatment of the content.

Subject area revisions that corrected errors in the terminology, usage, definition, and procedures.

Language revisions which resulted in simplifying, improving, and correcting the language.

Format revisions which made the modules more consistent.

Each writer was assigned to specific modules in one subject area. (The two writers assigned to the same subject area assisted each other in the process.) The revisions were supervised by PL Managers/Advisors. During the revision of the first few modules, PL Managers/Advisors provided detailed suggestions.

Specific module revision procedure started with the Evaluation Unit providing copies of module test results, MOE review comments, and feedback from schools for each module. In general, the writer who originally wrote a module did not revise it.

The PL writer studied the module and made notes regarding suggested changes. He also worked through the available data, identified major problem areas, hypothesized causes for these problems, and listed suggested revisions on a copy of the module. Special attention was paid to module test results from various schools. If these results indicated performance below the 70% level, the writer sought assistance from the PL Managers/Advisors, the Evaluation Head, and Implementation Head for additional information. A decision was made about whether the module test, the teaching procedures, and/or the lesson content should be revised. During the first few revisions, the PL Managers/Advisors participated heavily in the activity. However, the PL writer worked independently to come up with his suggested modifications. This list was presented to the PL Manager/Advisor along with a rationale for the major changes. The Manager/Advisor made additional suggestions and modified some of the suggestions. After receiving approval, the writer rewrote the module. Before retyping, the revised module was reviewed and approved by the PL Manager/Advisor.

Copyediting. This was the final stage in the production of the revised version of the PL module. During this stage all typographical and layout errors were identified and corrected. This step was undertaken to ensure quality control the final version of the module. A Copyeditor/Proofreader worked with the typist and the writer during this stage.

After the PL writer had produced a revised module and it had been approved by the PL Manager/Advisor, it was typed. The typed version was proofread and copyedited by the PL writers or the Copyeditor who corrected all typographical errors and doublechecked the format with the PL Style Manual. The typist made the necessary corrections. The revised and proofread version was then handed over to the Production Unit which pasted up the illustrations. After a final check by the PL writer this revised version of the PL module was printed.

2.7.2. Summative Evaluation

The initial LOP implementation plan projected the tryout of IEL instruction in Systems Schools in Grades 1 through 4 in 1981 and Grades 1 through 6 in 1982. That plan also estimated that the revisions based upon Laboratory and Systems school tryouts would be completed so that all six grades in five Experimental Schools would be completed by the 1983 school year. This plan was too ambitious; it overestimated the abilities of staff to produce quality materials in limited time. Early experience showed us that writers, editors, advisors, illustrators, and production specialists required more time. By March of 1980 it became clear that the project could not meet the original schedule for summative evaluation, and in July of that year the Evaluation Committee concurred.

The 1980 revised evaluation design and schedules were:

LABORATORY SCHOOL

1980: Grades 1-3
Grades 1-5

SYSTEMS SCHOOLS (5)

1981: Grades 1-3
1982: Grades 1-5
1983: Grades 1-6

EXPERIMENTAL SCHOOLS (5)

1983: Grades 1-6

The original design of the summative evaluation required 10 experimental schools, and external consultants felt that the project staff would have interacted with the 5 systems schools to a degree that would make them unacceptable as pure experimental schools. Five more experimental schools were added to the initial design. One year of experimental school operation also was not considered adequate to give a fair evaluation of the system. A number of Liberian officials wanted to continue the Laboratory School as a permanent demonstration school. The development of instructional materials proved even more time consuming than was estimated in 1980. Because of these factors, the evaluation schedule was changed once again to the following:

LABORATORY SCHOOL

1980: Grades 1-3
1981: Grades 1-4
1982: Grades 1-5
1983: Grades 1-6
1984: Grades 1-6

SYSTEMS SCHOOLS (5)

1981: Grades 1-3
1982: Grades 1-4

1983: Grades 1-5
1984: Grades 1-6

EXPERIMENTAL SCHOOLS (10)

1983: Grades 1-5
1984: Grades 1-6

Experimental Schools. At the start of the March 1983 school year, IEL expanded from its five systems schools to ten additional Experimental Schools. A main criterion was that all components of the IEL system be completely "packaged." The tryout-and-revision cycles which have been the operating mode for Laboratory and Systems Schools were not to be the mode for the Experimental Schools. These schools, although experimental in design, were to be considered as operational schools in which IEL was being introduced as a complete system. Through 1983, however, a true experimental situation was never attained as the IEL system underwent several major modifications.

School sampling. In 1980, five Systems Schools were selected along with five Optimum Conventional Control Schools and five Status Quo Control Schools. At the same time that the above 15 schools were selected, an additional 15 were selected as experimental schools.

The revised evaluation design in 1983 called for a total of 30 additional schools (10 Experimental, 10 Optimum Conventional, and 10 Status Quo). Therefore, the Project Staff repeated the sampling procedures and identified 15 additional schools, i.e., five cells of three comparable schools from which the experimental and the two groups of control schools could be randomly selected. The sampling procedures involved: (1) identifying as many as 25 potential schools, (2) surveying the schools for enrollment, attendance, enrollment patterns among the six grade levels, facilities, and number of faculty and qualifications, (3) administering and scoring standardized ID tests to the fifth and sixth grade in each of the 25 schools to estimate the "school achievement levels" (the ID tests administered were Reading, Verbal Analogies, and Arithmetic), (4) obtaining the approval of county and school officials for the participation of selected schools in the project, (5) developing five sampling cells of three comparable schools, (6) making a random assignment of schools within each cell to one of the three treatment groups, and (7) informing school officials of their selection.

Test construction. The (WAEC) was subcontracted early in 1982 to construct, try out, finalize, administer, and score the summative evaluation instruments under the supervision and guidance of USAID's independent external evaluation expert and IIR's Contract Monitor.

The posttests for Grades 1-3 were tried out in April 1982, scored and items analyzed for difficulty levels. The first version was administered for the first time in November in the participating schools (IEL, OC, & SQ). The next test administration in 1983 involved Grades 1-4.

Statistical analysis and interpretation were undertaken by the independent external evaluation expert, Klaus Galda. A content validation of the tests was conducted by Kelly in 1983-1984.

1982 Summative evaluation. An evaluation of achievement of Grades 1, 2, 3, and 4 students in five IEL schools, five matched optimum control (OC) schools, and five matched status quo (SQ) schools was conducted in November 1982 by the West African Examinations Council (WAEC) and a report was presented in March 1983. Due to the lack of exposure of most IEL students to grade level curriculum, insufficient controls in the field data gathering, the lack of additional information on explanatory variables and statistical irregularities, the 1982 evaluation was not considered adequate. In early 1983, the summative evaluation design was modified to help remedy these problems and a new outside evaluator was approved by USAID.

1983 Summative evaluation. In August 1983, Edward F. Kelley was appointed as the external evaluator for the IEL project by USAID. He augmented the earlier research design with additional data collection so that characteristics of schools, background and ability of teachers, effectiveness of principals, and the extent of material coverage in IEL classrooms were included as variables.

In November 1983, achievement tests were administered in 15 IEL, 15 OC, and 15 SQ schools in English, mathematics, science, and social studies across grades 1 - 5. In grades 1 and 2 only English and mathematics were assessed. Two sets of examinations were employed; 16 developed by the West African Examination Council (WAEC) and 10 developed by the IEL project staff. IEL tests measured achievement in only English and mathematics, while the WAEC examinations covered those areas as well as science and social studies. Testing occurred over a two week period. Responses to the WAEC examinations were transferred to coding sheets by WAEC staff, and the data sheets were sent to Albany, New York, where they were processed on a mainframe computer at the State University of New York. The same process was followed for the IEL examinations. The number of children in each grade level for whom there is usable data follows: Grade (1) 1,793; Grade (2) 1,468; Grade (3) 1,309; Grade (4) 1,071; Grade (5) 874; Total = 6,515, and the total data set amounted to more than 2 million key strokes of information.

Both the WAEC and IEL tests were norm referenced and designed to discriminate among individuals through a ranking of scores. The tests authored by the IEL staff showed a better capture of the instructional skills and outcomes that the program intended than did the WAEC examinations.

2.7.3 Cost-effectiveness Evaluation

Cost-effectiveness has always been a major concern of the IEL Project. Our initial plans and projections indicated that the project will result in significant savings in costs associated with teacher training--if effectiveness was measured in terms of student achievement. A basic premise for the project had been a trade-off between increased instructional materials costs and decreased teacher-training costs.

The Project Staff made every attempt to keep the materials costs also within reasonable limits. Since the inception of the project we repeatedly reduced the number and nature of instructional materials. For example, the original packages for the programmed teaching (PT) component included posters, flashcards, and consumable worksheets. We reduced this variety to standard-sized printed books of three different types. Similarly, the original package for the programmed learning (PL) component called for 32-page modules. We reduced this to 24 pages. We also altered the layout and the format of the modules to reduce printing costs as much as possible. We continued these cost reduction efforts until we were convinced that our materials costs were below those of the conventional textbook costs.

Windham's Cost-effectiveness reports

In 1983 Douglas Windham published four reports based on his cost-effectiveness analysis of the IEL Project. The primary purpose of his analysis was to determine the unit costs of the IEL instructional system and to contrast these costs with the textbook alternatives planned for the Liberian Ministry of Education. For this analysis, two major issues of internal cost efficiency were identified. The first was the relative costs of photocopying versus printing as the means for eventual reproduction of the IEL classroom materials. The second was the problem of adapting IEL semester packages to very small class sizes.

Based on a series of interviews with IEL staff members and analyses of various implementation manuals, Windham determined the types and numbers of IEL materials required. Using data from the National Educational Survey, Windham estimated the number of students in various grades. Based on these figures, he computed the relative costs of the IEL instructional systems for grades 1-6 and comparative costs for three alternative approaches of using textbooks:

Textbook A - use of approved text at current prices, one book per student

Textbook B - use of approved text at reduced prices resulting from the World Bank Project, one book per student.

Textbook C - use of approved text at reduced prices from the World Bank Project, one book per two students.

Windham's conclusions are shown in Table 1 on the next page.

TABLE ONE

RELATIVE PER-STUDENT COSTS OF INSTRUCTIONAL MATERIALS

IEL versus Textbook Requirements
by Grade Level and Class Size

Grade Level Instructional Material	Number of Students in Class		
	20	40	60
GRADE ONE			
IEL	\$ 5.91	\$ 2.95	\$ 1.97
Textbook (A)	9.38	9.38	9.38
Textbook (B)	4.69	4.69	4.69
Textbook (C)	2.35	2.35	2.35
GRADE TWO			
IEL	6.27	3.13	2.09
Textbook (A)	10.88	10.88	10.88
Textbook (B)	5.44	5.44	5.44
Textbook (C)	2.72	2.72	2.72
GRADE THREE			
IEL	6.11	3.07	2.04
Textbook (A)	10.73	10.73	10.73
Textbook (B)	5.37	5.37	5.37
Textbook (C)	2.68	2.68	2.68
GRADE FOUR			
IEL	6.70	3.35	2.23
Textbook (A)	9.42	9.42	9.42
Textbook (B)	4.71	4.71	4.71
Textbook (C)	2.36	2.26	2.36
GRADE FIVE			
IEL	6.70	3.35	2.23
Textbook (A)	11.65	11.65	11.65
Textbook (B)	5.83	5.83	5.83
Textbook (C)	2.91	2.91	2.91
GRADE SIX			
IEL	6.70	3.35	2.23
Textbook (A)	9.02	9.02	9.02
Textbook (B)	4.51	4.51	4.51
Textbook (C)	2.26	2.26	2.26

- From Windham (1983)

This table indicates that if optimum sizes of 60 and 70 students for the PT and PL classrooms were obtained, the IEL system was more cost-effective than a textbook based system. However, the existing enrollment patterns in IEL schools (especially in rural schools) never reached these optimum levels.

The reality of Liberian classrooms is reflected by the following class size figures given in Windham's report:

First grade - 25
Second grade - 27
Third grade - 23
Fourth grade - 19
Fifth grade - 16
Sixth grade - 15

Windham's analysis suggested that the number of copies of the IEL materials appear insufficient to realize the cost savings due to the economies of scales related to the printing alternative. Further inefficiencies arose from the fact that the design of the IEL system was insensitive to class size. For example, PT instruction required 15 copies of 4 review booklets per semester independent of the size of the class. The focus in PT classrooms was to keep the number of groups small and the size of each group large. Windham suggested that by increasing the number of groups to four even if it involved small groups of very few children, greater internal efficiencies can be achieved. He also suggested increases in the size of the PL groups from 7 students to 10.

