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PROGRESS REPORT
to the
AGENCY FOR INTERNATIONAL DEVELOPMENT
on the
AFRICAN MATHEMATICS PROGRAM
June 30 to December 31, 1964
under
AID Contract RES-21

A.I.D.
Reference Center
Room 1656 NS

Educational Services Incorporated

Watertown, Massachusetts 02172

January 31, 1965

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PROGRESS REPORT

The following is a progress report to the Agency for International Development on the African Mathematics Program of Educational Services Incorporated for the period June 30 to December 31, 1964. Activities during the period under AID Contract RES-21 included (1) conducting an eight week Workshop at Entebbe, Uganda, (2) organizing courses in Ghana, Nigeria and Tanzania for tutors and teachers and planning additional courses to be held in Liberia, Malawi, and Nigeria, (3) arranging for the publication of the manuscripts written at the 1964 Workshop and for the distribution of the Entebbe Mathematics Series to African schools using the material on an experimental basis, (4) preparing a final draft of a Syllabus on modern mathematics for submission to the West African Examinations Council and Cambridge Examinations Syndicate, (5) preparing a plan and timetable for the achievement of the short and long range objectives of the program.

The 1964 Entebbe Mathematics Workshop

The 1964 Entebbe Mathematics Workshop was held at the Lake Victoria Hotel, Entebbe, Uganda from July 5 to August 15. Participants were University mathematicians and secondary and primary school teachers of mathematics and teacher trainers from African, the United Kingdom and the United States. As in past years, the participants were divided into four writing groups: Primary, Secondary, Teacher Training, and Testing and Problem Writing. By the close of the Workshop, the third year of a primary course and the third year of a secondary course in modern mathematics had been prepared. In addition, another two volumes of teacher training materials were written. The objective test for Secondary One was revised and a test for Secondary

Two was also drafted. A joint subcommittee of the Secondary and Testing Writing Groups prepared a draft syllabus for submission to the appropriate examinations councils. Tentative planning was also begun for two All-Africa Institutes, each to be held for a four-week period during the summers of 1965 and 1966 in order to train a small core of people in each participating country who in turn can undertake the training and retraining of tutors and teachers of mathematics. A detailed report of the Workshop, Appendix A, is attached.

Courses in Ghana, Nigeria and Tanzania for Tutors and Teachers

An earlier report to AID, March 4, 1964, entitled Report of Tutor and Teacher Training Courses in Tropical Africa, December 1963 to February 1964 described eight courses for an equal number of countries conducted by E.S.I. under its contract with AID. Following these eight courses, requests were received from each country for follow-up courses. During the period covered by this report, the following such courses were held:

Ghana

Site: University of Ghana, Legon, Accra

Directors: Mr. B. A. Brown, Principal Secretary, Ministry of Education, Accra

Mr. D. A. Brown, Chief Education Officer, Ministry of Education, Accra

Mr. A. F. Kitcher, Education Officer, Ministry of Education, Accra

Lecturers: Professor Shirley Hill, University of Missouri, Kansas City, Missouri

Professor Paul Johnson, University of California, Los Angeles, California

Participants: Forty-six Primary Two mathematics teachers and head teacher

Dates: August 30 - September 11, 1964

Nigeria

Site: University of Ibadan, Ibadan

Directors: Professor Kathleen Collard, Chairman, Department of Mathematics, University of Ibadan, Ibadan

Mr. John O. Oyelese, University of Ibadan, Ibadan

Lecturers: Professor Vincent Haag, Franklin and Marshall College, Lancaster, Pennsylvania

Professor Kathleen Collard

Mr. Robert Offurum, King's College, Lagos

Demonstrators: Dr. Mary Alice McAlpin, Great Neck Public Schools, Great Neck, New York

Miss Lyn McLane, Weston Public Schools, Weston, Commecticut

Participants: Eighty-three Primary teachers, tutors and Ministry officials from the Federal Region, Western, Mid-western and Northern Nigeria.

Dates: August 23 - September 10, 1964

Tanganyika

Site: Kivukoni College, Dar es Salaam

Organizers: Mr. J. Ezekiel, Ministry of Education, Dar es Salaam

Mr. Hermann Sangiwa, Ministry of Education, Dar es Salaam

Lecturers: Professor Roy Dubisch, University of Washington, Seattle, Washington

Mr. Michael Kinunda, School Mathematics Unit, Ministry of Education, Dar es Salaam

Father C. Van Uden, Training College, Morogoro

Demonstrator: Mrs. Francile Marsh, Richland Public Schools, Richland, Washington

Participants: Fifty tutors from Kenya, Tanganyika, Zambia and Zanzibar

Arrangements were also completed for the holding of follow-up courses in Liberia and Eastern Nigeria during January/February 1965. In addition, a first course for Malawi and Zambia jointly was scheduled to be conducted in Blantyre during January.

Requests for additional courses for tutors and for teachers have been received from Sierra Leone, Eastern and Western Nigeria, Tanzania, Uganda and Zambia.

