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PROGRESS REPORT
to the
AGENCY FOR INTERNATIONAL DEVELOPMENT
on the
AFRICAN MATHEMATICS PROGRAM
July 1, 1965 to November 30, 1965
under
AID Contract RES-21, Amendment 3

Educational Services Incorporated

Watertown, Massachusetts 02172

December 30, 1965

TABLE OF CONTENTS

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 July 1, 1965 to November 30, 1965. The principal activities during the period under AID Contract RES-21, Amendment 3 consisted of 1) the holding of the 1965 Workshop to continue the preparation of mathematics texts for Tropical Africa, 2) conducting courses in Ghana and Sierra Leone to train teachers of trial classes and/or teacher trainers and ministry officials to use the Entebbe Mathematics Series and planning further courses for Liberia, Nigeria, Sierra Leone, Tanzania and Zambia, 3) arranging for publication of the manuscripts written at the 1965 Workshop, 4) submitting a revised syllabus to the West African Examinations Council and Cambridge Examinations Syndicate, and 5) intensive meetings during July and August of Professor Martin and Mr. Bradley with ministry, university and AID officials in eight of the ten participating African countries to discuss critical aspects of the African Education Program (see Appendix A).

The 1965 Workshop

Meeting at Mombasa, Kenya, this year, under the co-chairmanship of Prof. W.T. Martin and Mr. J.O. Oyelese, the African Mathematics Workshop was held at the Nyali Beach Hotel from July 5 to August 14, 1965. (A detailed report is contained in Appendix B.) A few participants remained for an extra two weeks as usual, to help to prepare the texts for publication.

Fifty mathematicians and teachers (see Appendix C) co-operated in the writing of Primary Four, Secondary Four and Basic Concepts Volume Four texts, and in the writing of tests for Primary and Secondary Three (see Appendix D and

Appendix E). The Primary tests are designed for children who have completed Entebbe experimental classes in Primary One, Two and Three. They are designed to determine the extent to which the children are mastering the appropriate concepts, evaluate the extent to which they are able to do mathematical thinking beyond routine arithmetic skills, and compare the mathematical knowledge and ability of these pupils with those in traditional mathematics classes.

Preparation was begun of the first year of a Secondary C text, designed for use in schools with a four-year secondary course. (The main Secondary texts are designed for a five-year course.)

A small group prepared a Report embodying suggestions for an ABC Institute in 1966 and 1967, which would bring together teacher training college personnel, Ministry of Education inspectors and administrators and university lecturers concerned with mathematics. The purpose of the Institute would be to train a body of people able to conduct mathematical institutes in 'modern' mathematics throughout the African countries participating in the Program. The Report of the Committee, whose work was supported by the Ford Foundation, was presented to the Foundation in early October. At the same time copies were sent to AID/W.

Extra-mural mathematical activities included visits to local schools, and the giving of two sets of lectures (one to Secondary school mathematics teachers and one for the general public). Experimental classes in Entebbe Primary work, held in two Mombasa schools, were found most instructive.

It is planned to hold the Mathematics Workshop in Mombasa again in 1966.

Courses for Ghana and Sierra Leone

Earlier reports to AID (March 4, 1964, January 31, 1965 and September 30, 1965) described fourteen courses held in the participating countries to train teachers and supervisors of experimental classes. Following these initial courses

requests were received for follow-up courses. However, because Amendment 3 was not signed until late June, 1965, the holding of courses during the summer of 1965 was inhibited. Nevertheless, it was possible to arrange two courses during the period covered by the report. As is customary, the Ministry of Education of the government concerned underwrote the transportation and incidental expenses of its nationals.

Ghana

Site:	University of Ghana, Legon, Accra, Ghana
Organizer:	Ministry of Education, Ghana
Lecturer:	Dr. Paul B. Johnson, University of California, Los Angeles, California
Tutorial Heads:	Mr. Theophilus Q. Armar, West Africa Secondary School, Accra
	Mr. A.K. Kitcher, Ministry of Education, Accra
	Mr. Jacob K. Okine, Accra Academy, Accra
Demonstrators:	Mrs. G.M. Lokko-Quenu, South Labadi Road Estate Primary School, Accra
	Mrs. S.A. Annan, Christiansborg Presbyterian Girls' Primary School, Accra
Participants:	Thirty-five Primary Three teachers and head teachers, and fifteen Primary One and Two teachers, a total of fifty.
Dates:	August 29 - September 11, 1965.

Sierra Leone

Site: Freetown Secondary School for Girls, Freetown.

Organizer: Ministry of Education, Freetown

Lecturer: *Dr. Mary Alice McAlpin, Elizabeth M. Baker School, Great Neck, New York

Asst.Lecturer: Mrs. Margaret H. Greene, Annie Walsh Memorial School, Freetown

Demonstrators: Mr. David Kamara, Secondary School, Kamakwie, via MaKeni

Mrs. Roberta Cole-Jones, Holy Trinity Infant School,Freetown

Miss Lovisa Johnson, Primary Teacher, Freetown

Participants: Thirty Primary teachers and head teachers

Dates: July 23 to August 19, 1965

Following signing of Amendment 3, planning began to meet the many requests on hand for such courses. E.S.I. has agreed to assist the following additional courses during the winter of 1965-66. In every case the Ministry of Education of the country concerned has agreed to contribute to the expenses of the course.

Liberia

January 3-28, 1966; Primary teachers and tutors at University of Liberia

January 3-February 17, 1966; Primary teachers. (A series of two-week vacation institutes at various centers.)

Nigeria (Western)

January 3-15, 1966; Inspectors, Headmasters and Primary teachers from the West, Midwest and Federal areas (to be conducted by Professor Donald Kreider, Dartmouth).

April 15-May 15, 1966; Secondary

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*All of Dr. McAlpin's expenses were underwritten by the Teach Corps of the Committee on International Relations of the National Education Association, Washington, D.C.

Sierra Leone

Around Easter, 1966; Primary teachers, tutors, and inspectors.

Tanzania

December 1-17, 1965; Primary inspectors and tutors.

January 2-15, 1966; Secondary teachers.

(To be conducted by Professor Paul Johnson, UCLA.)

Zambia

January 3-15, 1966; Primary and Secondary teachers.

(To be conducted by Professor B.J. Pettis, University of North Carolina.)

Publication and Distribution of the Entebbe Mathematics Series

During the period of this report it was necessary to devote considerable time to securing a new publisher for the Series and to gaining acceptance of his proposal by AID. After completing publication of the manuscripts written at the 1964 Workshop, Silver-Burdett indicated that it did not wish to publish the manuscripts which would be prepared at the 1965 Workshop. Thus began the long process. Bids were solicited from members of the textbook publishing industry in July. In September proposals were received from McGraw-Hill Co. and from Science Research Associates (SRA), a subsidiary of International Business Machines Co. However, these bids were unacceptable to AID. After several conferences AID agreed to accept the proposal of SRA to publish the Series on a cost-reimbursable basis. (McGraw-Hill withdrew its proposal when AID decided to require that the Series be placed in the public domain.) A subcontract between ESI and SRA is in preparation.