IEL Materials Cost Reduction Project

In July 1983, Thiagarajan coordinated a materials cost reduction project with the staff members of the IEL Project. This effort was in response to the conclusions of Windham's report.

It was not easy to come up with an IEL alternative in which the number and sizes of groups could be modified to suite Windham's suggestions. In the PT component, for example, an increase in the number of groups not only reduced the number of students in each group but also increased the number of times the PT teacher had to present direct instruction on the same lesson and the number of different sessions required to keep the learners on task. The three-group, three-session management plan permitted the PT teacher to provide direct instruction to one group while the other two groups were engaged in review and practice activities. If the number of groups were to be increased to four, then we had to come up with four different types of activities in order to keep the groups meaningfully employed in non-trivial tasks.

The project staff was also "tired of endless changes in the system" when the cost reduction project was undertaken.

The two primary goals for the project were: (1) to reduce the costs of the IEL materials and bring them in line with the costs of textbooks and (2) to do so without any drastic changes in the IEL system.

A variety of procedures were used to identify suitable cost reduction strategies:

1. Review of Windham's evaluation. We carefully analyzed the assumptions, data, suggestions, and projections in Windham's report. We used these pieces of information as the source for our problem-solving activities.

2. Individual interviews. We received cost-cutting suggestions (and criteria for the selection of the final strategies) from a number of knowledgeable experts, including Vani, Bernard, Reynolds, Tolle, Spector, Pasigna, and Nichols.

3. Materials/management systems analysis. We analyzed all PL, PT, arts and crafts, and test booklets to identify various cost cutting strategies. We also systematically reviewed different elements of the IEL management system.

4. Formative data analysis. Pasigna and Thiagarajan were simultaneously working on the IEL-PL Revisions and cost-cutting strategies. This enabled us to come up with parsimonious solutions that simultaneously improved the effectiveness of the IEL instructional system and reduced its costs. For example, IEL Instructional Supervisors suggested the elimination of the practice sessions to ensure fewer management hassles. This suggestion also resulted in considerable savings through the elimination of the need for five sets of 14 Practice Booklets.

5. IEL staff Delphi exercise. All IEL senior staff, writers, Instructional Supervisors, and advisors were involved in a modified Delphi exercise which began with general goal of reducing the IEL system costs and converged to specific methods of cutting recurrent materials costs.

Cost Saving Alternatives

In the IEL-PT system, the following changes were identified as resulting in cost reduction with minimum disruption:

- o The number of copies (in a semester package) of Review booklets was reduced to 7 (from 15); Reading Booklets were reduced to 5 (from 15); and the Practice Booklets were reduced to 1 (from 5).
- o PT practice sessions were discontinued. Wherever feasible, we shifted to a two-group, two-session implementation plan.
- o Preliminary computations for grade 1 indicated that these modifications will save about 50 percent of the number of pages. We anticipated similar savings in the second and third grades.

In the IEL-PL system the following recommendations were identified as resulting in maximum cost reduction with minimum disruption:

- o The maximum size for PL groups was reduced from seven to three. The semester package contained only three copies of each PL module.
- o Four out of 12 PL modules in each subject area were identified as optional modules. Only one copy of these modules were provided in the semester package.

These two modifications reduced the number of module pages in a semester package to a third of the original number. However, when we took into account test booklets and Arts and Crafts Manuals, the total number of pages for all materials was reduced to 37 percent from 11,166 pages to 4,184 pages in each of the three upper grades (4, 5, and 6). We also identified a number of layout/format changes which saved pages in each of the PT and PL modules.

Rationale

It must be emphasized that the suggested recommendations would have been implemented even independent of the cost-cutting requirements. In the IEL-PT system, the large number of different documents presented classroom management problems to the teachers. All Instructional Supervisors, most teachers, and many students complained about the use of PT Practice Booklets. Scheduling problems suggested the two-group, two-session strategy. The very minor contribution of the practice sessions to the overall instructional effectiveness of the system did not warrant the enormous hassles associated with them. In the IEL-PL system, scheduling problems had necessitated the need to identify a set of optional modules. PL groups of six or seven presented logistical problems (e.g., students having to wait impatiently for their turn) and sociological problems (e.g., large number of children "ganging up" on the slower member of the group). These problems suggested a reduction in the group size for PL learning.

The cost-reduction report identified implications for instructional design, implementation, and evaluation. In both PL and PT, ID implications were minimal. In implementation, minor management changes were required for PT and more significant changes for PL. In evaluation, we needed to collect some formative data from the systems schools to debug and smoothen problems that arose out of the changes.

In addition to designing, developing, and evaluating a total instructional system based on programmed instruction, a major objective for the IEL Project was to create a local cadre of trained technologists who can install, implement, and improve the system in future years. A significant function for all members of the technical advisory team was to provide appropriate on-the-job training and coaching to each member of the Liberian Staff. In addition, two Liberian staff members were sent overseas for appropriate graduate level training.

2.8.1 Overseas Training

The two members of the Liberian staff who received graduate level training in U.S. institutions were Mrs. Rose Bull (Evaluation Unit Head) and Edwin J. Clarke (Instructional Design Unit Head).

Rose Bull attended Florida State University during the early stages of the project to receive additional expertise in the area of evaluation. Edwin J. Clarke received advanced training in instructional design (leading to a master's degree in Instructional Systems Technology) at Indiana University during the later stages of the project. Robert Morgan at Florida State University supervised and coordinated Rose Bull's studies while Sivasailam Thiagarajan acted as an advisor during Edwin Clarke's education in Bloomington, Indiana.

Earlier, a three-month overseas training program was conducted in the campus of Indiana University as a subcontract by Delta Associates of Bloomington, Indiana. Details of this preliminary course are given below.

Physical Resources. The course was conducted at Indiana University's Bloomington campus. The participants were housed in one of the graduate student dormitories where they enjoyed all the privileges of fulltime students, including boarding and lodging, student passes for local buses, and access to the health clinic, libraries, and recreational facilities. Classes were conducted in a graduate seminar room on the seventh floor of the Main Library where participants had immediate access to technical literature. The library had convenient rooms and carrels for independent study and small-group discussions. Tutorial sessions and interviews were held in the student lounge of the dormitory.

Participants. A total of 13 Liberians attended the course. Eleven of them were instructional designers who were systematically selected on the basis of their performance in a previous workshop held in Gbarnga. (One of these instructional designers was later selected to be the writer-manager on the basis of his performance in the course.) In addition, the heads of the Evaluation and Implementation Units (Mrs. Bull and Mr. Nah) also participated in the course.

The systematic of programmed instruction for the IEL Project was gradually evolving even as the course began. No standard textbook was available in this innovative area; each participant received a series of handouts totaling more than 500 pages and occupying two binders. These handouts included a number of worksheets, flowcharts, glossaries, how-to manuals, reprints of articles, sample materials (many of them based on the participants' own products), and programmed booklets. In addition, each participant received two texts on related topics and a copy of the Project IMPACT Curriculum Writer's Manual by Aida Paigna. IIR had also acquired an extensive library of professional books in this specialized area.

Format. The course was conceived as an on-the-job training event. From the very beginning, each participant selected a relevant topic from the Liberian curriculum and systematically applied the principles and procedures to it. Morning sessions usually consisted of lectures, demonstrations, and discussions. Most afternoons involved practical assignments in which participants applied their learning (either individually or with a partner) to a real-life instructional task. Faculty members provided consultative help and supervisory feedback during these assignment periods.

Evaluation. Unobtrusive evaluation of participant learning was built into the daily assignments. Three other modes of evaluation were also used to measure the outcomes.

Participants presented a brief summary of what they had learned and what they had done on six different occasions (in connection with the visits of Dr. Spector, Dr. Garuffi, Dr. Nichols, Dr. Stolovitch, Mrs. Vani, and Dr. Whitten). These presentations gave the faculty an opportunity to evaluate the participants' progress.

Around the middle of the course Dr. Dormant undertook an in-depth interview of each participant. Questions in this interview dealt with individual participant learning (as well as with other areas).

An authentic simulation of instructional design was undertaken during the last two weeks of the course. During this simulation, we tested out not only the contents of the course but also the standard procedures for interaction among the writers.

Content and Objectives. The goal of the course was to enable the instructional designers to apply elements of appropriate technology to the systematic development of programmed instructional materials for rural Liberian elementary schools. The content of the course was selected to provide a relevant background of competencies and concepts in this area. Here is a summary of the major content covered during each week of the course:

WEEK 1	Introduction
WEEK 2	Instructional Systems and the Development Process
WEEK 3	Instructional Analyses
WEEK 4-7	Designing Programmed Teaching Materials
WEEK 8	Designing Practice and Review Activities

WEEK 9-10 Designing Programmed Learning Materials
WEEK 11 Learner Verification and Revision
WEEK 12-13 Project Simulation

Faculty. The course was developed by Dr. Thiagarajan with the assistance of Dean Harold Stolovitch of the University of Montreal and Dr. Diane Dormant of Bloomington, Indiana. It was conducted by Dr. Thiagarajan with guest lectures by Dr. Stolovitch, Dr. Douglas Ellson, and various members of Indiana University's Division of Instructional Systems Technology. Aida Paigna, Rebecca Belleza, and Dr. Corene Cassell of the IEL Project served as consultants during the course.

2.8.2 In-Country Training

Overseas training provided initial instruction for IEL staff members and specialized skills to two Unit Heads. Much of the participant training in the IEL Project, however, was carried out on site. The decision to provide local training rather than to send individual members overseas for training was based on a number of factors:

1. In-country training proved to be more cost-effective than overseas training. Training in Gbarnga was especially useful when a large number of trainees were involved.
2. The IEL Project utilized some specialized cutting-edge technologies of programmed teaching and programmed learning. Because these applications of low-cost learning technologies were novel and innovative, few appropriate courses were available in overseas universities.
3. In-country training enabled us to schedule the training activity for optimum impact. For example, we were able to provide training for PL writers when additional writers were hired. Similarly, training for criterion test construction was provided when the project required this activity.
4. In-country training enabled us to utilize the same staff member to serve different functions. For example, one of our staff members received initial training as an instructional designer. Later, he received training on data analysis and transferred to the Evaluation Unit when our needs changed.
5. In-country training enabled us to provide on-the-job training. The training of the illustrators were undertaken while they were actually producing illustrations for the modules. Similarly, module writers were given brief preliminary training and a series of follow-up feedback on the job.
7. In-country training enabled us to train the trainers. The training of teachers was initially conducted by the Implementation Advisor. During the second cycle, the same training involved additional activities by Liberian staff members. Through increasing responsibilities

train Liberian trainers to
conduct their own teacher training workshops.

Training of Instructional Designers

The following is a summary of various IEL training activities for instructional designers.

Four-week writer's workshop. This workshop was conducted at the beginning of the IEL Project in Gbarnga by Thiagarajan, Paigna, and Belleza. Thirty-four potential IEL staff members were selected by MOE from various counties of Liberia. They were introduced to a variety of programmed instructional techniques and guided through a series of practical exercises based on Liberian elementary school curricula. The workshop served two purposes: To provide preliminary training in programmed instruction and to select outstanding candidates for employment in the IEL Project. At the end of the workshop, based on the recommendations and evaluations by the workshop leaders, the Project Director selected 11 writers and two other project staff members for employment in the project.

Curriculum design workshop. This workshop was conducted at the beginning of the second year of the project in Gbarnga. Diane Dormant conducted the workshop which focused on systematically deriving a set of instructional prescriptions from the revised national curriculum. The workshop was attended by Edwin Clarke, Nathaniel Samba, and Joseph Kolubah. Clarke worked in the social studies curriculum for grades 1-6; Samba, in the mathematics curriculum for grades 4-6; and Kolubah, in the mathematics curriculum for grades 1-3. Using a collaborative problem-solving approach, the Liberian staff members and their advisors created procedures for the following: (1) reviewing the philosophy, goals and priorities, and curriculum objectives in the Revised National Curriculum, (2) designing a guide for curriculum analysis, (3) checking the internal consistency of the Revised National Curriculum, (4) developing module specifications for the IEL materials, (5) preparing lesson specifications for the IEL materials. The outcome of this workshop was a scope and sequence document for all instructional development in the IEL Project.

Programmed teaching workshop. The initial design of the programmed teaching materials was based on models from other countries adapted to fit the needs of Liberian elementary education. After the completion of an initial set of modules during the first year of the project, a special workshop was conducted by Thiagarajan to consolidate various procedures and principals. All PT writers attended this workshop as a part of their on-the-job training. It was also attended by the PT Managers and Advisors who supervised the production of PT modules.