Publication and Distribution of the Entebbe Mathematics Series

Although the Workshop officially ended August 15, a small number of participants remained until August 29 to prepare the manuscripts for publication. Prior to the 1964 Workshop, negotiations were carried on with some eleven United States educational textbook publishers to assume responsibility for publishing and printing the Entebbe Mathematics Series. The most favorable bid was received from the Silver-Burdett Company of Morristown, New Jersey, the educational publishing subsidiary of Time, Inc. By the end of the report period Silver Burdett had published and printed the second volume of Basic Concepts of Mathematics and was well along in the preparation for publication of the third volume of Basic Concepts, and the third year of a primary text and of a secondary text in modern mathematics. It is expected that the publication of the 1964 manuscripts will have been completed by the end of February and that these materials will be distributed to schools using them experimentally during March. During the 1964-65 African school year more than four hundred classes will be

using the Entebbe Mathematics Series on an experimental basis.

Syllabus on Modern Mathematics for West African Examination Council and Cambrid Examination Syndicate

Since the beginning of the African Mathematics Program the initiators have been aware that to achieve widespread use of these modern mathematics texts the appropriate authorities (The West African Examinations Council in West Africa and the Cambridge University Examination Syndicate for East Africa) would have to agree to offer examinations covering them. Therefore, since the first Workshop in 1962, there has been a Testing Writing Group which included representatives of the West African Examinations Council (and in 1964 of the Cambridge Examinations Syndicate) as well as U.S. participants active in the work of Educational Testing Service of Princeton.

This Testing Group has prepared examination materials for Secondary One and Two. Moreover, candidates scores on the traditional tests and on the Entebbe Secondary One test have been correlated. Concurrently, Africans have been trained to write objective-type, machine-scoreable tests.

On completion of the Secondary Two texts it became clear that it would be difficult to secure African secondary schools willing to try the material experimentally unless there was assurance that the examining bodies would offer a test covering the new concepts at the end of Secondary Five, i.e., an O-Level Syllabus. Prior to, during and following the 1964 Workshop, the Program devoted considerable time to this problem. During the 1964 Workshop a joint subcommittee of the Testing and Secondary Writing Groups prepared a draft syllabus. Between the end of the Workshop and the period covered by this report, the draft was again circulated and revised. During January, 1965 a final suggested

syllabus was forwarded to both examining authorities with appropriate additions covering material. Copies have also been sent to the Chief Education Officers of the AID missions in the participating countries, to the Permanent Secretaries of the Ministries of Education and to participants in all former Workshops.

A detailed background paper on this work is attached as Appendix B.

Plan and Timetable for the Achievement of the Objectives of the Program

Two meetings of the Steering Committee to discuss the short and long range plans of the program have been held in the United States since the close of the 1964 Workshop.

It has always been an objective of the program to develop African leadership for mathematics curriculum reform efforts. Therefore, it seemed appropriate to begin to add Africans to the Steering Committee. In addition, it was felt desirable to add a few more Americans who have played a vital role in this work. Therefore, the following have been invited to join the Steering Committee and have confirmed their desire to do so:

Mr. D. K. Abbiw-Jackson, Kwame Nkrumah University of Science and Tech., Kumasi, Ghana

Dr. Iya Abubakar, Ahmadu Bello University, Zaria, Northern Nigeria

Mr. Christopher Modu, West African Examinations Council, Accra, Ghana

Mr. Paul E. Mugambi, Makerere University College, Kampala, Uganda

Mr. John O. Oyelese, University of Ibadan, Ibadan, Western Nigeria

Mr. J. E. Rhythian, Makerere University College, Kampala, Uganda

Professor Alfred L. Putnam, University of Chicago, Chicago, Illinois

Professor Donald E. Richmond, Williams College, Williamstown, Massachusetts

Dr. Onyerisara Ukeje, University of Nigeria, Nsukka, Eastern Nigeria

Dr. Awadagin Williams, Fourah Bay College, Freetown, Sierra Leone

(Mr. Stephen White resigned from the Steering Committee and was replaced by Mr. James L. Aldrich.)

It was the feeling of the Steering Committee that at this point in the program it was necessary to select an Executive Committee of United States and African participants who could meet at least once between Workshops and also serve as the Planning Committee for the Workshops. At the first meeting of the Steering Committee during the Fall, an Executive Committee was selected to consist of:

Chairman, Professor Ted Martin, Massachusetts Institute of Technology, Cambridge, Massachusetts

Professor Robert P. Dilworth, California Institute of Technology, Pasadena, California

Mr. John O. Oyelese, University of Ibadan, Ibadan, Western Nigeria

Professor Walter Prenowitz, Brooklyn College, Brooklyn, New York

Dr. Onyerisara Ukeje, University of Nigeria, Nsukka, Eastern Nigeria

Dr. Awadagin Williams, Fourah Bay College, Freetwon, Sierra Leone

It is planned to hold a meeting of the Executive Committee at Kano, Northern Nigeria, February 26 and February 27, immediately following the African Science Meeting in order to plan the 1965 Workshop and to discuss the long range objectives of the program which were tentatively agreed upon by the United States members of the Steering Committee.