SRA began to work on 1965 manuscripts the day after its proposal was accepted. Nevertheless it will be most difficult, if not impossible, to meet the commitment of the program for printed texts because of the time required by a

publisher to secure the additional staff needed for such an undertaking. In any case as of this writing it is hoped that Secondary C One will be available partly in printed form and partly through a manuscript reproduction process for use in Nigeria, Tanzania, Uganda and Zambia in January, 1966.

More than three hundred inspection sets of the 1964 Workshop texts were distributed to interested officials during August, 1965.

Syllabus

Because of the change in the approach to geometry agreed on at the 1965 Workshop (see Appendix B), slight modifications were required in the syllabus which had been submitted earlier to the West African Examinations Council and Cambridge Examinations Syndicate. A revised syllabus was mailed to the two examining authorities and to the Ministries of Education concerned during this report period. The response received thus far has been most favorable.

In conclusion, ESI wishes to express its thanks to the REPAS office of AID/W, to the Contract Officers of AID/W responsible for RES-21 and to the educational advisers of the AID missions in the participating countries for their cooperation in this joint effort to improve mathematics education in Tropical Africa.

APPENDIX A.

Report of Visits made in Africa during July and August 1965 by Prof. W.T. Martin of M.I.T. and Mr. H.P. Bradley in connection with Educational Services Inc.'s African Education Program

Professor Martin, Chairman of E.S.I.'s African Mathematics Program Steering Committee, and Mr. Hugh P. Bradley, Director of the African Education Program, visited African countries to discuss:

a. The proposed All-Africa courses to train leading mathematics teacher training tutors from ten African countries.

b. The use of the Entebbe Mathematics materials and the secondary school program.

c. Country teacher training institutes.

d. Science centres.

The countries and regions visited were: Tanzania, Malawi, Zambia, Kenya, Uganda, Federal Nigeria, Northern Nigeria, Western Nigeria, Ghana and Liberia.

In each country an attempt was made to meet with representatives of Ministries, universities and A.I.D. When time was available and the opportunity occurred, visits were made to classrooms using Entebbe materials and to people who have had connections with the African Education Program.

Tanzania

Ministry Meetings: A meeting was held with the Chief Education Officer, the Chief Inspector of Schools and four Ministry officers concerned with teacher training, and the teaching of mathematics or science. It was also attended by Dr. J.E. Phythian, Head of the Mathematics Department of The University College, Dar-es-Salaam and a member of the African Mathematics Program Steering Committee.

a. The meeting agreed that the proposed All-Africa Teacher Training Course would satisfy an urgent need and it was agreed that Tanzania would send representatives.

b. The meeting re-affirmed Tanzania's desire to continue full experimentation of the Entebbe Primary materials and the intention to use modern mathematics in all schools. It was stated that the Ministry did not feel bound by the decisions of the Dar-es-Salaam Conference of December 1964 regarding syllabus and that if Entebbe materials suitable for a four-year course were available in January 1966, Tanzania would wish to experiment the new course.

c. Assistance was requested for an institute in September/October 1965.

d. It was the intention of the Ministry to cooperate with The University College, Dar es Salaam, in setting up a Science Centre. It was stated that the Ministry and University would welcome E.S.I.'s cooperation.

University Meetings: The meeting at the University was attended by Professor Honeybone, Head of the Department of Education and Director of the Faculty of Arts; Dr. J.E. Phythian, Head of the Department of Mathematics; Mr. Harris, Mr. M. Natamila, Lecturer in Chemistry, and other members of the Science Faculty.

Matters discussed included courses for the introduction of "modern" mathematics, the Science Workshop and the Tanzanian Science Centre. Professor Honeybone hoped that E.S.I. would be able to help his plan for building the centre and expressed a desire to use the Entebbe Science materials. Professor Honeybone planned to have his Science Centre undertake three tasks:

a. Supervision of science teachers in secondary schools.
b. Teaching training in science.
c. Elementary curriculum reform.

A.I.D.: At a later meeting the A.I.D. representative was informed of the outcome of these discussions and E.S.I.'s plans for the area.

Subsequent to these meetings Tanzania has requested that the September/October institute be delayed to December, and offered to house the 1966 Science Workshop in the University College, Dar es Salaam. The possibility of locating the Workshop at Dar es Salaam is being investigated.

Malawi

Ministry Meeting: At a meeting with the Permanent Secretary and the Acting Chief Inspector of Schools the following points were made:

a. Full cooperation with the All-Africa course was promised.
b. Continued and more extensive use of the mathematics materials was indicated.
c. Additional country mathematics institutes were discussed in general, but no definite dates were fixed.
d. The suggestion was made by the Permanent Secretary that a Science Centre should be located at Domasi Teacher Training College.

University Meeting: The University of Malawi is still in its very early infancy and has not yet moved into permanent buildings.

At a meeting with the Acting Vice-Chancellor and the Registrar, there was an assurance that the University concurred with the purposes of a Science Centre and would hope to cooperate. Until such time as the University could take a close interest, members of the Faculty would be encouraged to act as consultants when requested.

A.I.D.: The A.I.D. Education representative was informed of the outcome of the meeting.

Visits: Visits were made to two schools where classes were using the Entebbe mathematics materials. Grade 1 and 2 children were observed dealing with sets and using the number line in discussions on elementary operations.

Zambia

Ministry Meeting: Much time was spent with the Chief Inspector of Schools, the UNESCO mathematician attached to the Ministry, and the Inspector of Mathematics.

a. The C.I.S. recognized the value of the proposed All-Africa teacher training course and stated that Zambians would be selected to attend.
b. The C.I.S., a classicist, and a recent appointee from the Manchester Grammar School, England, was not fully conversant about Zambian affairs. After some discussion he recognized the value of experimentation with the mathematics materials. However he showed little enthusiasm for the experiments in mathematics.
c. The Unesco mathematician and the Inspector of Mathematics privately and in the meeting with the C.I.S. made clear their enthusiasm for 'modern' mathematics. Apparently they have managed to sway the C.I.S., since E.S.I. has received a request for an institute in December/January.
d. The C.I.S. was more enthusiastic about the possibility of curriculum research in science. He suggested possible sites for a science centre but felt that his knowledge was insufficient to make a decision.

University Meeting: There was an informal conversation with Mr. Clifford Little and Professor Karl Bigelow, chairman of the committee setting up the University of Zambia. Interest was shown in the Science program, but the University has not yet opened.

A.I.D.: Mr. David Alter was informed of the proposed content of the talks. He suggested that the Charles Lwanga College would be a good site for the Zambian science centre.

Visits: Five classes using Entebbe mathematics materials were visited.