The workshop was based on an extensive manual which contained detailed instructions for writing different types of lessons in different subject areas. The manual also contained examples of page layout, appropriate scripts, teacher directions, learner tasks, correction procedure, and practice/review activities. This manual standardized major types of PT lesson procedures.

... involve the writers the manual and explaining the examples. Following this, each writer was assigned a practical exercise in his or her subject area. The writer's product was carefully reviewed. The Workshop Leader, the PT Manager, and the PT Advisor gave editorial feedback to the writer. This feedback was continued on a decreasing level until the writer acquired sufficient mastery of the procedures.

Programmed learning workshop. At the end of the third year of the project, our focus shifted to PL modules. By this time, the procedure for writing such modules were tried out repeatedly and certain standard formats were invented. A set of new PL writers had to be hired in order to increase the rate of production.

Ten potential writers were selected from the Gbarnga area on the basis of a standardized test designed to identify language, subject area, and instructional design skills. They attended a workshop conducted by Thiagarajan and Passigna with Nathaniel Samba playing an apprentice trainer role.

A large number of handouts were produced to explain various procedures for designing three types of PL modules: informational, procedural, and conceptual. These handouts contained explanations and examples of how to write lesson text, how to simplify the language, how to write instructional questions, how to write summary statements, how to write processing questions, how to write open-ended personalized questions, and how to write lesson test items. The procedure in the workshop involved a walk through a sample module to identify various components of PL lessons and a practical assignment on a topic in each trainee's subject area. These practical assignments were reviewed by the workshop leaders and feedback given to the writers. At the end of the PL workshop, the top five participants were selected and employed as PL writers on the IEL Project.

Tutorial instruction. The IEL Project also provided training on PL/PT design to a number of individuals from Cuttington University College and the University of Liberia. The educators were given training by Thiagarajan, Passigna, and Edwin Clarke on how to write PL materials and how to edit PT materials. Training was individualized to fit the free-lance assignments given to these external consultants. The training program made heavy use of sample modules and PL and PT handouts. Candidates trained through this process were employed as PT module editors and PL module writers. As a result of this training we were able to subcontract the design of PL social studies modules and the editing of PT language modules.

Editor, supervisor, and trainer training. Edwin Clarke, Nathaniel Samba, and Joseph Kolubah received additional on-the-job training on editing programmed instruction modules and supervising their production. During the later periods of the project, Kolubah undertook the instructional design management of PT modules and Samba, PL modules. Kolubah and Samba also participated in the training workshops at increasing levels of responsibility. They were trained to provide local training on PT and PL for future instructional development activities.

PL. In June 1983, a special revision workshop in Gbarnga. At this time most of the PL modules were completed and a considerable amount of formative data had been accumulated. PL writers attended the workshop along with their Managers. The objective for the workshop was to review and analyze feedback data (including module test data, comments from MOE subject matter experts, and feedback from schools) and to convert them into appropriate revisions in the PL modules. The PL Managers and their Advisors were also trained in specifying general system revisions while the writers were trained in identifying and implementing appropriate changes to each module.

Outreach activities. In-country training of instructional designers did not stop with the project staff. We provided informal training to people from other Liberian projects who visited the IEL project. In addition, Thiagarajan conducted a semester-long course at Cuttington University College on programmed instruction for developing nations. This course was attended by 15 undergraduate education majors. Edwin Clarke, the Instructional Design Unit Head, continued conducting this course.

In-country Training for Production Staff

At various times throughout the IEL Project we employed nine illustrators. Our production staff also included typists, word processors, and Xerox technicians. All members of this staff were trained on various technical skills through a series of on-the-job programs.

Technical training for illustrators. Although the IEL illustrators were selected on the basis of their artistic aptitude, their level of technical expertise varied considerably. Robert Jacobs, Jr. provided technical training on the use of different graphics tools such as lettering templates, dry transfer letters, and inking pens. He also provided them basic instruction on composition and appropriate pen-and-ink techniques. Some illustrators were trained on layout and paste-up techniques and procedures for using a PMT camera for reducing and enlarging the artwork.

Visual literacy workshop. This workshop was conducted by Diane Dormant for illustrators and instructional designers. The workshop presented basic principles from empirical research on text illustration which were of immediate applicability to illustrating IEL modules. Using several existing illustrations by the IEL artists, Dormant explained the basic principals for attracting and focusing learners' attention on the critical element in the illustration, simplifying the illustration, and ensuring clarity of message design. Using a short manual, Dormant also explained how instructional designers and illustrators could work collaboratively to improve the efficiency of module illustrations.

Training for typists. The IEL Project depended heavily on instructional text which used a consistent specialized format. During the life of the project some 15 typists had worked on preparing PT and PL modules. They were trained through short workshops and individualized tutorial sessions on the PT and PL format. A style manual for the typists was created by the Technical Advisors, PT/PL Managers, and the Head of the

Unit. This manual and sample pages. The typists were walked through the special format requirements and given feedback during their initial assignments. At the beginning of the project, this training was conducted by the advisors. Soon after the training of the first set of typists, this training function became the responsibility for the PT and PL Managers.

Word processors. A significant amount of the typing of the project materials was done on word processor equipment. This was especially true of the PL modules which underwent a number of revisions. Initially, word processors were trained on Wang equipment by the local representatives. Additional training for the word processors were provided by Jacobs and Thiagarajan. Because of equipment malfunction, we shifted to Osborne microcomputers and Wordstar as the word processing system. The shift from Wang to Wordstar was accomplished primarily through on-the-job training by Nichols, Thiagarajan, Pasigna, and Bernard. After we had trained two word processors to operate on Wordstar, they in turn trained some other typists.

Xerox equipment use and maintenance. Throughout the life of the project, more than a million pages of instructional text were reproduced by our Xerox machine. Because of the critical dependence on this photocopying equipment and because of the unavailability of timely service in Liberia (and especially in Gbarnga), we employed a fully qualified Xerox technician as one of our technical advisors. Kirk Sims trained six different Printers Assistants on the use of a fairly sophisticated Xerox 9400 equipment. These operators acquired the skills of producing multiple collated copies printed on both side of the paper. In addition, Sims trained two of the Printer's Assistants on maintaining the machine so that they were able to troubleshoot and fix typical malfunctions. Primarily through an "apprentice" program, Sims was able to produce a high level of technical expertise among these two Liberian staff members.

Training of the Implementation Staff

A major aspect of the in-country training involved the training of a large number of elementary school teachers, their administrators, and the IEL Project staff on the implementation of the IEL instructional system. This training was a critical component for the effective institutionalization of the instructional system and it received highest priority from the technical assistance team. Details of this training are provided below:

Training of instructional supervisors. Instructional Supervisors were assigned the responsibility of acting as the liaison between the project and the system schools which used our materials. During the IEL Project, we trained ten different Instructional Supervisors. Initial training was conducted by Corene Cassell, the Implementation Unit Advisor. Training during the later stages of the project was undertaken by Cathy Rogers.

The basic training for instructional supervisors had two components: training in the skills and competencies of implementing PT and PL materials and supervising this implementation. For the first component, Instructional Supervisors received the same type of training which was

For _____, in using PT materials, they learned the skills of presenting information to the students, signaling, providing feedback, providing remedial instruction, and administering the tests. In PL, they received instruction on organizing PL groups, supervising learning activities, and administering module tests. In the second component of the training, the Instructional Supervisors were taught to observe the classrooms in which PT and PL modules are being implemented, to provide feedback and demonstrations to teachers, and to maintain different records. A major reference document for the training of Instructional Supervisors was the Implementation Handbook by Nichols which outlined in detail all implementation procedures related to the IEL system.

Training of school personnel. Before the beginning of each school year, the IEL project staff trained teachers and principals from the schools where the instructional system was to be implemented. The original training was conducted by Corene Cassell and the training during the later stages was conducted primarily by the Liberian project staff under the supervision of Cathy Rogers.

The workshop lasted from 2-3 weeks at various times. The basis for the workshop was a series of training manuals carefully prepared and repeatedly revised on the basis of feedback from the training program. The content of the workshop included a general introduction to the IEL system, administrative background, and the roles and functions of teachers at various levels. The training covered competencies related to direct instruction and to the supervision of practice/review activities in PT classrooms. Teachers were also taught management and supervision procedures for PL classrooms.

Principals from various IEL schools attended these workshops. In addition to participating in the general training along with their teachers, they received additional instruction on administration and supervision. All participants received instruction on the administration and the scoring of module tests. The workshop included demonstrations by the workshop leader, Instructional Supervisors, and master teachers from IEL schools which have been in operation from an earlier time. Each participant had an opportunity to conduct some practice microteaching.

Currently this teacher training workshop is packaged for administration by the Liberian staff at various regional centers when large scale dissemination occurs.

Follow-up coaching for school personnel. Instructional Supervisors followed up the initial teacher training workshop with classroom visits, observation, and supervisory feedback. These activities of the Instructional Supervisors were augmented by similar activities by the local principal. During the initial implementation period such coaching played a very important instructional role.

Mid-year follow-up workshop. In between semesters, a short workshop was conducted for the teachers and principals. The purpose of this workshop was to provide retraining in problem areas, to orient teachers and principals to changes in implementation procedures, and to clarify any

This was by the IEL Evaluation Unit and the Instructional Supervisors.

Training of Evaluation Personnel

Although the Evaluation Unit was the smallest of all IEL organizational units (with only one permanent position), it had a very key role to play in the project. Frequently we used part-time personnel for evaluation activities and they received in-country participant training:

Evaluation and research design. Training in these areas were provided to Bull (during the early period of the project) and to Azango (during the later stages of the project) by Johnson, Nichols, and Thiagarajan, and Bernard. This training was given prior to the implementation of an evaluation project (such as collecting baseline data on elementary school children) or a mini-research project (such as the one on absenteeism in elementary school). The technical advisors provided initial instruction and gave practical assignments to the trainee; they provided feedback and remedial instruction on the completion of the projects.

Training for test administrators. During the collection of baseline data from various schools, we employed a number of part-time evaluation assistants to administer language and reading tests. These test administrators were selected from applicants and volunteers in the Gbarnga area and they were trained by Rose Bull, the Evaluation Unit Head. Through this training, we were able to administer a number of tests and to collect reliable data.

Training in data analysis. Saywenyan, the Evaluation Assistant, was entrusted with the responsibility of tabulating and analyzing module-test data from various schools. He was trained on basic statistical procedures and the use of a TI programmable calculator by Daryl Nichols. On the basis of this training, Saywenyan was able to derive mean scores and standard deviations for various sets of scores.

Training on formative data collection activities. During the third year of the project, Instructional Supervisors collected evaluation data from systems schools. These activities were structured by two forms for recording observation and interview data from these schools. Initial training was provided by Daryl Nichols. At the later stages of the project additional training was provided by Bernard and Rogers. This training was supported by a manual which contained sample forms and sets of instruction. The result of this training was reliable collection, tabulation, and analysis of various qualitative data from the systems schools.

Training on content validation. A critical evaluation activity was the content validation of achievement tests constructed by the West African Examinations Council and by the IEL Project staff. Kelly conducted a workshop in which school teachers in Monrovia (with a background in educational measurement) were taught how to match test items with instructional objectives provided in the Revised National

. The result of this training was content validation data which provided a critical variable in interpreting the summative evaluation results.

Achievement test construction. The West African Examinations Council was given a subcontract for constructing and standardizing achievement tests based on the Revised National Curriculum for elementary education. Christian Agbenyaga conducted a training workshop for selected Liberian teachers on the construction of objective test items. The workshop dealt with the choice of appropriate items to measure the achievement of various objectives in the test construction specifications. The result of this workshop was the creation of an initial item pool for WAEC's achievement test.

Criterion test construction. All instructional designers received training in the construction of criterion tests for use as module tests in PT and PL modules. During the later stages of summative evaluation, when it became apparent that the achievement test constructed by the West African Examinations Council was not adequate, a group of IEL staff members were formed into a team for the construction of criterion tests which reflected the scope and sequence of the IEL instructional materials. These staff members were trained by Kelly and Richards to construct appropriate test items and to assemble them into suitable tests. The result of this training was the creation of the criterion tests which were administered during the final summative evaluation of the project.

Conclusion

Participant training has been a priority area in the IEL Project because of our focus on the continued institutionalization of the project. It was an integrated activity which took place almost daily. Formal workshops, especially for the training of school personnel and instructional designers, are now available in packaged forms; the Liberian staff are capable of conducting these workshops to produce a multiplier effect. Informal on-the-job training activities have resulted in changes in the attitudes, knowledge, and skills of IEL staff members. Their increased competencies form a significant outcome of the IEL Project.