The Steering Committee and E.S.I. for some time have felt it would be appropriate to come to some agreement on a timetable for achievement of the long range objectives of the program. It seemed particularly important to consider when and how the research and evaluation aspect of the program would

terminate. Equally important is consideration of how wide-spread training and retraining of mathematics teachers and tutors can be achieved.

At the more recent Steering Committee meeting a detailed, if necessarily tentative, timetable was presented for each of the activities which together constitute the total program; namely, 1) the preparation of primary, secondary, teacher training and evaluation material at summer Workshops, 2) the holding of courses in each participating country to train teachers and tutors to use successive grade levels of the material experimentally and 3) the organizing of All-Africa Institutes to train those who in time would assume the task of training and retraining the mass of African teachers. A timetable was also agreed to for the general release of materials to the African educational public. While these plans and timetables are a part of the proposal for support for the program from July 1, 1965 to June 30, 1967 which was presented to AID this month, they are also reproduced as Appendices C, D and E of this report.

This report would be incomplete if we did not express our indebtedness to the REPAS office of AID/W and the Chief Education Advisers of the AID missions in the participating countries for their cooperation.

Educational Services Incorporated
108 Water Street
Watertown, Massachusetts 02172
January 31, 1965

FINAL REPORT

THE 1964 ENTEBBE MATHEMATICS WORKSHOP

The Third Entebbe Mathematics Workshop convened for its first plenary session at the Lake Victoria Hotel Monday, July 6. Professor W. T. Martin, Chairman, Mathematics Department, M. I. T., presided at the opening session. Chairmanship of this year's workshop was shared for the first four weeks by Professor Martin and Mr. John Oyelese, Mathematics Department, University of Ibadan, Nigeria. During the remainder of the conference Mr. Oyelese shared the chairmanship with Professor Donald Richmond, Mathematics Department, Williams College.

The organization of this year's workshop differed somewhat from that of the past two years. Approximately two thirds of the participants were at the workshop for a six week period (July 5th to August 15th). The bulk of the writing was completed during that period. About twenty participants remained in Entebbe until August 29th to refine the manuscripts produced by the writing groups. This arrangement made it possible to cut down on editorial problems and produce finished copy for publication somewhat sooner than in the past.

The workshop had four writing groups: 1) Primary, 2) Teacher Training, 3) Secondary, and 4) Testing. These writing groups worked individually, but there were ten or twelve participants who served in two or more of these groups and provided liaison among them.

Primary

The Primary Group completed the third year text and associated teachers' guide. Revision of Primary II was considered but postponed because it had not yet had sufficient trial and therefore, feedback was lacking. There are, however, some minor changes which would be incorporated in any reprinting of Primary I and Primary II. Some revision work on the Handbook for Primary Teachers was also being carried out.

The ever-present problem of evaluation was also an important consideration of this writing group. Consequently Professor Hardgrove

visited numerous experimental classes in East and Central Africa during the spring. She talked with teachers and ministry people about the suitability and effectiveness of the primary materials. Her report Evaluation of The Materials for Primary Schools is attached (Appendix I)

Demonstration classes were held in the Lake Victoria-Mugwanya Road Primary School.

Teacher Training

The work of this group has directed toward the writing of textual materials to be used in the training of primary school teachers. Substantial progress was made last year on the foundations of arithmetic. This material was tested in experimental teacher training institutes held in Tropical Africa during the winter. The results of these institutes were highly encouraging. The book was found to be useful both for institutes and as a text for training colleges. There is no existing text which fills the needs of the latter. Work on the arithmetic section was finished this year; A companion unit in geometry was also completed by the end of the workshop. The geometry section will provide teacher training materials basic to the teaching of the primary geometry.

Testing

The testing group revised tests for the Secondary I materials and wrote new tests for Secondary II. Specimen questions for the School Certificate Examinations were also written. Later in the workshop this group worked on exercises for the teacher training text. Preliminary discussions were held with the primary writing group concerning a possible testing program for the first three years of primary.

Direct contact with the Cambridge Examinations Syndicate was established. Mr. Donald Garbutt, a member of the Cambridge group, was a participant at this year's workshop. His presence in the testing group, together with that of Mr. Modu of the West African Examinations Council, was an important step toward bringing the Entebbe secondary materials into the existing system of examinations in Tropical Africa. A draft of a syllabus was completed and definite plans were made to submit it to the two examination groups for approval.

A report of the Chairman of the Testing Writing Group is attached. (Appendix 2).

Secondary

The Secondary writing group was the largest at the workshop. A large sub-group worked on geometry. Various alternative approaches for geometry had been under consideration since the 1963 Workshop. The secondary group reached full agreement on the content and method of approach for geometry which it felt combined the best of the existing reform programs. The group wrote Secondary III and planned in some detail the future writing of Secondary IV and V.

A report by the Chairman of the Secondary Writing Group is attached (Appendix 3).

By the end of the workshop there had been a total of 58 participants and observers in attendance. Appendix 4 contains their names and affiliation. A staff of eight provided administrative and secretarial support for the workshop.