Kenya

Ministry Meeting: Talks were held with the Minister, the Chief Education Officer and the Chief Inspector of Schools.

a. All three strongly supported the proposed All-Africa Institute.
b. There was a firm intention to continue experimenting with the Entebbe mathematics materials and the adaptation of these materials. At the Secondary level, there was a clear statement from the Minister and the

C.I.S. that the E.S.I. mathematics materials should be tried out in Kenya schools. The Secondary-C materials were to be made available.

c. There was no request or expression of need for a country institute.

d. There were discussions on duties of the E.S.I. innovator appointed to the Nairobi Science Centre. It was pointed out firmly that the innovator was not an additional teacher trainer to be given a training college teaching load, and that his main task was curriculum development through the Science Centre.

University Meeting: There were discussions with the Acting Vice-Chancellor and the Registrar.

Official permission has been granted to have the All-Africa Institute in the University College, Nairobi. Halls of residence were visited and found suitable. The Registrar requires to be notified as soon as possible what accommodations will be required. Classroom accommodation was also viewed and found very suitable for the courses.

A.I.D.: The AID Education Advisor was informed of the content of the talks with the Ministry and University.

Visits: A visit was paid to His Excellency the Ambassador of the U.S.A.

A discussion was held with the Acting Head of the Nairobi Science Centre, who had been at the Entebbe Science Workshop. He stated that he was in full sympathy with the philosophical purposes of the Science Program.

There were discussions with the Head of the Nairobi Mathematics Centre requesting information about the Kenya experiments with the Entebbe material. This information has still not been made available.

Uganda:

A visit was made to the Elementary Science Workshop at Entebbe and there were discussions with country groups regarding the development of the Science Program in the countries. All participants were very enthusiastic and anxious to continue with the work being initiated at Entebbe. However none was in a position to make any committments on behalf of his government.

Ministry Meeting: At meetings with the Chief Education Officer and the Chief Inspector of Schools, there were discussions on the choice of participants for Workshops. It was pointed out that the Mathematics Workshop is no longer considered as a training institute nor is it intended that there should be equal participation from all countries. Participants were invited on the basis that they could satisfy a need in one or other of the writing groups.

The Chief Inspector explained the difficulty in providing proper supervision of the 'new' mathematics program and indicated that he would welcome a direct expatriate appointment to undertake this task. Generally, on mathematics training, it seemed to be the opinion that there was sufficient local strength to run short institutes. Both the senior officials stated that they would be glad to send suitable people to the All-Africa Institute.

The work of the science program was discussed in general terms. It seems probable that the Uganda Science Centre will be part of the Institute of Education.

University: A visit was also paid to the Institute of Education. The Director, Mr. Senteza Kajubi, was not p esent. There was a long discussion with the Assistant Principal who described long-term plans for the full implementation of the Entebbe Mathematics in Uganda schools. These plans seemed too ambitious and in our opinion did not allow sufficient opportunity for the teachers -- or the tutors -- to understand and assimilate either the concepts of the 'modern' mathematics or the activity teaching methods recommended to teach it. The Assistant Principal was informed of our desire to cooperate and assist in the work of running institutes which will further the experimentation of the Entebbe Mathematics Series.

A.I.D.: At a later meeting Dr. E. Trethaway and His Excellency the U.S.A. Ambassador to Uganda were informed of the discussions and the more general aspects of the program in East Africa were described.

Federal Nigeria

Ministry Meeting: There was a meeting with the Senior Advisor for Secondary Education (Mr. Davis) and his Assistant (Miss M. Gentle), the Officer in Charge of Teacher Training (Mr. Etti) and Mr. R. Agiobu-Kemmer. A change of attitude about the use of the Entebbe materials seemed to have taken place and there were indications that Dr. G. Alele Williams' plans for institutes and for greater use of the materials would meet with some cooperation. Mr. Etti was enthusiastic about the teacher training plans.

Much interest was shown in the work of the Elementary Science Program. Mr. Etti and Mr. Agiobu-Kemmer by reason of their immediate responsibilities showed more signs of taking further action. There was no indication that a Science Centre would be opened in the immediate future.

University: A visit was paid to the Advanced Federal Teacher Training College for discussion with the Head of the Mathematics Department. The College works to train secondary teachers to teach 'modern' mathematics and is anxious that some classes should be doing 'modern' mathematics and be available for teaching

practice. Dr. Joseph Battle, a member of the staff, who visited Mombasa, is very enthusiastic and anxious to help in running institutes.

A.I.D.: There was a meeting with Mr. Samuel Fuhr and Dr. Jard. Both were very interested in the programs and expressed strongly their need to be kept informed and their desire to help.

Kaduna (Northern Nigeria)

Ministry Meeting: At a meeting with Mr. Mejabi, Acting Chief Inspector of Schools, Mr. Mohammed Muhtaru, and Mr. Dulong, Permanent Secretary for Education, some very real interest in the ABC program was expressed, with the Permanent Secretary requesting that the Ministry officials take appropriate action to ensure that Northern Nigeria be involved. Mr. Muhtaru and Dr. Iya Abubakar, a member of the African Math Program Steering Committee and of the Mathematics Department of the Ahmadu Bello University, Northern Nigeria, took part in later discussions with Mr. Shehu Bakari, Acting Deputy Senior Inspector for Primary Schools, who showed some resistance to the introduction of modern mathematics at primary level. (He himself had just published a primary school arithmetic book.) Dr. Abubakar and Mr. Muhtaru firmly urged the need for immediate action, stating that Northern Nigeria was already behind the rest of Africa in the introduction of 'modern' mathematics.

It was clear that any Northern Nigeria science centre would be located at the University of Zaria. Officials, while anxious to have a centre, were unwilling to discuss details in the absence of Dr. Joselin, Principal of the Institute of Education.

University Meeting: Professor Martin later had discussions with Dr. Joselin in London. Dr. Joselin has plans for a Science Centre which will undertake supervision of science teaching in Northern Nigeria. Further discussion will be necessary to find out the plans for elementary science curriculum reform work in this centre.

Teacher Education: There was also a meeting with some five mathematicians of the Wisconsin group presently working in Northern Nigeria Teacher Training Colleges. This group was considering how the Entebbe materials can be used in the existing Northern Nigerian T.T.C. curriculum. They were keen to introduce 'new' mathematics and intended to use Basic Concepts as a core book. They made firm offers to help in institutes to spread the experimentation with the Entebbe materials.

Western Nigeria

Ministry Meeting: A meeting in the Ministry was attended by Mr. A.M. Fagbulu, Dr. Tunde Yoloye, Mr. J.A.O. Sofolahan and Mr. J.O. Fatimehin. The proposed All-African course was welcomed as furthering the Ministry aim to become educationally independent as soon as possible. Mr. Fagbulu also indicated that he intended to

encourage a wider use of the Entebbe material and that he felt the Ministry's involvement (as opposed to the previous University initiative) should be greater. It seemed probable that there would be a country institute in Western Nigeria within the next three months.