The Institute for International Research and the IEL Project Administration have prepared several reports and documents.

2.9.1 Life of Project Implementation Plan

By the end of July 1979, we completed our contractual statement of work. This document combined the project implementation plan and life of project plan and provided detailed information on our activities and schedules. The development of this document was coordinated by the Principal Investigator with inputs from all of I.I.R.'s technical team members and feedback from the Project Director. The document is organized according to the following outline:

- I. Summary of Progress
- II. Life of Project Schedule
- III. Plan for the Teacher Education Specialist
- IV. Plan for the I.E.L. Project
- V. Participant training

Highlights of each section are given below:

Summary of Progress. This section reported on the progress in the areas of staffing, acquisition of facilities, equipment and commodities as well as the technical activities during the Bloomington Conference, Gbarnga Workshop, Monrovia Conference on Instructional Systems, and the Bloomington course.

Life of Project Schedule. This section listed the schedule of activities and critical performance indicators for the entire life of the Project. A foldout timeline graphically displayed the schedule for the following activities:

- Project Planning
- Curriculum Analysis
- Developing Learning Continuum
- Developing Learning Materials and Procedures
- Reproduction and Distribution of Materials
- Tryout and Revision of Materials and Procedures
- Developing Evaluation Plan
- Developing Evaluation Instruments
- Collecting Evaluation Data
- Developing Instructional Management Plan
- Developing Teacher Training Course
- Conducting Teacher Education Review
- Short- and Long-Term Training

Plan for the Teacher-Education Specialist. This section provided specific details of the role of the Teacher Education Specialist in the following areas:

Status of _____ on.

Professional Support for On-Going Programs
Liason for the I.E.L. Project
Preparation of Handbook on Teacher Education

This section also provided detailed schedules for various activities.

Plan for the I.E.L. Project. This section gave detailed information on the following topics:

Staffing
Materials Development
Production
Teacher Training
Evaluation

Participant Training. This section contained general suggestions and specific recommendations for short- and long-term training of Liberian personnel. It also includes suggested schedules for the training of evaluation head, teacher-training head, teacher education specialist, and instructional design head.

Among the important changes discussed in this plan is the modified evaluation design. This plan and the corresponding schedule changes were agreed upon by the MOE Evaluation Committee. The LOP discussed the implications of this modified design on school sampling, materials preparation, teacher training, and school supervision. Also discussed were the formative and summative evaluation activities of the IEL Evaluation Unit. The plan listed the modified role of the Teacher Education Advisor which included coordinating the activities of the West African Examinations Council (WAEC) during the preparation of the IEL summative tests.

Another revision to the Life of Project Plan was submitted in February 1984. This last revision described, among other things, the shift in production procedures from photocopying to offset printing. This change was considered to be the more cost-effective production alternative in light of the need for mass production of enough materials to supply 45 IEL schools and other schools identified by the MOE and USAID.

2.9.2 Progress Reports

The Institute for International Research, as the contractor, submitted quarterly and annual progress reports to USAID and to GOL. These reports dealt with the activities, problems, and recommendations for the specified period. In preparing the reports, the technical assistance team worked closely with the Liberian project staff to best reflect a total point of view.

2.9.3 Other Reports

External reviewers have commented that the IEL Project is one of the most widely documented projects of its kind. More than 200 different reports, papers, and documents were produced throughout the life of the project dealing with matters of relevance not only to the IEL Project but also to the design, development, and implementation of low-cost learning systems in different developing nations. The variety of reports include the following types:

Outcomes of various conferences (e.g., the Conference on the IEL Management Systems)

Consultant reports (e.g., MacMakin, "IEL Materials Production: Review and Recommendations")

Committee reports (e.g., Bernard, "IEL Dissemination Planning Committee Report")

Evaluation Reports (e.g., Harrison and Morgan, "An Evaluation of the Improved Efficiency of Learning Project")

Responses to evaluation reports (e.g., Nichols, "Some Notes on IEL Costs")

Reports for presentation at national or international conferences (e.g., report presented at the Rome Conference by the Hon. Minister for Education)

Booklets for Liberian educators (e.g., Samba, "Programmed Instruction and the Improved Efficiency of Learning Project")

Technical notes from members of the advisory team (e.g., Thiagarajan, "Integration of Textbooks")

Technical manuals (e.g., Paigna "How to Design an Informational Module")

Reports on mini-projects (e.g., Azango "Absenteeism in IEL Schools")

Journal articles (e.g., Pasigna, "Success Story: Liberia's IEL Project")

News releases

End of tour reports from technical advisors

Taken together, these reports document a case study of a large scale project replete with technical challenges.

In the Project Procedures chapter we frequently reported some of the outcomes of the IEL Project. In this chapter we summarize the results of the project.

3.1 Mid-term Evaluation Reports

Three major mid-term evaluations have been completed during the life of the IEL Project. The first was a Formative Evaluation of the Improved Efficiency of Learning Project conducted by Dr. Robert Jacobs of Southern Illinois University. The second was An Evaluation of the Improved Efficiency of Learning Project by Dr. Grant V. Harrison of Brigham Young University and Robert M. Morgan of Florida State University. The third evaluation, Improved Efficiency of Learning Project: Mid-Term Evaluation Committee Report, was conducted by a committee whose members were Dr. Gladys Harding (Liberian Ministry of Planning), Mrs. Etmonia Tarpeh (Liberian Ministry of Education), Dr. David Sprague (U.S. Agency for International Development, Washington, D.C.), Mr. Curt Wolters (USAID/Liberia Program Office), and Dr. Edward Tolle (USAID/Liberia Education and Human Resources Office).

3.1.1 Robert Jacobs

Robert Jacobs' conclusion was that the IEL Project "holds great promise for Liberia." However, he was concerned with many of the project procedures. Here are short excerpts from his reports:

- The teaching portion of the PT management system is operating very well, but the practice and review sequences are not. The groups get bored and restless when they finish before the end of the period. Frequently the teacher has to interrupt his/her PT activities with the group time to restore order or try to get the practice or review group back to the prescribed format. So there is not only a breakdown in the group mode of learning, but frequent interference with the PT activity. This is not an occasional circumstance; it is a common experience in all the experimental schools.
- At the start of the project, individual lesson sheets were used. The individual lesson sheets were soon discarded in favor of the group practice exercises because the lesson sheets were 'throw-aways' and their use would increase production costs considerably. Pupils get bored with the group learning and they tend to be more attentive and diligent when employing the individualized mode. But be that as it may, the fact is that the present management system (management of learning) is not working as expected in the practice and review sequences and some sort of remedial action is needed.

are very common. Absenteeism in a single classroom on a given day may run as high as 25%. There is not adequate provision for smooth absentee re-entry into the IEL learning system at the Grade 1-3 levels, and since this phenomenon is the rule rather than the exception in Liberian schools, attention needs to be given to system changes which will provide either for self-study during absences or for smooth and orderly 'catch-up' to reenter the group mode after an absence.

- Teacher absences are also quite common in Liberian schools. In one of the schools visited the teacher had been absent for more than two weeks. The children showed up each morning and were simply sent back home because there was no teacher. Teacher absenteeism is a fact of life in Liberia which must be taken into account in any proposed learning management system. If the IEL materials incorporated some degree of flexibility and were sufficiently self-contained to permit self-study to some degree when the teacher is away, at least some learning could take place.
- A system which deliberately holds back the faster learner would seem to deny altogether the importance of making provision for the faster learners. Projected plans for the Grade 4-6 levels will actually hold the faster learner to the progress rate of the slower learners in his group. Simply because there is exclusive reliance on 'learning in groups' in the present IEL system, it will be extremely difficult to adapt the system to any future moves in the direction of accommodating the fast learner.
- When learning is only in groups, self-reliance and independent thought are actually suppressed. It would be difficult to argue that the present IEL system with its exclusive use of the group mode will develop self-reliance and independent thinking.
- With regard to the needs for each learner to have some instructional item to carry to and from home, IEL in its present form has little to offer. Materials for Grades 1-3 must be used in groups at schools and are not sufficiently self-contained to be used as take-home items. Neither are the PL modules used in Grades 4-6.
- Introduction of self-learning at the lower (Grade 1-3) levels where PT technology is being applied is probably more difficult than with the PL component. It may not be unreasonable to suggest that in programmed learner behavior in the practice and review sequences both individual and group modes of learning might be employed. The materials modification would be only in the practice booklets. The practice booklet might become the 'carry-home' item, and the materials would have enough flexibility to permit some level of learning when the teacher is absent.

before they are printed in final form the IEL materials be reviewed and evaluated by a materials and programming specialist who has not been directly involved in their creation.

- Perhaps the most exciting of the observable strengths is the behavior of PT teachers. They are performing exceptionally well and are enthusiastic about their work. And pupils are learning. It is the consultant's belief that IEL holds great promise for Liberia in meeting basic requirements for development of the country.
- Both the design and implementation units need to have ready access to all feedback information. Effective utilization of feedback information requires close collaboration between the design and implementation units. Such collaboration has been restricted in the past by the extreme pressures of the production schedule, each unit being in somewhat of a survival struggle, trying to keep heads above water. There is, of course, no point in gathering information if it is not used. Attention needs to be given to effective utilization of feedback and to follow-up remedies at the same time efforts are being made to improve information-gathering procedures.

The concerns and recommendations expressed by Jacobs were reviewed by the IEL Project staff. Changes in the IEL instructional system were undertaken to reflect Jacobs' concern. Suggestions regarding self-instruction were seriously considered and a gradual shifting of the locus of control for instruction from the teacher (in PT classrooms) to the group (in early PL classrooms) to the individual (in later PL classrooms) was undertaken. Alternative approaches for providing students with take home materials were considered. Cost factors prohibited the use of certain approaches. A flexible system for students taking home PT practice booklets and PL modules was created. A much more systematic approach for collecting, analyzing, and sharing feedback information was created by Nichols and implemented immediately.

3.1.2 Grant Von Harrison and Robert Morgan

These two independent evaluators, who are experts in elementary curriculum and instructional systems design, conducted their evaluation of the IEL Project in February 1982. Their major conclusion was that "the development process utilized in the IEL Project represents the most advanced state-of-the-art technology for instructional development." Excerpts from their comments are provided below.

- An intensive review of the materials, classroom observations, interviews with teachers, principals, and students, and actual learner data have led the evaluators to the following conclusions:
 1. The academic content is appropriate in amount, level and quality.

developed, consistent with the most current state-of-the-art technology.

3. The materials and processes are instructionally effective and more so than any other system that could be envisioned at this time for the unique Liberian circumstances.

- With very few exceptions, the content of the modules is consistent with the instructional objectives specified in the Module Specifications document, which in turn is consistent with The Revised National Curriculum from the Liberian Ministry of Education. The learning activities are commensurate with the specified instructional objectives.
- Most of the modules systematically require the students to deal with various types of learning tasks. This feature is one of the major strengths of the materials.
- the writers have made a conscientious effort to assure that learning objectives were commensurate with the desired learning outcomes. It appears that the PT Writer's Manual has been a key factor in ensuring that suitable instructional strategies were selected and utilized.
- The instructional methodology ensures that the students are told immediately whether their responses are appropriate or not. It appears that the amount of such feedback is very adequate and its timing very effective.
- The designers have consistently employed illustrations effectively. The type, size, and amount of detail in these illustrations appear to use the state-of-the-art visual-literacy strategies to provide clarity. The number and quality of illustrations have been consistently excellent.
- Every component of the IEL materials and methodologies appear to serve a single purpose: To help the students acquire the competencies identified explicitly or implicitly in the Revised National Curriculum
- Except for extremely divergent learners, there is sufficient provision for the range of individual differences found in a typical class. Handling the extremely slow or the extremely fast learner may require some adjustments and additional teacher training. However, the basic structure of the IEL system has the flexibility for accommodating such children.
- We have examined the six transition modules and judged that these are not suitable for continued use. They do not effectively serve the transitional purposes for which they were intended. Nor do they provide the kind of directly relevant targeted remediation for the IEL system which is needed. They appear to be too complicated for effective use. The production and implementation cost would be prohibitively expensive.