January 31, 1965

APPENDIX I

EVALUATIONS OF THE MATERIALS FOR PRIMARY SCHOOLS

Material Produced:

.Primary One: Pupils' Text and Teachers' Guide, Revised Preliminary Edition

.Primary Two: Pupils' Text and Teachers' Guide, Preliminary Edition

.Primary Three: Pupils' Text and Teachers' Guide, Preliminary Edition

.Mathematics Teachers' Handbook for Primary I-III Teachers

.Syllabus for Primary I-VI

The Entebbe mathematics material for primary schools is written to accomplish these purposes:

(1) to introduce a program which includes the best mathematics which (African) children should and can learn.

(2) to suggest methods of teaching and learning which make mathematics meaningful and which challenge and interest children; to try to create an atmosphere in which children learn as a result of their own experiences and thinking.

(3) to help teachers learn the basic concepts of mathematics.

Writing group.

The writing committee is composed of primary teachers, teachers of teachers and university mathematicians. Among the group are people who are authors of modern programs of mathematics, and people who have a knowledge of African children, of African education and of Africa itself.

How the material is prepared.

The program produced for a primary class is the result of the work of the total writing groups. The plans for the program are made in group meetings where each item of the outline is thoroughly discussed in terms of:

A. (1) the mathematics involved,

(2) whether the mathematical idea can and should be learned,

(3) the place of the idea in an evolving program, and

(4) how the idea can be developed with children.

First drafts of the units are written by a sub-group. The total group then reads the drafts and writes critiques for consideration of the sub-group. The unit is then discussed in an open group meeting. As a result of the critical reading and of the discussion the units are re-written and again presented to the entire group for consideration. Most units are then accepted with minor alterations. A few units are again re-written. All the units of the program are given a final editing by a small group consisting of at least one mathematician.

At each stage in the development of the program the unity of the entire mathematicis primary program and of the program for particular classes is considered. Also considered are the pupils for whom the program is written and the mathematical ideas being developed.

At each annual workshop a pupils' textbook and a teachers' guide for a primary class is written. In addition to the textbook constant attention is given to a developing syllabus for the entire program. A syllabus for Primary I-VI was prepared for printing and published in 1963. The syllabus was revised in 1964.

Evaluation:

Testing program

No formal evaluation scheme which produces a quantative result is used because no instrument exists which tests the attainment of the objectives of a modern mathematics program for Primary One and Two in terms of depth of understanding. Several have been written by other groups. However, these instruments have not been sufficently developed or tested to enable the drawing of significant conclusions.

The writing group is planning a testing program for Primary Three classes. A test will be prepared in the 1965 workshop and use in a few classes that year, revised and used in Primary Three classes in 1966. This program of evaluation may have to be delayed one year in order to have the number of pupils necessary for significant results.

Though no test scores can be reported other significant means of evaluation are used. They are listed below:

(1) Teacher judgments

The teacher of each experimental class submits a Unit Report for each unit taught. The reports ask for their best judgments regarding:

unit taught. The reports ask for their best judgments regarding:

Can the children learn the ideas?

What is their attitude toward the ideas in the books?

What are the difficulties you had in following the books?

What suggestions can you give for the improvement of the books?

The questions asked are those which obtain both general and specific information.

(2) Feedback from workshop members

The workshop members in their capacities as supervisors of teachers of the program report specific strong and weak points and offer suggestions for improvement. Members of the writing group confer with supervisors to get information for the improvement of the program.

(3) Classroom visits

Members of the writing team have visited selected classes to observe the attitude of the children and teacher toward the program, to note the way in which the teacher used the suggested activities, to make some judgment about how the children think about mathematics, and to interview the teachers regarding strengths and weaknesses of the program and ways of improving it.

(4) Special teacher judgments

Selected activities were taught by special teachers and observation made to decide if the material can be taught as suggested. The results were reported to the writing group.

(5) Leaders of courses for tutors and teachers

Members of the workshop have conducted eleven courses during the past year or acted as discussion leaders in these courses. The courses were attended by persons from ten African countries. They have given feedback information to the writing group obtained during discussion by the members of the course after they made a study of the material.

(6) Critique of mathematician

A university mathematician who was not a member of the writing team read critically the revision of the Primary I Pupils' Text and Teachers' Guide and the Primary I-III Teachers' Handbook before their publication. This plan will be followed in the revision of other texts and if possible with all other material.

(7) Syllabi

Persons responsible for the writing or revision of the syllabi in various African countries have requested and are studying the syllabus written for Primary One-Six. In the countries where there has been a revision the reports are that the Entebbe syllabus has influenced the written.

(8) Requests for use

The increased requests for books is one means of evaluation. Persons in the countries of Africa are studying the syllabus, reading the material and many have decided that they wish to use the material. In three countries the request is for a rather large number of books.

(9) Attitude toward school mathematics

The attitude in most of the eleven participating African countries has been significantly influenced by the materials produced by the workshops. This attitude has also been influenced by the results of the contacts between teachers, mathematicians, experts in school mathematicis, and ministry representatives made possible by the African Mathematicis Program. These changes in attitude have been in the direction of the goals listed on page 1 and have been reported by independent observers.