There were also very clear indications that there will be a Science Centre in Western Nigeria within the next twelve months. Mr. Fagbulu seemed to feel that the Centre need not be attached to the University -- but rather be part of the Ministry's Curriculum Development Division. He also made the suggestion that the Ministry could appoint one of their Laboratory Assistants as Technician to the Centre.

University Meeting: Dr. Tunde Yoloye -- present at the meeting described above -- is a member of the Department of Education in the University. It was agreed that he should be the "contact" man with regard to science work and general E.S.I. matters in the University.

Ghana

Ministry and University: A meeting in the Ministry was attended by Dr. N.G. Bakhoom, Principal, University College of Science and Education, Cape Coast; Mr. D.A. Brown, Permanent Secretary Designate to the Ministry of Education; Mr. J. Mills, Chief Education Officer Designate to the Ministry of Education.

It was agreed that Ghana would send people to the All-Africa Mathematics Institute despite the rather special conditions existing in Ghana. There were further discussions of the country institute to be held later in the month and finally about the use of the secondary materials vis-a-vis the materials of the Ghana Mathematics Society. The Ministry officials stated that they have not given permission for the use of the Mathematics Society's materials and that there is an official decision to experiment with the Entebbe materials. Dr. Bakhoom, noting that all of the Society's writers were expatriate, suggested that a small committee be formed to evaluate both sets of the materials.

The meeting then discussed the plans for a Science Centre at Cape Coast College of Science and Education. It was thought that E.S.I. would be able to cooperate but there were difficulties in recruiting staff at short notice. In the meantime the College would proceed with its plans, with E.S.I.'s cooperation, and the Entebbe participant from Ghana would be associated with the College in trying out the Entebbe science materials.

Liberia

University and Ministry: A meeting was attended by Dean Willcox of the University Department of Education, Miss Theodora Ward of the University Department of Education, and Mr. Jefferson Lewis of the (Ministry) Department of Education.

The main topic of discussion was the Science Workshop and a Science Centre. Initially, the Dean and Miss Ward stated that they thought the Entebbe science materials could only be taught by secondary teachers and they proposed a course to introduce secondary teachers to the materials. After discussion it was agreed that primary teachers could be introduced to single units to try out on an experimental basis. It was then pointed out that the University finds it difficult to run courses for primary teachers as usually they do not have the basic qualification to attend credit-earning University courses. Further discussion of possible Department and University cooperation in organizing courses did not come to any final decision.

Later Miss Ward and Professor Martin met with Mr. H.M. Thompson of the USAID/Cornell University team at the University of Liberia and with the Director of the Cornell University team. Mr. Thompson and Professor Martin went on to meet Mr. John Norris, the Peace Corps Volunteer recently appointed to supervise the introduction of modern mathematics into Liberian schools.

H.P.B.
November 1965

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APPENDIX B.

The Mombasa Mathematics Workshop

Summer 1965

by D. K. Abbiw-Jackson

When a colleague at previous Entebbe Mathematics Workshops and I exchanged greetings at Yuletide, 1964 and he added the postscript: "Meet you in Mombasa....next summer...." I could not by any stretch of my imagination fathom out what the two of us would be doing in Mombasa at that time. But I was soon to be enlightened. A few weeks later came the invitation to participate in the 1965 Mathematics Workshop to be held at Nyali Beach Hotel, Mombasa. A second question immediately raised itself. Why was our venue no longer to be Entebbe's Lake Victoria Hotel, which some workshop veterans already considered their summer home? Was it just another reminder of the impermanence of the human condition?

This question was, for me, not answered until I arrived at The Nyali Beac Hotel on July 3, when I learned that a Science Workshop was being organized concurrently with the Mathematics one and that the former had taken over Lake Victoria Hotel. It must be a source of great satisfaction to all who have participated in any of the Mathematics Workshops, that the three years of our existence have so pleased our parents that, in spite of their birth pains and our teething troubles, they have decided to bear another child. We heartily welcome our younger sister and wish her a very fruitful and full life.

The 1965 Workshop followed the pattern of the previous year. The main workshop lasted six weeks, from July 5 to August 14. About a quarter of the participants then stayed on for another two weeks to mop up. There were a little over 50 participants altogether; just under half were Africans, about the same number Americans, and the rest was made up largely of expatriates working in Africa. There were also about ten on the Administrative and Secretarial Staff and a few observers.

The First Plenary Session

The Fourth Mathematics Workshop opened, like its predecessors, with a plenary session, held on the morning of July 5, 1965. We were privileged to have the session opened by the Provincial Commissioner for the Coast Province of Kenya, Mr. Mwai Mathenge. It is only appropriate to record here our gratitude to Mr. Mathenge for taking time off from his arduous duties to perform this function, and our appreciation of the sustained interest he took in both the mathematical and the other activities of the Workshop.

The opening session was co-chaired, as was the entire workshop, by Professor W. T. Martin and Mr. John Oyelese. As in previous years, the Chairmen of the four writing groups--Primary, Secondary, Teacher Training, and Testing--reviewed the progress of their respective groups, and spoke of their hopes and aspirations as well as outlined their plans for the summer. The meeting was then informed of the proposal to organize ABC Institutes during the summers of 1966 and 1967. The purpose of the Institutes would be to create in the participating countries a cadre of people trained in the "new" mathematics, who would help disseminate the new ideas in mathematical thinking and teaching methods. It was announced that a committee had been set up at the Workshop to advise on the structure of the Institutes and the possible on-going activities between the Institutes.

Further, Professor Ted Martin and Mr. Hugh Bradley would be visiting the various countries to discuss the project with Ministries of Education and other interested bodies.

Representatives from participating countries were then called upon to report on the use of the Entebbe texts in their countries during the past year. Without exception, the reports were most encouraging. The numbers of classes using the Primary texts had increased considerably, though continuity in some cases had been broken by the late or non-arrival of materials. Institutes had been requested and held in almost all the countries. These had been very successful and the lecturers had all reported themselves as very much impressed by the keen interest shown by those attending the courses. The Volumes of "Basic Concepts" were being used in an increasing number of Teacher Training Colleges and in one country in all the Training Colleges.

The question of issuing a Syllabus covering the Secondary texts and of an assurance that there would be an appropriate, recognized Examination at the conclusion of the course was still hindering a whole-hearted acceptance and use of these texts. Also, one or two other projects have appeared on the scene in some countries, and this made it all the more necessary that this problem should be cleared up soon. Perhaps I may be allowed to state a personal opinion here. There is no best curriculum for a School Mathematics Course to the exclusion of all others, and it is to be welcomed that our pioneering trail is being followed by others. This is recognition enough, if one were required, of the importance of the Entebbe Mathematics Project. It is too hoped, however, that the various experiments will all be allowed reasonable chance to prove themselves, and that the African countries will themselves make the choices and adaptations most suited to their differing circumstances.