- Based on extensive interviews with participating teachers and principals, there is a consensus that with appropriate training the IEL system is workable within a typical Liberian school. It is the opinion of the evaluators if the size of the class were to become much larger, the strength of the program would probably diminish.
- The following are some of the salient points that were consistently expressed by different people associated with the project:
 - Children are learning more than they would in conventional classrooms.
 - Children enjoy the learning activities.
 - Children are taught content that most likely would not be taught in a traditional classroom.
 - The attendance of children in the IEL schools is substantially higher than in conventional schools.
 - Children like the illustrations in the IEL modules and these illustrations seem to help them better understand the concepts being taught.
 - Children enjoy working in groups.
 - Children are learning more about Liberian culture and social structure from the IEL materials than from other texts.
 - Absenteeism of teachers using the IEL materials is significantly lower than that of other teachers.
 - The tests that accompany IEL materials are generally better than teacher-made tests.
 - Better records regarding student performance are maintained by IEL teachers.
 - IEL teachers put in more time and work harder than the other teachers.
 - Parents are more inclined to have their children enroll in the IEL school.
 - Parents are more supportive of having their children attend school on a regular basis.
- A weakness in the management of the project is the failure to fully implement the internal evaluation and feedback plan.

education.

- It is a fallacy to assume that individualization of learning can only, or even best, occur when students are learning in isolation from one another. Small group learning, as exemplified by the IEL review and practice groups and the PL groups, can be more effective than traditional instruction -- and at no greater cost. There are also studies to suggest that the learning pace of the slower, lower-aptitude students is appreciably accelerated by such small groups without slowing down the faster students.
- The project sponsors should be aware that the PL modules are perfectly suitable as they are now being developed to be used as individualized, self-paced instruction. They have been designed for use by a small group but could be used by an individual as well. In the opinion of the evaluators this individual use of the PL modules would be unwise even if cost were not a factor. There is genuine pedagogical value to the small group approach.
- The evaluators believe, with respect to the issue of individually-paced learning, that in the IEL Project the best that can be done has been done.
- If the IEL staff will commit themselves to following the evaluation plan in the Life of Project Implementation Plan, attend to the recommendations of the Jacob's report, and follow the recommendations below, the evaluators feel confident the feedback system for the project will be effective.
 - Improve the validity of the module tests (according to specific suggestions already provided to the IEL staff).
 - Provide teachers and others (who give tests) specific training on how to administer pretests, block tests, and achievement tests.
 - During this experimental phase of the project only, provide paper and pencil to students for module test so that data can be systematically collected.
 - Ensure that all data is summarized, analyzed and reported as soon as possible.
 - Have all key team heads and advisors review the data each month.
 - Make sure that teachers understand how to collect, summarize and report the data.
 - Develop diagnostic tests to ensure that all children are placed in the appropriate grades based on their entering competencies.

- Develop a reading proficiency test to determine when students are ready to move into the PL modules.
- Report data to appropriate audiences on a regular basis.
- Analyze the accumulated data at the end of each year in terms of lessons, modules, subject area, grade, and school.
- Develop an observation instrument to be used by the Instructional Supervisors for evaluating teachers.
- Develop a standard operating procedure for all aspects of the feedback system so that everyone knows who is supposed to do what.

Almost all of the specific recommendations from Harrison and Morgan were incorporated in the IEL Project. Their suggestions regarding the evaluation system were integrated in the formative feedback procedures created by Nichols.

3.1.3 Mid-term Evaluation Committee

A major conclusion in this committee's report was that the IEL Project offered a "unique opportunity for improving the quality of education in Liberia within reasonable costs" and that "outstanding progress is being made." Specific excerpts from this report are given below:

- The committee recommends additional time and funds be allocated for the project. Early efforts by the Liberian MOE and USAID/Liberia to expedite this action would guard against a loss of momentum by the project staff. The Life of Project Plan should be revised by the project staff and an up-to-date time schedule given for each significant function of the project. Any major deviation from the revised plan should be anticipated as far in advance as possible and brought to the attention of the Steering Committee.
- The committee urges that particular attention be given to evaluation of the practice and review sections of PT in the 1983 tryout. Emphasis should be given to increasing the directions for teachers and the variety of exercises for students in these sections. The Steering Committee should follow this matter closely.
- Special attention needs to be given to the role and use of the laboratory school. The opportunity this school affords to obtain more comprehensive and current information about teacher and student performance does not appear to be adequately utilized. The committee suggests regularly scheduled meetings of the lab school teachers, instructional supervisors and module writers.

time evaluation specialist. The focus of the position relates directly to the function of feedback and revision and only the presence of a qualified professional evaluator will keep its importance sufficiently forward in the minds of the project staff.

- The committee urges that during the next revision of the materials the staff carefully review the content and illustrations for their relevance to the school child in Liberia.
- The storage and maintenance of the written materials could be a major problem for each experimental school as the amount increases. Plans for the construction of shelves to hold the project materials should be started. A decision should be made as to the advisability of leaving this responsibility to each school and involving the local community or some other workable alternative.
- The absence of textbooks and accompanying teacher training in optimal control schools jeopardizes the experimental design. Because the children in the experimental schools have an advantage from their repeated experience with tests, every effort must be made to balance off this experience with tests in the control schools. Plans must be made to test the control schools at least four times prior to the final summative test.
- Care should be taken that the project staff and the MOE take into account the frequent absences of both teachers and students. The MOE should study this problem to see how school attendance by students and teachers can be improved.
- There is a clear need for someone to begin formulating strategies that will lay the groundwork for integrating the IEL system into the traditional education system. There is a need for clarification as to the role of the teacher education specialist to assure that he carries out his liaison responsibility for the IEL Project.
- The Curriculum Unit in the Instruction Department (of the MOE) should review the scope, sequence, and content of all modules to make sure that they are consistent with the revised national curriculum, factually accurate and consistent with Liberian tradition. The committee recommends that the Steering Committee make every effort to involve the Instruction Department and any other relevant divisions of the MOE from now on.
- The IIR contract calls for M.A. level training for 5 GOL professionals: PT Design Team Head, PL Design Team Head, Evaluation Head, PT/PL Teacher Trainer, and the Teacher Education Specialist. To date only the evaluation professional has received the long term training and she has left the project staff. The Instructional Design Head is the only other Liberian presently scheduled for long term training.

project
highest educational qualifications and stature in its senior positions. The present Liberian staff should be expanded to provide adequately trained personnel, or those who can be trained within the project's time frame. Funds should be reserved especially for this training.

- The project now requires a more thorough and analytic study of both development and recurrent costs. The committee urges that a thorough cost study be conducted as soon as possible.
- The production aspects of the project should be moved to a site where permanent public electricity is available. The implementation unit can remain in Gbarnga and the lab school moved to the present project site.

The recommendations from the committee were reviewed by the IEL Project staff and appropriate actions taken. For example, storage facilities for the modules in experimental schools were constructed and installed. A new system of coding PT lessons and modules as core and optional items was created so that those schools which suffered from frequent absences of teachers could focus their attention on basic skills. A specialist committee of the Ministry of Education was formed to review the content of IEL modules. A cost-effectiveness analysis of the project was conducted by Douglas Windham. The production facilities (photocopying equipment) were moved to Monrovia where electricity was more reliably available.

3.2 Other Results and Outcomes

The following section provides brief summaries of other results and outcomes related to the IEL Project. These results are divided into six sections: (1) staffing and institutionalization, (2) instructional materials development and production, (3) teacher training and implementation, (4) teacher education, (5) evaluation, and (6) participant training.

3.2.1 Staffing and Institutionalization

The IEL Project staff form a cohesive core of competent technicians who are capable of dealing with various aspects of designing, producing, evaluating, and implementing a complex instructional system. Many visitors to the project offices have remarked on the efficiency and the work ethic which prevailed in this organization. A major positive outcome of the IEL Project is this organized group of specialists who are capable of transferring a sophisticated technology to install and to implement the IEL instructional system in new elementary schools in Liberia, to tackle similar educational challenges which lend themselves to the design of an instructional system, and to provide technical assistance to other developing nations, especially in Africa

3.2.2 Instructional Materials

One of the most tangible products of the IEL Project is a large number of systematically developed and validated materials which are written by Liberian authors for Liberian elementary school children. These materials are incorporated within a total instructional system which provides an effective and flexible framework for their use. The following is a list of the more important components of the IEL instructional materials system:

1. Programmed teaching modules. A total of 100 modules grades covering up to the first semester of the third grade. Each module is separately bound in three parts. The modules deal with the subject areas of language, reading, mathematics, and science/social studies.
2. Review booklets. Four review booklets per semester to accompany the PT modules. These booklets contain a variety of review exercises covering the topics from the PT modules.
3. Practice booklets. Fourteen practice booklets per semester covering the same topics as the PT modules.
4. Semester test. One test per semester covering all subject areas and content taught in the PT modules for the semester.
5. PT reading booklets. One reading booklet per semester in grades 2 and 3. These reading booklets contain additional material to accompany the PT modules in different subject areas.

6. PL modules. Ten PL modules in each of the five subject areas (language, reading, mathematics, science, and social studies) for grade three, second semester. Twelve PL modules in each subject area for each semester of grades 4, 5, and 6. In the third grade, 40 PL modules constitute the core modules and the other 10, enrichment and optional modules. In the other three grades there are 40 core modules and 20 enrichment/optional modules.

7. Programmed learning student guides. These guides summarize group learning procedures for use by the leaders and team members in PL learning groups.

8. Test booklets. There are 10 programmed learning test booklets for each semester. These booklets contain tests on each PL module.

9. Test answer keys. A single copy of the answer key provides the correct answers and the scoring system for each of the module tests for the semester.

10. Block and semester tests. A single booklet for each semester contains various tests to be administered upon the completion of each block of PL modules and at the end of the semester.

11. Arts and crafts manual. A single manual contains shorter manuals on 60 different arts and crafts activities, 20 each for the three upper grades.

3.2.3 Teacher Training and Implementation

A complete teacher training package is available which incorporates various training manuals, forms, sample materials, and leader's guide. IEL Instructional Supervisors in the Implementation Unit are trained to conduct these teacher training workshops in various regional training centers. The complete implementation materials package includes the following:

IEL Handbook. This book is used every day in training. It serves as a ready reference for teachers, principals, education officers, IEL staff members, and other interested parties.

Typical Day In An IEL School. This book gives a complete example in easily readable form the day to day functions of a PT teacher, PL teacher, and a principal.

Training Manual for PT. (Techniques For Programmed Teaching). This training manual is used in teaching participants how to conduct direct instruction.

Semester Boxes Grade 2 PT. Semester boxes are used for four specific reasons: (1) to give the participants a visual reference to materials they will be using (2) to give practice in how to use the semester box (3) to give sample modules in all subject areas and (4) to give demonstration

and practice in using review booklets, reading booklets, and practice booklets. This grade level carries all of these components.

Training manual on sounds. This training manual is used to teach the participants how to say sounds correctly. (Used by trainers only.)

Wall charts. A reproduction of the letters found in the Practice Booklet on sounds. (Used by trainers only.)

Practice booklet on sounds. This booklet is used after participants have been drilled thoroughly on saying the correct letter sounds.

Practice module on relating sounds to pictures. This booklet is used to give practical experience in using sounds with actual lessons from the module.

Training manual for review. This booklet is used to teach participants how to train their students to perform in their review groups.

Review booklets for participants. This book gives participants a chance to role play all activities outlined in the Training Manual for Review.

Training manual for individual and group testing. This book is used to teach participants how to give Individual and Group tests.

Sample module test booklet. This booklet is used along with the Training Manual, Individual and Group tests.

Sample semester test booklets. This booklet is used to teach participants how to give the Semester Tests.

Program teaching - program learning instructional system. This booklet teaches participants about the daily instructional cycle how records are kept and how students are grouped for instruction and review groups.

Programmed teaching and programmed learning instructional material management system. This book gives detailed instructions about each of the components in PT Modules: (1) Review Booklets (2) Reading Booklets (3) Practice Booklets, and (4) Semester Test Booklets. It tells how the books are arranged, the coding system and the hierarchy of instructional levels. This book also gives detailed instructions about each of the components in PL modules: (1) Module Tests, (2) Block Tests, and (3) Semester Tests. It explains how the modules are divided into three categories: core, optional and enrichment. It explains the hierarchy of the instructional levels and gives information on how material delivery books are maintained.

Supervision process. This book gives detailed instructions about the two components of the supervision process.

Training manual for learning in PL groups. This training manual has a sequence that is used for the IEL training staff and teachers to

introduce PL learning. The IEL staff members use this manual to train teachers of IEL schools. The teachers, in turn, are to use the manual to train students in PL group learning behaviors.

How to learn in PL groups. This training module is used along with the Training Manual for Learning in PL groups.

Lap boards. Used as a writing surface if desks are not available.

Peer group boards. These boards are used in each of the peer groups with lessons that require the use of blackboard.