Clarence Hardgrove
Chairman of Primary Writing Group
of Entebbe Workshops

APPENDIX II

REPORT ON THE WORK OF THE TESTING GROUP

The group began its work by revising the four one-hour 40-item multiple-choice tests constructed during the 1963 workshop. These tests based on the Entebbe Secondary 1 textbooks had been administered to 262 pupils in Nigeria, Ghana, Sierra-Leone and Liberia who had used these texts. The revision of these tests was carried out in the light of the statistical analysis of the results* provided for the workshop by the West African Examinations Council. Three 40-item and one 21-item tests were reconstructed from the four tests. It is proposed that two of the three tests be used in future as standard evaluation instruments on the completion of Secondary 1 books in the schools using the Entebbe materials. The third 40-item test should be declassified and distributed to the schools for the use of the teachers in familiarizing their pupils with the nature of the questions in the two tests which will be given at the end of the Secondary 1 course. It is also proposed that the 21-item test containing more difficult questions be placed at the disposal of teachers for instructional or other purposes.

The major task of the Testing group was the construction of tests for use at the end of Secondary two course as was done in 1963 for the Secondary 1 textbooks. Four 40-item multiple

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*Vide an earlier report issued at the 1964 workshop on the Secondary one and two testing program (1963/4).

choice tests were again constructed and it is hoped that these tests would be printed and administered in the same manner as was the case with the 1963 tests. The distribution of the tests to schools which use the Entebbe materials and the analysis of the results could again be undertaken by the West African Examinations Council if satisfactory arrangements can be made for this work. Alternatively, the tests could be shipped our directly to the schools with instructions to return the test booklets and the answer sheets to the West African Examinations Council for analysis. No doubt, then ESI would collate and supply the Council with the addresses of schools to which the Secondary 1 and 2 tests should be forwarded if the latter is to distribute them.

Further objective items were written by the Testing group as cumulative review exercises at the end of each of the three volumes of Secondary two texts. The items could, however, be printed as supplements to the texts pending the revision or reprinting of the books which have already been produced. These cumulative review exercises comprise 71 items for Volume 1, 40 items for Volume 2 and 98 items for Volume 3 of the Secondary two books.

O-level Examination Syllabus and Specimen Questions

The Testing group gave considerable attention to the draft syllabus for an O-level examination proposed by the Secondary Writing Group, and after discussions with the latter agreed on a final draft syllabus to be recommended to such examining authorities as the Cambridge Local Examinations Syndicate and the West African Examinations Council for an O-level examination. As indicated in the proposed draft, the syllabus is subject to alternatives in the light of both the teaching and examining experience in the first few years of the use of the Entebbe Mathematics textbooks.

Specimen questions based on the Syllabus have also been proposed by the Testing group to reflect the standard and form of the question papers for an O-level examination. It is suggested that the Syllabus be forwarded to the West African Examinations Council and the Cambridge Local Examinations Syndicate on behalf of the schools which propose to present candidates for and O-level exam in 1967. It is recommended also that the specimen questions be submitted to the West African Examinations Council along with the syllabus

At the request of the Teacher Training group, the Testing group agreed to write a few exercises for the geometry section of the 1964 Basic Concepts. It was, unfortunately, not possible in the time available to meet this request as adequately as the Testing group would have liked to do; however a few questions were turned over to the former group for inclusion in their 1964 drafts.

August 20, 1964

C. Modu
Chairman, Testing Group

APPENDIX III

SECONDARY WRITING GROUP

The aims of the Secondary Writing Group, which were to write the Students' Text and Teachers' Guide for Secondary Three and to plan in some detail the material for Secondary Four and Five, have been fulfilled.

The material for Secondary Three has been written in two parts Algebra and Geometry, and the writing group hope that these two parts will be bound together in separate volumes. The reason for this is that in some schools different teachers may be teaching the material and they will find it useful to have the two separate books.

Appended to this report is the list of Chapter headings in Secondary Three and proposals for units which will consist of one or more chapters in Secondary Four and Five.

There was little difficulty in determining how the Algebra should be developed. The future of the Geometry Writing was much less certain, and one week at the beginning of the Workshop was spent exploring possibilities. When this had been done there was almost unanimous decision that the subject should be developed as it has been with a brief informal approach followed by a deductive development based on a suitable set of axioms.

During the first three weeks of the Workshop discussions between the Chairman of the Workshop, Professor Ted Martin, representatives of the Ministry of Education in Uganda and teachers in Schools, Colleges and Universities in East Africa lead to the decision that work should be started on the preparation of texts for a Four Year Secondary School Course following a Seven Year Primary School Course. Accordingly three members of the Secondary Writing Group began writing a text containing a single years work, made up of material from the Secondary One and Secondary Two texts which would not be covered in Primary School. It is anticipated that the East African Secondary Schools will follow a first year course using the text so prepared with a second year course using the Secondary Three Text.