The meeting was told of the African Elementary Science Programme. As already reported, the first Science Workshop was held during the summer. It is planned to open in the various countries science centres, which will devote effort to round-the-year development and adaptation of the materials produced at the first workshop, supervise the use of these materials in the schools, and make preparations for next workshop. The centres could also serve as focal points for organizing and supervising the distribution of the mathematics texts.

The Writing Groups

Primary. Chairman---Professor Clarence Hardgrove

The outline of the contents of Primary One through Six, prepared in previous years, was revised, in the light of recent curricular developments and also to take account of the trend towards a Seven Year Primary Course. A detailed outline in flow diagram form was prepared for the contents of Primary Four through Seven care being taken, of course, that this tied in neatly with the texts already written. The spiralling of topics throughout the course was specifically indicated, and ideas which were basic to the course but were not explicitly mentioned in the outline were noted down.

The main task for the summer, the writing of the Primary Four text, was more than accomplished. Twenty-one units were written, treating arithmetical and geometrical topics, and introducing very elementary ideas of Statistics (mainly collecting and recording of data). The summer's task was more than accomplished in that, at the end of the workshop, most of the units were in

a form ready to go to the printers.

Secondary: Chairman - Dr. Awadagin Williams

The group split into three, instead of the usual two, subgroups: Algebra, Geometry, and a Secondary C. This third subgroup was made necessary by the fact a number of countries are changing to a Four Year Secondary Course, from the Five Year one for which the Secondary series are being written. An outline programme for Secondary Four and Five Algebra and Geometry had been prepared at the 1964 Workshop. With very slight modifications, the Algebra programme for Secondary Four was adopted and texts were written in the course of the Workshop.

The Geometry outline met with a different fate. The Secondary Geometry succeeded in maintaining its dubious distinction of being the most controversial of the subjects with which the workshops have to deal. Last year the bone of contention had been when and how formal geometry was to be introduced, after the largely informal treatment of Secondary One and Two. This summer the controversy centred mainly on whether we were not being too tradition-bound in treating only the static aspects of Euclidean Geometry to the complete exclusion of a dynamic approach through transformations. After long discussions, decisions were arrived at, more or less to the satisfaction of the writing subgroup as a whole. It had earlier been decided to write the Secondary Four Geometry text in a less formal but no less rigorous manner than the geometry of Secondary Three. A transitional chapter in the text introduced pupils to this new style of presentation. Units followed, which were basically a continuation of the geometry of Secondary Three, but the writing was infused by the new spirit. Units on transformation geometry were also written, and these should provide further insight into the geometry, which would be known to the pupils at this stage. An outcome of the discussions, which so to speak came out with the wash, was the decision to write Secondary Five Algebra and Geometry as one text, and not in separate volumes as with Secondary Three and Four, or even in distinctly algebraic and geometric units as in Secondary One and Two. An outline of this programme was drawn up, and should this or something similar to it be adopted by the writers at next summer's workshop, it would bring home effectively to the pupils the much-talked-of essential unity of mathematics, of which they may not have had as yet any convincing demonstration.

The Secondary C programme was not without its problems and difficulties. Almost the entire first half of the main workshop was spent in thinking out the structure of the course, and the discussions in the geometry subgroup had inevitable repercussions on this exercise.

The actual writing of Secondary C One Algebra began during the last half of the summer, using to a considerable extent material from the present Secondary One and Two texts. For the geometry, always a thorny problem, it was decided to rewrite the present Secondary One through Three for use in the first two years of the shorter programme, and to introduce transformations informally at this stage. The subgroup wrote about two-thirds of Secondary C One Geometry. Both Secondary C One Algebra and Geometry are being completed in the USA so that they can be available for use in January 1966.

Teacher Training: Chairman - Prof. Donald E. Richmond

The aim of the group has been to write materials which would be suitable for use in Teacher Training Colleges. Three volumes of a "Basic Concepts" text had been written at previous workshops. This summer the fourth and final volume was written. This volume contains units on Measurement, Ratio and Proportion, Functions and Graphs, Probability and Statistics, and concludes with an Epilogue. The chapters on Fractions in the first volume were revised and a short chapter on LCM and GCF added. A long chapter on Number Theory (Divisors, Primes, LCM, GCF). was also written and will be included as a supplement to the fourth volume.

The primary objective of this group has now been achieved and with that the group ceases to exist as such. We believe that the texts produced and the uses to which they are put will always be a source of pride to all who have worked in this group.

Testing: Chairman - Mr. Christopher Modu

The Testing Group seeks to develop a series of experimental tests designed to help evaluate the effectiveness of the texts produced at the workshops, and of the teaching of these texts. Until this year, the group had worked at the Secondary level only; this summer it took on the Primary as well.

Tests for the Secondary are developed along these lines: Questions are assembled at one workshop and tried out in test form by appropriate classes during the school year. Information obtained on individual questions is used at a subsequent workshop to construct tests, which are tried out again in the schools. If the results are judged to be satisfactory, the tests are considered to be in "final form". Thus it was possible only this summer to judge whether tests based on the Secondary One texts could be considered as having reached the "final form". (One has to remember that tests are written a year after the texts on which they are based.) The results of the try-out allowed such a judgement to be made.

Questions based on the Secondary Two texts and assembled during the 1964 Workshop could not be pretested last year, as the number of classes ready to take the tests was considered to be too small. It is hoped to administer these tests in the 1965/66 school year to over 1,200 pupils in five countries. During the summer, questions based on the Secondary Three texts were written and will be pretested when a sufficiently large number of pupils have studied the texts.

An experimental test, based on the Secondary One texts, was devised, which would enable the progress of Entebbe classes to be compared with that of more traditional classes. The test consists of those questions in the Secondary One tests which should be accessible to pupils following a more conventional curriculum. The performance of Entebbe classes on these questions is already known. In the course of the next school year it is hoped to be able to administer the test to about ten carefully selected traditional classes. The selection will attempt to match the Entebbe classes with traditional classes of about the same ability, where the relative abilities of pupils will be determined by the history of their school's performance at the School Certificate Examination. It cannot be overemphasised that the reliability of the results obtained will rest heavily on the proper selection of traditional classes. If the experiment proves successful, similar ones at other levels will be devised.

As already mentioned, the group undertook this summer to prepare evaluative tests at the Primary level, specifically at the end of Primary Three. Since very little has been done in the area of evaluative mathematical testing of an age group so young, a lot of thinking had to be done about the form the tests should take. The main decisions made were that tests would consist of sequences of questions, each sequence to be made up of related questions, seeking to test comprehension of a limited area of concepts, and secondly that tests were to be administered orally. A set of more than sixteen sequences was prepared, and these will be pretested in the course of the next school year.

The Testing Group also collaborated with the Secondary Group in preparing a final draft of a Syllabus for Examination in Mathematics at O-Level based on the Entebbe texts and to be submitted to the West African Examinations Council and the Cambridge Local Examinations Syndicate.