A training manual for upgrading skills of Grade 3 students. This manual is designed to give help to students who first experience IEL at grade 3. These students are often handicapped by not having complete readiness in reading comprehension. This manual is designed to overcome anticipated deficiencies of this kind.

A training review booklet for upgrading the skills of grade 3 students. This Review Booklet gives the students a review of the materials just learned in their Direct Instruction session.

A training manual for upgrading skills of grade 2 students. This manual is designed to give help to students who first experience IEL at grade 2. These students are often handicapped by not having complete readiness in computational skills. This manual is designed to overcome anticipated deficiencies of this kind.

A training review booklet for upgrading the skills of grade 2 students. This Review Booklet gives the students a review of the materials just learned in their Direct Instruction Session.

A training manual for upgrading the skills of grade 3 students in Math. This manual is designed to give help to students who first experience IEL at grade 3.

A training review booklet for upgrading the skills of grade 3 students in Math. This Review Booklet gives the students a review of the materials just learned in their Direct Instruction session.

Training manuals, reading booklets, and review booklets for upgrading the skills of grades 4, 5, 6 students:

1. How to Read Words
2. How to Answer Wh questions
3. How to find meaning of words
4. How to read stories
5. Reading booklets
6. Review booklets

These are designed for children who are changing from the conventional school to the IEL school. These students often suffer from a low level of English comprehension. The training in these manuals are designed to ensure a minimum level of reading comprehension before students begin learning in PL groups.

Training review booklet for upgrading the skills of grades 4, 5, 6 students. This book is designed to follow Direct Instruction Lessons.

Training reading booklet for upgrading skills of grades 4, 5, 6 students. This book is designed to be used occasionally during direct instruction to supplement the learning materials found in the upgrading modules for grades 4, 5, and 6.

3.2.4 Teacher Education

The outcomes of the activities by the teacher education advisor include the following:

1. Curriculum handbook for rural teacher training programs and extension services. This handbook includes a rationale for the program and the scope, sequence, schedule, objectives, and course outlines for the curriculum in teacher training institutions.

2. Preliminary course of study in programmed teaching and programmed learning for rural teacher training institutes. This course is designed to familiarize trainees in rural teacher training institutes and their counterparts in extension schools with programmed instructional materials of the IEL system.

3.2.5 Evaluation

Test Construction

A number of tests have been constructed as a part of the IEL Project. These include module, block, and semester tests for PT and PL classrooms. In addition, the following two tests were constructed for summative evaluation of the project. They can be used for other evaluation purposes in Liberian elementary education.

1. WAEC achievement tests. These measure the achievement of the Liberian National Curriculum.

2. IEL criterion tests. These measure the achievement of the instructional objectives for the PT and PL modules of the IEL system.

Evaluation Data

Independent evaluations of the IEL Project have been conducted by Galda and Kelly. Detailed reports of these evaluation studies are available elsewhere. The following are brief summary results of these studies:

Some Tentative Results on the Effectiveness of the IEL System

In October 1982 Daryl Nichols prepared an internal report based on his analysis of data from two consecutive administrations of a pretest. These tests were administered one year apart to the five original IEL schools and 10 control schools (five each of optimum control and status quo schools). These tests covered basic skills in reading and mathematics.

Nichols summarized the main findings as follows:

- Achievement levels in IEL and non-IEL schools were approximately equal when the study began in March 1981.
- Testing of students who completed grades 1, 2, and 3 in 1981 show IEL students outscoring non-IEL students on all tests.
- Results from the 1982 administration of these tests show all five IEL schools ranking higher than any non-IEL school.
- IEL schools showed greater learning gains than non-IEL schools during the 1981 school year.

Pretests were given each year to both IEL and control schools. These pretests were to be used in the summative analysis when their results were to be compared to the results of posttests. A comparison of pretest results in 1981 with those of 1982 gave some indication of the relative effectiveness of the IEL system in Grades 1 through 3.

1. Achievement levels in IEL and non-IEL schools were approximately equal when the study began in March 1981.

Dr. Galda, summative evaluation consultant, developed the following table in 1981.

	BEGINNING OF GRADE 1			BEGINNING OF GRADE 2			BEGINNING OF GRADE 3		
	N	Lang.	Math	N	Lang.	Math	N	Lang.	Math
OC	232	50.0%	56.4%	154	49.3%	48.8%	102	46.0%	14.8%
SQ	152	51.4%	55.9%	116	35.5%	38.9%	89	41.2%	18.2%
IEL	224	45.1%	54.2%	117	37.7%	52.4%	116	45.6%	25.4%

To quote Dr. Galda: "Overall, the groups seem fairly comparable, although there are some fluctuations in some of the tests. As a rough (ordinal) measure of overall comparability we can assign three points to each first place on a test, two points to each second place, and one point to each third place. In this way OC has 14 points, IEL has 12, and SQ has 10. Thus, the IEL schools are generally comparable to the non-IEL schools."

2. Testing of students who completed grades 1, 2, and 3 in 1981 showed IEL students outscoring non-IEL students on all tests.

Scores from the 1982 administration of the tests are shown in the following table. This table is parallel to Dr. Galda's 1981 table in Section 1.

The figures listed under Grade 2 are results of tests administered to students who completed Grade 1 in school year 1981.

	BEGINNING OF GRADE 1			BEGINNING OF GRADE 2			BEGINNING OF GRADE 3		
	N	Lang.	Math	N	Lang.	Math	N	Lang.	Math
OC	107	49.0%	58.5%	104	50.9%	44.3%	92	30.5%	37.3%
SQ	111	42.6%	50.7%	76	39.7%	41.4%	67	28.4%	37.0%
IEL	119	61.0%	63.1%	145	74.5%	54.3%	78	35.7%	40.1%

Applying the same ordinal measure of overall comparability, OC has 12 points, IEL has 18, and SQ has 6. Thus, IEL schools scored highest in all three grades on both tests.

3. Results from the 1982 administration of the tests showed all five IEL schools ranking higher than any non-IEL school.

Relative standings of schools on the 1982 tests are shown below.

S.S. Collins	IEL
Frelalah	IEL
G. Doloboi	IEL
J. S. Milton	IEL
Dorothy Cooper	IEL
E. J. Yancy	SQ
Martha Tubman	SQ
Gorlu	SQ
Gbellemah	SQ
Ganglotah	OC
David Fejue	OC
Yanniqueleh	OC
Corporal Woah	OC
Nyofakollie	SQ

One SQ school, Mamadee School, is not included because of the small size of Grades 3 and 4.

The difference between the means of IEL and non-IEL schools was equivalent to 1.9 standard deviations.

4. IEL schools showed greater learning gains than non-IEL schools during the 1981 school year. IEL, OC, and SQ schools were compared on the gain or loss between 1981 and 1982. Standard scores (stanines) were computed for schools (not individual students) separately for the two years. IEL made a relative gain of 1.6 points (0.8 standard deviations) while SQ gained only 0.4 points (0.2 standard deviations), and OC actually lost 1.4 points (0.7 standard deviations) relative to the other schools.

1983 Summative Evaluation

In August 1983 Edward Kelly undertook the external evaluation responsibilities for the IEL Project. In November 1983 achievement tests were administered in 15 IEL, 15 optimum control and 15 status quo schools in English, mathematics, science, and social studies across grades 1-5. Two sets of tests were used: 16 achievement tests developed by the West African Examinations Council, and 10 criterion tests developed by the IEL Project staff. The results of this summative evaluation are summarized below:

A. Reliability and Validity of the Tests

Fifteen of the 16 WAEC examinations showed acceptable levels of reliability (KR-20). The reliability of the Science 4 examination (.62) was judged unacceptable. Analyses of the validity of the WAEC examinations against the IEL instructional materials showed a wide range of results. Three tests, Science 4, Math 5, and Social Studies 5 showed 70% or more invalid items. Six tests contained between 40% and 57% invalid items, and four contained between 13% and 35% invalid items.

Investigation of the validity of the WAEC items with respect to the IEL instructional materials proceeded systematically. English speaking high school teachers in Monrovia who had graduate level training in measurement and who had no connection with either the IEL or the WAEC were hired to conduct the analysis under guidelines developed by the evaluator. All tests were reviewed by two raters; the results were compared; and differences of opinion were negotiated -- if possible -- and the results were tabulated and sent to the United States for processing. Items were declared invalid by the raters if the test item asked a question or required information that was not contained in the instructional content of the IEL materials. In order for an item to be declared invalid, both raters had to agree. Where there was disagreement that could not be negotiated, the item was accepted as valid. Consequently, the results are possibly an underestimate of the frequency of invalidity of the test item content.

In general, the WAEC tests exhibit a poor match against the instructional content of the IEL program. It is argued that this result is due to the ambiguity of the national curriculum from which both the tests and materials were developed independently.

Further analyses of the WAEC examinations showed a medial to high level of cross test correlation, and the presence of a single factor in grades 3 through 5 that accounted for more than 67% of the variance in the

correlations. Correlations between the two test batteries in English and mathematics are low to medial, .20 - .50. These results support the belief that the two sets of tests are measuring different constructs, and that as a result, their results are not comparable.

Nine of the 10 IEL tests in English and mathematics showed acceptable reliabilities (KR-20). The reliability of the IEL grade 4 Math exam (.57) was judged unacceptable. Since the IEL materials were developed directly from the national curriculum, and since this relationship has been widely reviewed and certified, the item validity of the IEL examinations was assumed.

B. Achievement Differences

Twenty-six separate comparisons were conducted (16 for the WAEC tests and 10 for the IEL tests). In each comparison the average performance of students in the three groups was compared. Seven of the comparisons produced non-significant differences ($p > .05$). The IEL group was superior to both other groups in 11 of the remaining 19 comparisons, while the OC's were superior in 4, and the SQ's in 6. The number of comparisons sums to more than 19 due to the fact that in some of the comparisons the results for the groups are combined; that is, two groups did better than one other.

The superior performance of the IEL is closely related to which test form (IEL or WAEC) was used. Ten of the 11 comparisons that show the IEL superior are based on the IEL achievement tests in English and mathematics. These results support the conclusion that the WAEC tests are generally invalid as measures of achievement for the IEL instructional program.

The size of the effect for the IEL compared to the mean performance of the OC and SQ groups ranges from 8.7 percentile points to 30. The average effect was 17.3 percentile points, and the median was 16.2. On the average, IEL students scored 17 percentile points higher than did the comparison group. If the average score is set at the 50th percentile for the comparison group, the IEL group tended to perform at the 67th.

Based on the evidence available, Kelly concluded that "when the IEL system is appropriately implemented and assessed against measures that are valid, it demonstrates achievement outcomes that are superior to those achieved in traditional elementary schools in Liberia. This finding, when combined with other evidence descriptive of the IEL's increased student enrollments as well as its cost savings, clearly supports the continuation and expansion of the program in Liberia."

Cost Evaluation Analysis

Details of Windham's cost effectiveness analysis and IEL's materials cost reduction project have been reported earlier. After the completion of the IEL cost reduction project, Windham recalculated the costs

associated with the IEL materials. He concluded that the cost reduction project had accomplished a great deal in meeting the earlier criticisms in the cost analysis reports. The absolute levels of cost reduction were dramatic and the largest cost reductions were made for PL grade levels where class sizes were most likely to be small. The table on the next page shows the comparisons of costs from Windham's report. He concluded that "if the new IEL system can be instituted without loss of instructional benefits, then the overall cost effectiveness of the IEL system relative to any of the textbook alternatives is greatly enhanced." Windham indicated, however, that elementary schools with very small class sizes still presented some cost problems. He suggested that we should phase dissemination in such a way that these small enrollment schools received IEL materials last.

Student-Teacher Ratios and Cost

A rationale which was central to the IEL project was that one of the biggest savings in cost is not in materials but in teacher costs. World-wide, costs associated with teachers (training, salaries, retirement, etc.) amount to 80%-90% of total educational costs. In IEL it has been assumed that the number of students that a teacher could provide for was far more than would be possible in conventional schools. In a small school, for example, one teacher could easily provide for PL learning in grades 4-6. In the project's own Laboratory School, two teachers were able to handle all six grades.