Further to this work a syllabus for the O-level Examination was drawn up. It is hoped that E.S.I. will present this to the Cambridge Examinations Syndicate and to the West African Examinations Council on behalf of the Schools using Entebbe Material. The examining boards will wish to know in what year the first O-level examinations are to be held and a rough estimate

of the numbers of schools and candidates involved. Those two Examining Boards will have to refer the syllabus to their Advisory Panels and it is hoped that any questions raised by the panels will be referred back to E.S.I. While there is little difficulty in preparing the syllabus on the subject matter already written, there is an inevitable sketchiness on those topics not already written.

In presenting the syllabus, it is hoped that E.S.I. will stress the experimental nature of the material, which may well lead to changes in detail or stress in the syllabus without affecting the over-all structures.

Secondary Three		Chapter Headings
Algebra:	Unit 1.	Quadratic Equations and Inequalities
		Chapter 1. Linear Equations and Inequalities
		Chapter 2. Quadratic Equations and Inequalities
		Chapter 3. Factorization
		Chapter 4. Radicals
		Chapter 5. Completing the Square
		Chapter 6. Graphical Solution of Quadratic Equations and Inequalities
		Chapter 7. Systems Involving Quadratic Equations
	Unit 2.	Powers and Roots
		Chapter 8. Integral Exponents
		Chapter 9. Rational Exponents
		Chapter 10. Irrational Exponents
		Chapter 11. Logarithms
	Unit 3.	Functions
		Chapter 12. Functions
		Chapter 13. Polynomial Functions

Geometry:

Chapter 1.	Deductive Reasoning
Chapter 2.	An Introduction to Deductive Reasoning in Geometry
Chapter 3.	Our First Geometric Postulates
Chapter 4.	Filling Space with Points
Chapter 5.	Congruence, Inequalities and Measurement for Segments
Chapter 6.	Congruence, Inequalities and Measurement for Angles
Chapter 7.	Congruence of Triangles
Chapter 8.	Logic - The Rule of the Game of Proof
Chapter 9.	Exterior Angle Theorem and Inequalities in Triangles
Chapter 10.	Elementary Properties of Parallel Lines
Chapter 11.	The Parallel Postulate and Some Consequences
Chapter 12.	Transversals to Many Parallel Lines

Units In Secondary Four and Five

Algebra:

Secondary IV:	Unit 1.	Rational Functions
	Unit 2.	Exponential and Logarithmic Functions
	Unit 3.	Relations and Functions
	Unit 4.	Arithmetic and Geometric Progressions
Secondary V:	Unit 1.	Probability and Combinatorial Analysis
	Unit 2.	Trigonometry
	Unit 3.	Linear Algebra

Geometry:

Secondary IV:	Unit 1.	Area and Volume
	Unit 2.	Three Dimensional Geometry
	Unit 3.	Similar Triangles
Secondary V:	Unit 1.	The Circle and the Sphere
	Unit 2.	Vectors
	Unit 3.	Introduction to Co-Ordinate Geometry of the plane.

Professor Kathleen Collard, Chairman
Department of Mathematics
University of Ibadan
Ibadan, Western Nigeria

APPENDIX IV

1964 ENTEBBE MATHEMATICS WORKSHOP PARTICIPANTS

July 5-August 15, 1964.

CO-CHAIRMEN:

Professor W.T. Martin, Chairman Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts
Mr. John O. Oyelese, University of Ibadan, Ibadan, Western Nigeria
Professor Donald E. Richmond, Williams College, Williamstown, Massachusetts

PRIMARY WRITING GROUP

Professor Clarence E. Hardgrove, Chairman, Northern Illinois University, De Kalb, Illinois
Miss Lucy Addy, Achimota School, Accra, Ghana
Mr. Muhamed Bashraheil, Bububu School Zanzibar, Tanzania
Mrs. Virginia Sherman-Boyd, Department of Education, Monrovia, Liberia
Professor Vincent Haag, Franklin and Marshall College, Lancaster, Pennsylvania
Professor Shirley Hill, University of Missouri, Kansas City, Missouri
Professor Paul B. Johnson, University of California, Los Angeles California
Mr. Hosea Kasule, Namutamba Teacher Training College, Kampala, Uganda
Professor Paul D. Merrick, Webster College, Webster Groves, Missouri
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THE ENTEBBE SYLLABUS AND THE O-LEVEL EXAMINATION

The O-level Examination

Under the system of education in effect in English speaking Africa, students are called upon to take what are called "Ordinary level," or "O-level" examinations in several subjects. These examinations usually take place at the end of either the student's fourth or fifth year of secondary school, depending on the curriculum in effect in his country. The examinations cover material which is basic to the subject.

Success in these examinations enables the student to continue his studies and, just as important, most employers consider the passing of a certain number of subjects at O-level as a prerequisite for many positions. Failure in several subjects at O-level not only ends the academic career of the student, but also places a relatively low ceiling on his potential income and drastically reduces the choices of occupation open to him.

The O-level examinations are governed in West Africa by the West African Examinations Council, and elsewhere by the University of Cambridge Examination Syndicate. These examining bodies take responsibility for all phases of the O-level examinations, from setting the questions to scoring the papers.