ABC Institutes:

As reported earlier, a committee was set up at the beginning of the Workshop to advise on the form of the proposed ABC Institutes and possible continuing activities between Institutes. At first, members of this committee worked on a part time basis, but it was soon realized that this was insufficient for the amount of work to be done. A writing group was then organized, with Dr. Grace Alele Williams as Co-ordinator. At the end of the Workshop, the group had prepared a very comprehensive document, containing their proposals on the matters referred to them. The story may be told to show how eagerly members of the committee worked, even as part time consultants. When the Secondary C group got down to the writing of their texts, it became immediately apparent that the group was seriously undermanned. No chairman was, understandably, prepared to release any member of his group. No chairman, that is, except one. When this one was approached about releasing a particular member, he was surprisingly quick to agree. But the reason soon came to light. The member in question had been working more or less full time on the ABC Institutes committee. It is not too difficult to be generous with what belongs to others.

The Second Plenary Session

Perhaps it is some measure of the progress we have made since the groping efforts of the pioneering days of 1962 that this year, as in 1964, there was only one other plenary session, in addition to the opening one. At this second meeting, Dr. Grace Williams reported on the work of the ABC Institutes committee, and Prof. Ted Martin gave a brief account of the activities of the other groups during the summer.

Other Workshop Activities

The usual "other workshop activities" were organized this year, as in previous years. There were the evening background and specialist lectures. These ranged from the very interesting opening lecture on "Cobweb cycles - a mathematical analysis of a market supply and demand situation, leading to cyclical price fluctuation", through "Admirable and Perfect Numbers", "Definition by Recursion",

"Logic Is a Swindle" and its rebuttal "(Logic is not a Swindle)", to the highly topical "Mathematics Syllabus Reform in England" and "Transformations in Secondary School Geometry".

There were film shows, both educational and recreational. One should mention again Mr. Mathenge, who not only got the Kenya Information Services to show us a very interesting film, portraying Kenya - the country and its people, their history, their life as it is today, and their hopes and aspirations - but was himself present at the showing, together with a corps of top civil servants in the region to answer participants' questions on aspects of life in Kenya.

Through our visits to schools and contact with local teachers, much interest in the "modern" mathematics was aroused. Finally their interest had to be satisfied by some classroom use of the materials in a Mombasa Primary School and by lectures given to the general public and to Secondary school teachers which were organized by Mr. J. Bundred, the local Inspector of Schools.

Our new venue also provided game park enthusiasts with fresh fields to explore. We are grateful to the lions, who nearly made off with two very valuable members of the workshop, for changing their minds before it was too late. We accept the apologies made by the Kenya representative for this misdemeanour, and also on behalf of the pack of lions, which failed to turn up to be presented to the last group of participants to visit Tsavo Park.

The versifiers, who were very much in evidence at the 1962 Workshop, suddenly came to life again almost at the end of the main Workshop. They seemed to have been aroused from a Rip van Winklian sleep by the Muse herself, who descended in the form of an Ode read at the Farewell Dinner.

A welcoming party early in the Workshop provided an opportunity for many new friends in Mombasa to meet Mr. Gilbert Oakley, Director of ESI and the participants. The party was attended by many distinguished local people. Among the many other distinguished visitors to the Workshop were the Assistant Minister of Education, Kenya, The Hon. Mr. Matame, Mr. Kyale Mwendwa, the Chief Education Officer, Kenya, Mr. John Gitau, Chief Inspector of Schools, Dr. W. Lybrand, USAID Consultant, Dr. W. Niblo, USAID, Mr. F. Sutton, Ford Foundation, Mr. K. Komora, Provincial Education Officer, Mr. S. Muhanji, Provincial Information Officer, and Mrs. Maggi Goni, Social Welfare Worker.

The list of visitors is an indication of the kind of welcome we received in Mombasa and in Kenya. We have reason to be grateful to many people in Kenya, and the Kenya Ministry of Education. In particular, we are deeply indebted to Mr. K. Komora, Provincial Education Officer and his staff, including those in the Coast Teacher Training College for their friendly welcome and their cooperation given to us during our stay.

It is a pleasure to record once again our gratitude to the Educational Services Organisation for promoting this and other projects in African Education and to the various Foundations and other bodies which are financing the projects.

And a last word about our new venue. Comparisons with our former one will be invidious. Suffice it to say that those who missed their after-tea and evening constitutionals to Kitoro village (a suburb of Entebbe) were amply rewarded with dips in the Indian Ocean before lunch and after tea, and with exploring the vast Nyali Estates. The attractions of Mombasa were also to be had for only a shilling's (round trip) ride on the Municipal Bus. Our thanks go to the Management of the Nyali Beach Hotel for, among other things, presenting each of the participants with an autographed paper-knife.

APPENDIX C.

1965 MOMBASA MATHEMATICS WORKSHOP

Participant List

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

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

Mr. Robert A. Ampomah, University College of Science Education, Cape Coast, Ghana

Mr. Muhamed A. Bashraheil, Bububu School, Zanzibar, Tanzania

Professor Edwin F. Beckenbach, University of California, Los Angeles, California

Professor David Blackwell, University of California, Berkeley, California

Mr. Samuel O. Bortei-Doku, Ministry of Education, Accra, Ghana

Professor Jean M. Calloway, Kalamazoo College, Kalamazoo, Michigan

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

Professor Roy Dubisch, University of Washington, Seattle, Washington

Professor George F. Feeman, Williams College, Williamstown, Massachusetts

Professor Ross L. Finney, Princeton University, Princeton, New Jersey

Professor Samuel Goldberg, Oberlin College, Oberlin, Ohio

Professor Vincent H. Haag, Franklin and Marshall College, Lancaster, Pennsylvania

Professor Clarence E. Hardgrove, Northern Illinois University, DeKalb, Illinois

Mr. F.B. Dyck Harding, Milton Margai Training College, Goderich, Freetown, Sierra Leone

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

Mr. Isaac Hunja, Kaguno School, Kiganjo, Kenya

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

Mr. Julius E. Jonah, Prince of Wales School, Freetown, Sierra Leone

Mr. Hosea Kasule, Nsangi Junior School, Kibuye, Kampala, Uganda

Mr. Frank N. Kazembe, Education Offices, Inspectorate Headquarters, Limbe, Malawi

Mr. Edward Kizza, University College, Nairobi, Kenya

Professor Donald L. Kreider, Dartmouth College, Hanover, New Hampshire

Professor Peter A. Lappan, Michigan State University, East Lansing, Michigan

Professor W.T. Martin, Massachusetts Institute of Technology, Cambridge, Mass.