Teacher savings have been ignored in most cost analyses primarily because of small enrollment in most schools. One fact which was overlooked in Liberia was that students are able to attend schools of their choice even if they must walk a number of miles to do so. The IEL Project staff and the external evaluators have reviewed the enrollment patterns in the IEL and control schools during the life of the project. IEL schools had almost doubled in enrollment with no increase in the number of teachers. Control schools (OC and SQ) had no increase in enrollments during the same period, and the teaching staff had been increased slightly. As a result, the student-teacher ratio in IEL schools was almost double the ratio in the control schools. For whatever reason, more children were attending IEL schools than were attending conventional schools. Hence, the IEL Project staff pointed out that the equivalency of teacher costs for IEL and control schools could no longer be assumed. Daryl Nichols indicated that assuming a minimum salary of \$200 per month for elementary school teachers and training and fringe benefits of an additional 25% to salaries, the gross per teacher salary would be \$250 per month or \$3,000 per year. These assumptions based on 1983 figures, suggested that teacher costs per student per year are \$65.68 for IEL and \$124.92 for non-IEL schools. These savings in teacher costs were in addition to the savings in the material costs as computed by Windham. The teacher cost savings far outweigh the savings in materials costs in IEL schools.

COST COMPARISON: ORIGINAL VERSUS REVISED

IEL MATERIALS

ITEM	TOTAL		PRINTING COST		EXPECTED MATERIALS LIFE	ANNUAL COST	
	ORIGINAL	REVISED	ORIGINAL	REVISED		ORIGINAL	REVISED
Grade One							
Modules	3,200	3,190	\$96.00	\$95.70	2	\$48.00	\$47.85
Other Materials	11,690	3,866	350.70	115.98	5	70.14	23.20
Total	<u>14,890</u>	<u>7,056</u>	<u>446.70</u>	<u>211.68</u>		<u>118.14</u>	<u>71.05</u>
Grade Two							
Modules	3,200	3,082	\$96.00	\$92.46	2	\$48.00	\$46.23
Other Materials	12,890	6,058	368.70	191.74	5	77.34	36.35
Total	<u>16,090</u>	<u>9,140</u>	<u>482.70</u>	<u>274.20</u>		<u>125.34</u>	<u>82.58</u>
Grade Three (I)							
Modules	1,600	1,382	\$48.00	\$41.46	2	\$24.00	\$20.73
Other Materials	7,045	3,819	211.35	114.57	5	42.27	22.91
Total	<u>8,645</u>	<u>5,201</u>	<u>259.35</u>	<u>156.03</u>		<u>66.27</u>	<u>43.64</u>
Grade Three (II)							
All Materials	9,386	3,860	\$281.58	\$115.80	5	\$56.32	\$23.16
Grade Four							
All Materials	22,332	9,328	\$669.96	\$279.84	5	\$133.99	\$55.97
Grade Five							
All Materials	22,332	9,328	\$669.96	\$279.84	5	\$133.99	\$55.97
Grade Six							
All Materials	22,332	9,328	\$669.96	\$279.84	5	\$133.99	\$55.97

Teacher Training Costs

Evaluation data on the IEL Project indicated that the so-called unqualified and underqualified teachers using the IEL instructional systems were able to produce student achievements comparable to those produced by fully trained elementary school teachers. Additional cost savings resulted from this fact (which was one of the initial justifications for the IEL Project). Sometime during the early stages of the project, teacher training at the Kakata Rural Teacher Training Institute was estimated to cost approximately \$5,000 per trainee. This has undoubtedly gone up during these years and is perhaps 1000% compared to the cost of the one month IEL teacher training workshop.

3.2.6 Participant Training

In an earlier section we indicated how a combination of overseas training, in-country workshops, and informal on-the-job training has been provided to IEL staff members and others in the following competency areas:

- Instructional design
- Curriculum design
- Programmed teaching
- Programmed learning
- Editing and supervising programmed instruction materials
- Revising programmed materials
- Instructional design for developing nations
- Text illustration techniques
- Text illustration design principles
- Typing instructional materials
- Word processing
- Using Xerox equipment
- Troubleshooting and maintaining Xerox equipment
- Instructional supervision
- Implementing the IEL system
- Using IEL PT modules
- Using IEL PL modules
- Administering standardized achievement tests
- Analyzing test data
- Computing statistics
- Collecting formative data
- Content validation of test items
- Achievement test construction
- Criterion test construction

At the end of the project two packaged training workshops were available. The first of these was the implementation training workshop package which forms the critical core of any future dissemination activity. The second package was for training instructional designers in developing programmed teaching and programmed learning systems. This workshop could be of important use should the MOE decide to expand programmed instruction to secondary schools.

The most significant outcome of participant training is the group of qualified trainers who can provide systematic training in the areas of implementation and instructional design without the need for technical assistance.

4. RECOMMENDATIONS

This chapter of the report lists a number of recommendations about the future of the IEL Project. It begins with a summary of the current Liberian elementary education context within which future plans for the project are to be reviewed. Three major recommendations related to small-enrollment schools, integration of IEL and textbook-based systems, and the integration of the IEL system within the MOE are next discussed. Finally, a series of specific recommendations are provided.

4.1 The Liberian Elementary Education Context

Currently the Liberian elementary educational system incorporates 1700 schools, 250,000 students, and 9000 teachers. This is a dramatic quantitative expansion from the situation just a decade ago. However, there has not been a corresponding qualitative improvement of the elementary educational system. Various surveys and studies have identified these recurrent problems with Liberian elementary education:

- o Less than two-thirds of six-year-olds enter first grade.
- o Only one-third of those who enter first grade complete the sixth grade.
- o It requires an average of 10.6 years of schooling for each graduate of a public sixth grade class.
- o The enrollment rate for girls is less than one-half that for boys.
- o The student-teacher ratio is 35:1.
- o Urban classrooms are overcrowded while rural classrooms do not have a sufficient number of children to be cost effective.
- o Less than 40% of schools have adequate furniture.
- o Less than 5% of the students have appropriate textbooks.
- o Less than 30% of the teachers are qualified.
- o The two teacher training institutions are poorly equipped and staffed.
- o Only a fraction of the required elementary school personnel are supplied by the Liberian teacher-training institutions.

In this broad context, the IEL Project has been in its Phase 1 for six years. At this time the project has a comprehensive instructional system with nearly 600 different types of printed materials and several specific activities for teachers and students. The system is now being utilized in its fully operational mode in more than 100 elementary schools in different counties. All external evaluations agree that the IEL instructional system is a cost-effective alternative for providing quality education to Liberian children. It appears that we are now in a position to seriously undertake a nation-wide implementation of the system under the second phase of the project.

Three potential problems, however, threaten to thwart our attempts at a broad dissemination of the IEL system:

1. The IEL system appears to be optimal for classrooms with large enrollments. Most rural Liberian elementary schools have classrooms with very few students. Suitable modifications have to be made to make the system cost-effective in these small-enrollment schools.

2. The IEL Project and the World Bank IV Project have been developing simultaneously in Liberia. These two projects have to be integrated to ensure that they do not operate in competition with each other.

3. A major weakness in the current implementation of the IEL system is the lack of effective supervision. The system should be integrated with the Ministry of Education administrative structure to ensure consistent supervision.

4.2 Three Major Recommendations

Recommendations related to these three problem areas are discussed below.

4.2.1 Accommodating Small-Enrollment Schools

In his various discussions of the relative cost-effectiveness of the IEL system, Windham has repeatedly stressed the fact that its present configuration is not the most cost-effective alternative for small enrollment rural schools. He claims that the IEL instructional system, if disseminated on the basis of relative efficiency, will be adapted primarily by the most urban counties and, within all counties, by the most urban schools. The danger is that the IEL system will become a component of elite education rather than serving its original purpose of providing greater educational opportunities for the poor rural student. Implementing IEL in small schools (which constitute the majority of the Liberian educational environment) is not cost effective, according to Windham.

Windham's arguments concentrate on the cost of materials. He recommends a program of redesign of materials and classroom management systems to help achieve the original purpose of the IEL Project.

Our first recommendation is to undertake such a redesign to accommodate low-enrollment rural Liberian classrooms. We believe such a redesign can be efficiently undertaken without a major revision of the instructional materials. Obviously, the current situation has to be carefully analyzed with recent data and the redesigned system should be field tested in representative schools. However, the technical advisors and the Liberian staff have attended to aspects of the economies of small schools; they have a variety of alternative approaches. The IEL instructional system itself has the necessary comprehensiveness to permit flexible configurations. The project staff has worked on alternative management systems in IEL implementation approaches to accommodate single

teacher classrooms and classrooms with low student enrollments. Hence they should be able to create a new configuration to meet cost-effectiveness requirements.

If we look at the total educational costs in Liberian elementary schools, materials costs are not as significant as teacher costs. The IEL instructional system, with its alternative assignments of teacher responsibilities to accommodate various enrollment patterns, can help keep teacher costs down and significantly reduce teacher preparation costs. These factors, combined with the fine-tuning of the instructional system to work within the realities of rural schools, can provide significant cost savings. The readjustment of the IEL instructional system should be a major priority in the next phase of the project.

4.2.2 Integration of IEL and Textbook-Based Systems

The IEL Project was implemented in Liberia almost concurrently with another project dealing with the same set of problems in Liberian elementary education: The World Bank IV Education Project. This project is actively distributing textbooks for the elementary schools (both public and private) throughout Liberia. Because it is felt that IEL could not immediately respond to the need for instructional materials across the entire elementary system, the textbook project has been a major focus of the Ministry of Education. MOE has invested considerable resources in the project and the textbooks are perceived to be a quick solution to a pressing problem. Since both the IEL Project and the textbook project are considered to be effective, it is difficult to choose between them. The IEL Project cannot afford to be funded as an experimental fringe while MOE focuses on the large scale implementation of a textbook based instructional system.

IEL Project staff and technical advisors have been aware of this problem for a long time. A number of collaborative problem solving meetings have taken place between the two projects, as indicated by a joint paper by Snyder and Richard on how best to accommodate the two systems.

Both systems have some advantages and disadvantages. The textbook-based system is more compatible with the habitual educational patterns in elementary schools in Liberia. It is also compatible with post-primary education in Liberia. A distribution system for textbooks has been successfully established. However, most textbooks do not cover the revised national curriculum. They are not as Liberian in their content as are the IEL instructional materials.

IEL modules have been systematically developed to match the Revised National Curriculum. They have been repeatedly tried out in schools and revised to produce reliable results. External reviewers and Ministry of Education's curriculum reviewers agree that the content is accurate, appropriate, and adequate. Instructional systems design experts have asserted that the IEL system represents the state-of-the-art technology. Community acceptance of the IEL system has been indicated by increased enrollments in IEL schools. Teachers have successfully used IEL materials

with remarkably little protest about the "programming" aspects of the material. However, many educators in Liberia resist programmed instruction as a basic curricular philosophy. This resistance from Liberian educators is likely to increase if the IEL system is perceived as the elementary education approach most favored by the Ministry of Education.

Our second major recommendation is to integrate the IEL instructional system with the textbook-based approach. The instructional rationale for this recommendation is that since textbooks are universally used beyond the sixth grade and since competencies related to learning from textbooks are essential elements of effective study skills, elementary school children should be exposed to this instructional approach. A financial rationale for this recommendation is that the most cost-effective combination of instructional materials should be used and the costs should be equitably distributed among parents, communities, schools, and the MOE.

Snyder and Richard suggest one model for integrating textbooks with IEL materials: They recommend that the highly structured IEL system should be implemented at the lower levels of elementary education, with decreasing use of programming as students move up the grade levels. This means that IEL would be emphasized in early grades, with textbooks becoming the dominant approach by the end of the elementary school. This suggests one policy for the accommodation of IEL modules and text materials. In addition, an appropriate procedure will be to conduct content validation of textbooks and modules and to identify which areas of the curriculum at which grade levels are most appropriately covered by textbooks. Based on this validation, we could provide a cost-effective distribution of the instructional responsibilities between textbooks and IEL modules.

In various discussions during 1984, the IEL Project staff and the technical advisors have suggested different approaches for integrating textbooks with IEL materials. These suggestions are briefly discussed below.

1. Conventional use of textbooks. In each grade, the teacher may shift from IEL modules to regular textbooks and use the latter in the conventional fashion. Appropriate units of the text may be identified and scheduled in order to ensure optimal mix of the two materials.

2. Texts as enrichment materials. Students may study the text as a reinforcing activity during class periods or at home. This strategy requires cross references from PT and PL modules to the lessons in the textbooks.

3. Integrating text with Programmed Teaching. PT lessons can be designed around specific pages of the text, using the format which is currently used with PT Reading Booklets. This will require some analysis and instructional design. However, judging from our experiences in the Bangladesh/IMPACT Project, resources required for this type of instructional design are only a fraction of those required for the preparation of a PT module from scratch.

4. Integrating text with Programmed Learning. Adjunct programmed modules can be designed around the content of the textbooks. This process requires an analysis of the content, and the preparation of sets of questions, correct-answer feedback, summary statements, and peer-group instructions. This type of instructional design can be undertaken rapidly and inexpensively, using the instructional designers from the IEL Project.