The Purposes of the Syllabus

The examining bodies have expressed a willingness to provide O-level examinations based on new and experimental programmes of

study, provided that these programmes are educationally sound and consistent with already existing programmes. Ordinarily, these bodies will decide at least two years in advance if they will provide an examination adapted to a particular course of study.

The Entebbe Mathematics Programme has been in operation since 1962. Textbooks for the first two years of secondary school mathematics are now being used, and a text for a third year has been prepared and should be in use early in 1965. There are at least 46 schools throughout Africa that have either used or expressed an intention to use at least some portion of this material.

A major drawback of the Entebbe Programme has been the lack of a guarantee to schools and students using this material that an O-level mathematics examination based on the Entebbe material will be set. Many schools using the Entebbe material have expressed the understandable concern that they may be jeopardizing their students chances to pass the presently constituted O-level examination in mathematics, as the use of the Entebbe materials takes class time away from the material now present on these examinations. In many cases, the classes using the Entebbe material treat it as supplementary to the more conventional material, which commands most of the class time. Such an arrangement is not what the authors of the Entebbe texts had in mind. It is the opinion of the author that the Entebbe material would be best used as the basic course of study. Thus it would seem that the Entebbe material would not receive widespread use as it was intended to be used

unless an alternative O-level examination were arranged.

According to present plans, it is possible that some students may complete the Entebbe course of study in 1967, although it is not likely that a very large number of students would complete study of the material before 1968. In any event, it seems imperative that the approval for an alternative examination be obtained from the examining bodies as soon as possible.

Ordinarily, the examining bodies will send to the schools a description of the courses of study approved for examination. If the Entebbe programme is approved, it is possible and even likely that the syllabus drafted by participants of the Workshop for the purpose of describing the programme to the examining bodies will be distributed to the schools as an official description of the programme. Thus the contents of such a syllabus would have some effect on the decision of a school whether or not to use the Entebbe material and, if the school should decide to use it, how it would be taught.

Finally, it should be pointed out that the examining bodies are the final judges of the propriety of such a syllabus, or any part thereof. A proposed syllabus is treated as "subject to negotiation." The examining bodies reserve the right to make all final decisions about the exact composition of the examinations.

It was with these considerations in mind that the Secondary Writing and the Testing Groups at the 1964 Entebbe Workshop prepared a syllabus outlining a five year course of study of Entebbe material.

A Description of the Syllabus

As it is not a simple matter to write a detailed description of a five year course of which only three years work had been written there was a certain amount of disagreement as to how to proceed. The basic problems concerned the degree of flexibility such a syllabus would allow the Secondary Writing Group at future Workshops in the writing of Secondary Four and Five, the classroom teacher in the choice of covering or not covering some of the more novel and/or more difficult material, and the examining boards in setting questions for an O-level examination. It was the consensus of those involved in the writing of the syllabus that the present form of the syllabus maximizes the flexibility of all three groups in a manner consistent with the aims of the Entebbe project.

The syllabus in its present form is an outline of the topics to be covered in the Entebbe secondary texts and required of the student on an O-level examination. It is hoped that the syllabus also conveys some of the flavor and approach to mathematics that the Entebbe participants hope to convey through the use of the Entebbe texts. Some topics are listed as optional, in the sense that these topics will make up but a small, and to some extent optional portion of the examination. However, the syllabus is designed to encourage the teacher to cover as much of the Entebbe material as the abilities of his students and time allow.

A collection of specimen questions has been included with the syllabus. It is hoped that these questions will illustrate the

intent of the writers of the material with regard to what is to be expected of the student.

An appendix to the syllabus lists the chapter headings for the Secondary Three text and also the proposed unit headings for Secondary Four and Five. This appendix is intended to add information about the spirit and content of those volumes which have not yet appeared in print.

It cannot be emphasized too strongly that the syllabus in its present form must be considered tentative, and that modifications may become necessary in the light of future developments.

Submitting the Syllabus

The syllabus is being submitted to both the Cambridge Syndicate and the West African Examinations Council by Educational Services Incorporated on behalf of the schools using the Entebbe material. Both of these examining bodies have expressed great interest in the Entebbe programme, and members of the staff of each have participated in Entebbe Workshops (Donald Garbutt of Cambridge, and Christopher Modu and E. B. Laryea of the West African Council). Both Mr. Garbutt and Mr. Modu have expressed personal unofficial opinions that and O-level examination in mathematics based on the Entebbe material should be provided.

Once the syllabus has been presented to the examining bodies, each of them will study the syllabus and perhaps the existing texts, and then will arrive at some conclusion about an arrangement for an alternative examination based on the Entebbe material. Once

this conclusion has been reached, the schools which may have an interest in the decision will be notified of the decision.