Mr. M. McInerney, Ministry of Education, Dar es Salaam, Tanzania

Mr. Gaspar Mizambwa, Morogoro Teachers' College, Morogoro, Tanzania

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

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

Mrs. Mary C. Neville, Ministry of Education Inspectorate, USAID, Lusaka, Zambia

Mr. Alfred M. Newa, Mpwapwa Teachers College, Mpwapwa, Tanzania

Mr. Robert L.N. Offurum, King's College, Lagos, Nigeria

Mr. Jacob K. Okine, Accra Academy, Accra, Ghana

Professor Donald R. Ostberg, Indiana University, Bloomington, Indiana

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

Mr. Richard S. Pieters, Phillips Academy, Andover, Massachusetts

Mr. Richard S. Presser, Elston Senior High School, Michigan City, Indiana

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

Professor Hartley Rogers, Massachusetts Institute of Technology, Cambridge, Mass.

Professor Jerome M. Sachs, Chicago Teachers College North, Chicago, Illinois

Mr. Jameson Shakalima, Chilenje Lower Primary School, Lusaka, Zambia

Miss Kathleen M. Sowden, Whitelands College, London, England

Mr. Henry Swain, New Trier Township High School, Winnetka, Illinois

Mr. J.E. Modupe Taylor-Pearce, Milton Margai Training College, Freetown, Sierra Leone

Professor Bryan Thwaites, Southampton University, Southampton, Hampshire, England

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

Dr. Awadagin Williams, University of Sierra Leone, Freetown, Sierra Leone

Dr. Grace Alele Williams, University of Lagos, Lagos, Nigeria

Professor Izaak Wirszup, University of Chicago, Chicago, Illinois

Professor John E. Yarnelle, Hanover College, Hanover, Indiana

Staff

Mr. Michael B. Akanji, Department of Mathematics, University of Ibadan, Ibadan, Nigeria

Mr. Hugh P. Bradley, Executive Director, African Mathematics Program, ESI

Mrs. Theresa Bradley, Needham, Massachusetts

Mr. Peter E. Bundred, Mombasa, Kenya

Mr. Richard H. Bundred, Mombasa, Kenya

Miss Mary E. Morse, ESI

Miss Betsy E. Pannos, ESI

Mrs. Juliet Sequeira, Mombasa, Kenya

Miss Katherine Solovicos, ESI

Mrs. Noorbanu Z. Sunderjee, Mombasa, Kenya.

1965 Mombasa Math Workshop
Testing Group
August 9, 1965

Test 20.

REPORT ON SECONDARY TESTING ACTIVITIES

GENERAL

The Testing Group of the Entebbe/Mombasa Mathematics Workshops is involved in a series of experimental tests designed to help determine the effectiveness of the textual materials produced at these Workshops, and the uses to which these materials are put. This testing program is now entering its third year at the Secondary level and is beginning its first year at the Primary level.

The development of tests suitable for classes in the Entebbe program takes a minimum of two years. During the first year, questions are pretested, that is, tried out in test form by appropriate classes. On the basis of the information about individual questions thus obtained, tests are constructed and tried out during the second year. If this try-out proves satisfactory, the tests are judged to be in "final form" and can be used as a yardstick to measure developments within the program.

At present, this testing program is still in a very early stage. Although Secondary One tests are now in "final form", questions have not yet been pretested for Secondary Two or Secondary Three tests, or for a test at the level of Primary Three. (A separate report on Primary testing has been prepared.) Because there is very little past data from which to make comparisons, conclusions drawn at this time must necessarily be considered tentative, and may be confirmed or refuted by future observations.

SECONDARY ONE

As a result of the past year's testing, two 40-question objective tests based on the Secondary One material are now considered to be in "final form". These tests were assembled at the 1964 Workshop from a pool of questions written during the 1963 Workshop and pretested during 1963-64. During 1964-65, these tests were administered to Entebbe classes in four countries: Ghana, Nigeria, Sierra Leone, and Uganda. Each class was asked to take both tests.

Although the tests were administered to some classes too late for the results to be included in this report, there is sufficient data available to consider the tests suitable for further use. On the basis of the performance of 142 pupils, the average score was 19 correct (of a possible 40) on each of the tests, with scores ranging from 5 to 37 correct. In addition, results of individual questions correlated well with the results on the tests as a whole. A brief summary of the statistics available on these tests appears at the end of this report.

The subject matter in these tests reflects the content and spirit of the Secondary One text. There is a blend of questions within the scope of pupils in a more traditional course with other questions based on the more modern topics covered in the text. It was found that the results of the questions based on the more modern topics correlated better with the total test score than those questions of a more traditional nature. This seems to indicate that teachers are emphasizing the modern aspects of the text. However, there appears to be no significant difference in difficulty between the modern and traditional questions.

Perhaps the most significant aspect of the results of these tests was the marked difference in level of performance from class to class. As the results of both tests are consistent, it appears that some classes are considerably more adept in handling the Entebbe materials than others. The remarkable thing is not that this discrepancy exists, but that it appears so vivdly in the test results. The average scores of individual classes ranged from a low of 12 to a high of 25. However, when it is recalled that the chance score -- the score to be expected from guessing alone -- is 8, these averages range from 4 to 17 above the chance score. Seen in this light, a score of 25 represents considerably more than twice the achievement of a score of 12. Of course, the scores alone do not indicate the cause of this imbalance, which could be due to unequal background and/or ability on the part of the students, the teachers, or both. However, the existence of this imbalance underscores the need for designing experiments with extreme care. Any tests should take into account a wide range of ability and performance.

Although the results of a few individual questions were surprising in the light of the pretest results, there seems to be no discernible indications that major areas of the material are causing undue problems. In most cases, the individual questions proved less difficult than they did in the pretesting, perhaps an indication that the increasing familiarity with the material makes the teacher more effective.

It should be noted that these tests are designed more for use in Entebbe classes than in more traditional classes. The notation and terminology are at variance with the traditional, so that a traditionally trained pupil might be confused by unfamiliar wording and notation, even though the concepts involved might be familiar. Also, a significant number of the questions involve concepts not covered by the traditional courses.

SECONDARY TWO

The first pretesting of questions based on the Entebbe Secondary Two material will take place during the coming year. Four 40-questions objective tests were assembled for pretesting during the 1964 Workshop, but the number of classes ready for these tests during the past year was small, and it was decided to wait until more classes were available for testing. It is planned that these tests will be administered this coming year to a total of over 1,200 pupils in 5 countries (Ghana, Nigeria, Sierra Leone, Tanzania and Zambia).

Based on the experience gained with the development of the Secondary One tests, it should be possible to construct from the pretested questions two tentative "final forms" of the Secondary Two test during the 1966 Workshop. If these should prove suitable, as determined by further trials during 1966-67, they may be used repeatedly in future years in a manner similar to the projected use of the Secondary One tests.

SECONDARY THREE

Three 40-question objective tests based on the Entebbe Secondary Three material have been prepared during the 1965 Workshop for pretesting. These tests will be printed and administered when a sufficient number of classes has studied the Secondary Three material. This is not likely to occur before the 1966 Workshop.