5. Transition modules. Near the end of sixth grade, a set of transitional activities can be used to shift the students from module-based instruction to text-based instruction. This transition will involve sixth-grade textbooks. At the end of these activities, the students should be prepared to learn effectively in a conventional Grade VII classroom with regular textbooks.

6. Texts as references. A complete set of textbooks can be included with each IEL package for each grade (along with an atlas and a dictionary). This set can be used by the teachers and the students as additional instructional resources.

A decision regarding the long-term role of IEL materials in Liberian elementary educational policies and plans have to be made vis-a-vis textbooks. Our recommendation is not to treat them as competing alternatives but to work out efficient solutions for cost-effective integration.

4.2.3 Integration of IEL Within MOE

More than three years of field testing the IEL system in Liberian elementary schools has identified a number of problems associated with the lack of supervision in Liberian elementary schools. On the basis of the field test results, we have improved the quality of instructional materials and of classroom management. We were able to remedy some of the problems associated with the supervision of the teachers by principals. However, there remain a significant number of problems associated with lack of supervision in Liberian elementary schools.

In the IEL school, supervision has been provided by the Implementation Unit through its Instructional Supervisors. This unit is responsible for five major tasks:

1. Initial training of classroom teachers before they implement IEL instructional system.
2. Initial training of school principals in the materials use and system concepts.
3. The training of CEO's and DEO's on the overall IEL system components.
4. Conducting a mid-year workshop that provides a wide range of retraining depending on the needs which were identified during classroom visits and observations in the first semester.

5. Systematic visits to schools and classrooms and supervisory feedback to principals and teachers on the basis of observations and interviews to maintain quality control of the implementation of the IEL system.

Problems related to teacher absenteeism and to schools not functioning for the MOE mandated number of days during the year have contributed to major inefficiencies in the implementation of the IEL instructional systems. These problems are only partially responsive to changes in the IEL instructional systems. We have attempted to make the system highly motivating, reinforcing to students and teachers through effective learning, and easy to use. However, such within-system improvements have to be supported by external supervision and administrative checks.

Our third major recommendation is that the functions and the roles of the Implementation Unit (and its Instructional Supervisors) be systematically integrated into existing (or newly-created) MOE administrative structures. This move requires the creation of policies and procedures to accommodate the IEL instructional system, the distribution of training and supervisory roles and functions to existing CEO's and DEO's, the hiring of centralized staff for carrying out additional functions arising from the implementation of the IEL system, and the training and supervision of all implementation personnel.

4.3 Some Specific Recommendations

The rest of the chapter contains a number of specific recommendations related to different aspects of the IEL Project. These recommendations have been collected through a content analysis of various IEL reports and documents and through interviews with various staff members and advisors.

4.3.1 Instructional Materials

Total package perception. Although various individual modules have been carefully developed, we had very little familiarity with the totality of the system. Large-scale implementation is yielding interesting data regarding the advantages and disadvantages of the use of the entire system. This information has to be evaluated and appropriate revisions have to be made.

Subject-matter integrity. IEL materials were developed by different writers for different grades. Initial work in harmonizing the terminology and the style has begun but not yet completed. There is a need to take a look at the continuum of the materials in each subject area (e.g., mathematics) to ensure a common set of terminology (e.g., numbers vs. numerals) and a common set of operations have been used throughout.

Toward independent learning. The IEL instructional procedure gradually develops independent learning competencies among the students. In the first grades using PT, for example, the students depended on the

teacher for pacing, information, questioning and feedback. In grades 3 and 4, many of these components were transferred to groups. In grades 5 and 6, these components were to be transferred to individual students. However, because the entire package was not available and because tight deadlines did not permit the design of new and appropriate strategies, we were not able to implement this pattern effectively.

Cross-curricular integration. Writers in different subject areas were not able to integrate their content in any meaningful fashion-- although attempts were made to provide science and social studies as the content for reading lessons.

Take-home materials. We have not satisfactorily solved the need for student-owned materials. With the total package available, we should be able to identify appropriate content for a take-home texts with excerpts from the modules.

Marking periods. Test administration schedules and procedures should be integrated with the requirements of various marking periods throughout the school year. A simple procedure for enabling teachers to produce progress reports based on existing test scores should be designed.

Content validity recheck. Although the content for the instructional materials are based on the Revised National Curriculum, the materials have undergone so many revision by so many different people that this may be a good time to recheck the content against the curriculum.

Scope and sequence. We do not have a comprehensive summary matrix of the scope and sequence for the modules. We are now in a position to produce various scope and sequence charts and continua of objectives to enable Liberian educators to review the materials rapidly.

Content updating. Social studies is a subject-matter area where the need for updating the content is obvious. Such updating is required in other subject areas to a lesser degree.

Cost considerations. Now that we have the total package, we are in a better position to design new and more cost effective formats. We finally have the data on the total number of pages, the average number of pages, and the number of illustrations. This should help us to take a more realistic look at the materials cost for the project and come up with a final set of recommendations.

4.3.2 Elementary School Children

Longitudinal data. We have information on students who have been in the IEL system for four years. Data from these learners will be very valuable in planning for long term and large scale dissemination of the IEL system.

First grade entrance. We need to provide a suitable orientation package or strategy to introduce children in first grade to the IEL system. Language difficulties are among the major problems for this particular group. We have used a special orientation package and a slower-than-usual progression through the first module as two alternative approaches to introducing the children to the IEL system. We need to identify some more alternative approaches and to pilot test them in order to come up with a suitable introductory experience or package.

Transition packages. For those schools in which IEL is introduced for the first time in any given year, students in all grades will be using the system for the first time. The assumptions made in developing the modules for a given grade may not be valid for students who have come through conventional classrooms. We have experimented with alternative approaches to this kind of transition. We need to identify more strategies and to pilot-test them before settling on a suitable strategy or a suitable package.

Out-of-school learners. One problem that the project can address is the high percentage of school-age children who are out of school. The core modules in the IEL package can be modified to make them usable by these learners.

Transition to conventional classrooms. The IEL Project has not attended to problems that are likely to arise when a sixth grade graduate reenters regular conventional classrooms in the seventh grade. We need to examine problems associated with such a transition for the learners and to prepare some introductory strategies and materials to ease this transition. We also need to determine when these transition strategies and materials should be used for maximum effectiveness.

Student absenteeism. We now have better student-absenteeism statistics. We still need to identify various causes of this absenteeism and to create approaches for reducing or eliminating these causes.

Tutoring. Although the Liberian educators at the Gbarnga Implementation Conference recommended exploration of peer tutoring as an implementation alternative, we have not integrated this strategy within the total IEL system in any systematic fashion. We need to identify factors related to the acceptability and effectiveness of peer tutoring activities. Now that we have the instructional materials for all six grades, we are in a position to experiment with and to integrate cross age tutoring as another strategy for increasing the effectiveness of the IEL system.

Homework. We need to collect some data on factors related to homework assignments for Liberian children. Although we have made a number of attempts at integrating homework as a part of the IEL system, we have not undertaken any systematic approach to this strategy. Homework assignments will play a very important role especially in the upper grades of Liberian elementary schools.

Number of PL booklets. Presently PL groups are made of three students each and the total number of PL modules are also limited to three. We need to collect more information on whether this small number of books is capable of satisfying the demands of larger groups.

PL groups. PL groups have just three students and this number is a reduction from the previous number of seven. It is our belief that such a small number reduces or eliminates some of the problems associated with long delays in taking turns. We need to collect more information to identify the optimum number of students in a PL group.

4.3.3 Elementary School Teachers

Teacher absenteeism. This problem is a major one in completing the modules for a given school year. We need to collect more information on causes of teacher absenteeism and to identify methods of reducing or eliminating these causes.

Alternative strategies. We need to explore with the elementary school teachers alternative approaches to provide instruction to the learners when the teacher is unavoidably absent. Peer tutoring, cross-age tutoring, one teacher substituting for another, and the principal combining the absent teacher's class with another class are some of the options which can be implemented. We need to pilot test these alternative approaches and to identify the best approach.

Modifications on teacher performance requirements. We are accumulating reports from teachers and Instructional Supervisors regarding the activities required of the teacher in implementing the IEL system. There are a few complaints from the teachers on tasks given to them. We need to examine these teacher complaints and modify the instructional system to better suit the preferences and the competencies of the teachers.

Reallocation of teacher responsibilities. The complete IEL system calls for redistribution of teacher responsibilities in such a way that the instructional load is equitably distributed. For example, teachers shift from upper grades of the elementary school to the lower grades in order to undertake both programmed teaching and programmed learning responsibilities. This kind of arrangement has not been tried out in the system schools primarily because sixth grade materials were not available earlier. We need to collect information on the feasibility of this approach and to identify problems associated with its implementation. Based on the information we can revise the system to ensure effective teacher performances.

PT procedural modifications. Experienced teachers in the IEL schools appear to have come up with various short cuts in handling the PT classrooms. Some of these modifications work against the effective implementation of the materials. However, some other local modifications appear to have increased the efficiency of our materials. The IEL project staff can identify the local variations and build upon successful improvisations.

Remedial instruction. Although a class period is set aside for remedial instruction for slower children or for those who have been absent, these strategies do not appear to be implemented consistently and

reliably. We need to explore teacher needs and preferences in this area and to provide appropriate tools, strategies, and incentives to ensure remediation is implemented.

Subject area competency. Many teachers appear to lack the basic competencies and concepts in the subject areas they teach. Although the IEL modules are designed in such a way that teacher content expertise is not a critical requirement, teacher competency testing data indicates a wide variety of deficiencies. We need to explore the relationship between competency levels and teacher effectiveness in the classroom. If necessary, we need to include basic subject matter area skills in preservice teacher training activities.

Preservice teacher training. Most of IEL teacher training activities as carried out by the Implementation Unit has been with inservice teachers. For future implementation of the project, we need to integrate competencies related to the implementation of the IEL materials with basic teacher training in KRTTI or ZTTI.

Inservice teacher training through radio programs. There is a need to integrate some aspects of the rural radio network project and the IEL Project. Inservice teacher training and appropriate review of IEL skills can be implemented in the near future through radio broadcasts.

Integration of radio lessons. The IEL Project should explore combining some of the activities of the rural broadcasting network with their activities. Some PT lessons (especially in language and reading for the first three grades) can be broadcast through the radio. Appropriate strategies can be incorporated in the system to effectively use such broadcast lessons.

4.3.4 Elementary Classrooms

Physical facilities. Programmed teaching and programmed learning activities require physical facilities which are somewhat different from those found in conventional classrooms. We need to attend to the provision of large size classrooms for programmed teaching and smaller areas for small groups of learners who can practice and review the materials under teacher supervision and similar areas for PL peer groups.

Supplies and materials. A basic assumption in the IEL system has been the availability of typical materials and supplies in schools and in classrooms. For example, we assume that pieces of chalk and copybooks are available. Some data indicate that these assumptions could be incorrect and that we need to provide more materials and equipment to the classrooms.

Materials distribution. The IEL system is heavily dependent upon a variety of instructional materials. We have a standard procedure for collecting, classifying, organizing, and shipping the materials. We need to collect information on how these materials are handled in the classrooms and schools. Based on this information, we need to work out

the most effective and practical way for storing, distributing, and collecting materials.

Daily classroom schedules. We currently suggest IEL classroom schedules for every day. There seems to be some variations in implementing such a schedule. Some schools do not find it convenient to adopt the IEL schedule. It is also doubtful whether such a schedule can be maintained without constant supervision. We need to fine-tune the daily schedule and make it more practical and usable.

Annual school calendar. We provide an appropriate school calendar based on the assumption that most of the required school days are in effect. However, observational data indicate that as much as 50% of school days are lost. We need to collect data on various causes for such loss of school days and work out strategies for reducing or eliminating these causes.

Covering the curriculum. We need a variety of approaches to ensure that the core curriculum for each grade in each subject area is covered. We have currently classified PL modules into core modules and supplementary modules. We need to gather data to see how the core modules are covered and how much of the other modules are used. We may need to make further modifications in the number of modules identified as the core modules.

The role of the principal. We need to clearly define the role of the principal in different types of IEL schools. The principal has various administrative, supervisory, and training responsibilities. The principal also has to be trained in order to function as an effective implementer of the IEL system. We need to work out realistic details of what responsibilities the principal can handle in different types of IEL schools.

Community relations. At present there is enthusiastic acceptance of the IEL system in those communities where it is being implemented. Most parents appear to be very positive toward the use of the IEL instructional system. We need to design strategies for channeling parental enthusiasm and energy to support the principals and teachers in IEL schools.