Professor Peter A. Lappan, Jr.
Department of Mathematics
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December 14, 1964

[illegible] Mathematics Program

Experimental Activities (1965-1971)

Year	Workshop Activities: Primary	Workshop Activities: Secondary	Workshop Activities: Teacher Training Texts	Workshop Activities: Evaluation Materials	Institutes: All Africa ABCD Courses	Institutes: Countries Regions	Supply of Materials Free of Charge
1965	Primary Four Pupil Books and Teachers Guides, and planning for Five and Six	Secondary Four Student Texts and Teachers' Guides	Teacher Training College Textbook Volume Four	Primary Three Evaluation; Secondary Three Evaluation	A. Tutors B. Admin. C. Univ. Lect.	8-14	Primary One, Two, Three Secondary One, Two, Three Teacher Training Text Volumes One, Two, Three Handbook, Primary One to Three Evaluation Tests: Secondary One and Two
1966	Primary Five Pupil Books and Teachers Guides. Handbook, Primary Four to Six	Secondary Five Student Texts and Teachers' Guides	Teacher Training College Textbook Volume Five	Primary Four Evaluation; Secondary Four Evaluation	A. Tutors B. Admin. C. Univ. Lect. D. Sec. Teach.	8-14	Primary Two, Three, Four Secondary One, Two, Three Four Teacher Training Text Volumes Two, Three, Four Handbook, Primary One to Three Evaluation Tests: Primary Three; Secondary One, Two, Three
1967	Primary Six Pupil Books and Teachers Guides	Revision Secondary One and Two Student Texts and Teachers' Guides	Phasing Out; Review of Books	Primary Five Evaluation; Secondary Five Evaluation	D. Sec. Teach.	8-14	Primary Three, Four, Five Secondary Two, Three, Four, Five Teacher Training Text Volumes Two, Three, Four, Five Handbook Primary One to Three, Four to Six Evaluation Tests: Primary Three, Four; Secondary, Two, Three, Four

Experimental Activities (1965-1971)

Year	Workshop Activities				Institutes		Supply of Materials Free of Charge
	Primary	Secondary	Teacher Training Texts	Evaluation Materials	All Africa ABCD Courses	Countries Regions	
1968	Phasing Out and Book of Suggestions	Phasing Out and Book of Suggestions		Primary Six Evaluation		8-14	Primary Four, Five, Six Secondary Three, Four, Five Teacher Training Text Volumes Three, Four, Five Handbook, Primary Four to Six Evaluation Tests: Primary Three, Four, Five; Secondary Three, Four Five
1969	General Evaluation Group. Goals for School Mathematics in Africa.						Primary Five, Six Secondary Four, Five Teacher Training Text Volumes Four, Five Handbook, Primary Four to Six Evaluation Tests; Primary Four, Five, Six; Secondary Four, Five
1970							Primary Six Secondary Five Teacher Training Text Volume Five Handbook, Primary Four to Six Evaluation Tests: Primary Five, Six; Secondary Five
1971	Small Evaluation Group (Mid-Year)						January 8, 1965

Appendix D

EDUCATIONAL SERVICES INCORPORATED

AFRICAN MATHEMATICS PROGRAM

MATERIAL PREPARATION AND DEVELOPMENT

PHASING OUT

(Book development from production, through experimentation, to general relea

		Year Produced	Period of Experimental Use	General Release
Primary Text and Teachers' Guides				
	Primary One	1962	1963-1965	1966
	Primary Two	1963	1964-1966	1967
	Primary Three	1964	1965-1967	1968
	Primary Four	1965	1966-1968	1969
	Primary Five	1966	1967-1969	1970
	Primary Six	1967	1968-1970	1971
Secondary Text and Teachers' Guides				
	Secondary One	1962	1963-1966	1967
	Secondary Two	1963	1964-1967	1968
	Secondary Three	1964	1965-1968	1969
	Secondary Four	1965	1966-1969	1970
	Secondary Five	1966	1967-1970	1971

	Year Produced	Period of Experimental Use	General Release
Training College Textbook			
Volume One	1963	1964-1966	1967
Volume Two and Three	1964	1965-1967	1968
Volume Four	1965	1966-1968	1969
Volume Five	1966	1967-1969	1970
Primary Teachers' Handbook			
Grades One to Three	1963	1964-1967	1968
Grades Four to Six	1966	1967-1969	1970

The years in the third column are the years when the materials in question will be considered to have been completed in terms of research and development. The relationship of E.S.I.'s Mathematics Program to these materials, after completion, has yet to be determined. Clearly the program will no longer be an R & D program; in all probability whatever functions remain will be transferred to an African institution.

It will be noted that release of secondary materials will in general be slower than release of primary materials. The pace of experimentation with the secondary materials has been slower.

1/8/65

Appendix E

Educational Services Incorporated

African Mathematics Program

Summary of Production of Materials and
Conclusion of Experimentation

Year	First Editions Completed	End of Experimentation with Editions of Materials
1962	4	-
1963	6	-
1964	6	-
1965	5	2
1966	6	5
1967	2	7
1968	-	5
1969	-	6
1970	-	4

(For each grade, the pupil texts and the teachers' guides are each considered to be separate editions.)

It may be seen that the writing-load is fairly evenly distributed over the years 1962-67. The peaks in completion of final editions indicate the special problems represented in the completion of the secondary texts and teachers' guides; the resolution of these problems will occupy much of the attention of the Program during 1967, and all the attention of the Program (so far as the preparation of materials is concerned) in 1968, 1969, and 1970.

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