FUTURE PLANS FOR SECONDARY TESTING

Now that there are two Secondary One tests in "final form", it is planned to administer these tests in alternate years to Entebbe classes in order to measure progress within the program. This coming year more than 1,200 pupils in at least 6 countries are expected to use one of these tests. A detailed examination of the results of these tests in this and succeeding years should reveal the extent to which the texts have been adequately taught and their contents mastered by the pupils. The performance of individual schools may be placed on a fixed scale, so that improvements may be noted as well as significant changes in performance on selected topics. Similar activities are projected for the Secondary Two and Three tests when they are in "final form".

In order to be able to make a comparison of the progress of Entebbe classes with that of more conventional classes, an experimental test has been devised for the Secondary One program. This test consists of those questions appearing on the Entebbe Secondary One test which should be accessible to pupils trained in a traditional curriculum. The performance of the Entebbe pupils on these questions is known from the past year's testing. The experimental test will be administered to about 10 carefully selected traditional classes so that the performance on individual questions may be compared with the results obtained from the Entebbe classes. To control the experiment as much as possible, the selection process for the traditional classes will attempt to match the Entebbe classes with traditional classes of equal ability, where the relative abilities of the two groups will be determined by their schools' history of performance on the School Certificate Examination.

The purpose of this experiment is to compare the performance of the Entebbe classes and the traditional classes on the common part of their respective curricula. A detailed statistical analysis will be done on a question-by-question basis, revealing the relative strengths and weaknesses of the two groups on individual skills and concepts. It is to be expected that there will be areas where each group exceeds the other. However, it is to be hoped that the Entebbe pupils will prove to be at least as competent as the traditional pupils on those topics given major emphasis in the Entebbe program.

This experimental test is expected to be administered during 1966, and the results should be available early in 1967. It is to be pointed out that the reliability of the data obtained from the experiment depends heavily upon the proper selection of traditional classes. Where possible, schools which have both Entebbe and traditional classes simultaneously will be selected, but it may be necessary to approach some schools which are not yet making use of the Entebbe materials. Although no undue difficulties are expected, it will be necessary to obtain the cooperation of several schools in a number of countries.

If this type of experiment provides meaningful results, similar experiments at levels of Secondary Two, Three, etc., will be devised. However, such plans will be influenced by the experience encountered with this experiment at the Secondary One level.

SUMMARY OF SECONDARY ONE TEST RESULTS

	Test 1	Test 2
No. of Pupils	142	140
High Score	37	35
75th Percentile	26	23
Median	19	19
25th Percentile	14	15
Low Score	6	5
Average Percent Score	47.6%	47.3%

(Total possible score on each test is 40.)

SECONDARY ONE TEST No. 1A ITEM ANALYSIS

No.	f	r	No.	f	r
1	.75	.31	21	.42	.35
2	.88	-	22	.36	.57
3	.72	.45	23	.32	.71
4	.59	.35	24	.32	.52
5	.75	.53	25	.35	.53
6	.58	.43	26	.50	.53
7	.53	.31	27	.39	.38
8	.65	.51	28	.32	.55
9	.68	.46	29	.47	.64
10	.65	.55	30	.46	.65
11	.70	.53	31	.68	.65
12	.65	.66	32	.20	.44
13	.44	.12	33	.51	.61
14	.62	.42	34	.32	.48
15	.39	.39	35	.42	.72
16	.34	.57	36	.23	.22
17	.65	.41	37	.47	.66
18	.34	.58	38	.23	.08
19	.70	.50	39	.25	.35
20	.23	.47	40	.29	.51

(f is the percentage answering the question correctly;

r is a measure of correlation of those answering the question correctly with those receiving high scores on the test. r's above .30 are generally considered acceptable.)

SECONDARY ONE TEST No. 2A ITEM ANALYSIS

No.	f	r	No.	f	r
1	.79	.28	21	.53	.21
2	.81	.39	22	.43	.48
3	.77	.26	23	.38	.34
4	.76	.45	24	.29	.20
5	.84	.39	25	.15	.00
6	.66	.53	26	.31	.10
7	.55	.50	27	.45	.64
8	.54	.32	28	.24	.39
9	.85	.47	29	.46	.58
10	.77	.48	30	.19	.37
11	.72	.39	31	.40	.51
12	.51	.42	32	.35	.69
13	.56	.19	33	.39	.50
14	.39	.56	34	.61	.45
15	.50	.33	35	.24	.24
16	.56	.60	36	.47	.43
17	.46	.47	37	.19	.34
18	.24	.25	38	.32	.55
19	.35	.29	39	.23	.54
20	.24	.29	40	.50	.61

1965 Mombasa Math Workshop
August 12, 1965

PRIMARY TESTING PROGRAM

As described above, the principal responsibility of the Testing Group during the first three Workshops was the preparation of Secondary testing questions, the pretesting of these questions, and finally the construction of end-of-course examinations to be used to evaluation purposes. This year the Testing Group was given the additional task of preparing an evaluative examination to be given to the experimental classes at the end of Primary Three. The objectives of this examination would be the following:

(1) To determine the extent to which the pupils in the experimental classes are adequately mastering the mathematical facts and skills which are appropriate for the Primary Three level.

(2) To evaluate the extent to which pupils in the experimental classes are able to do mathematical thinking beyond the routine arithmetical skills.

(3) To compare the mathematical knowledge and skills of pupils in the experimental classes with that of pupils in traditional mathematics classes.

At the present time, very little has been done in the area of evaluative mathematical testing for so young an age group. The difficulties are considerable since mathematical thinking ability is just beginning to develop at this age level and there are many verbal and reading problems to be overcome.

Test Development

In choosing a form of the test, the first major consideration was the manner in which the test is to be administered. Since it was felt that every effort should be made to minimize the effect of reading and verbal problems, it was decided to have the test administered verbally, using only the simplest words and sentence construction. Thus the test would consist of a text for the test administrator and a test booklet for the pupil. Any reading material in the pupil booklet would be kept to a minimum. In order to make the response as simple as possible, the pupil would be expected to mark one of three boxes with a cross or to fill in a box or blank space with a numeral.

A second criterion to be satisfied in choosing the form of the test is that it provide a child with the opportunity to begin in a very familiar situation and to proceed to the limit of his problem-solving abilities while remaining within the same circle of ideas. In this way, the distractions of changing ideas and concepts will not interfere with the exercise of reasoning powers. Accordingly it was decided that the test should be made up of sequences of questions, each sequence consisting of questions related to a limited area of ideas. It would begin with simple worked out illustrations and progress gradually to difficult questions. A further advantage of the sequence format is the opportunity it provides for measuring the development in time of the pupils' mathematical abilities by including the same sequences in tests given at a later date. In order to accomplish the objectives outlined above it is clear that sequences covering traditional curricular material as well as the Entebbe material will be needed. Furthermore, some experimental sequences

specially designed to test the pupils' ability to think ahead for himself from a familiar set of mathematical ideas must be constructed. During the 1965 Workshop a set of more than 16 sequences was prepared.

Pretesting

The use of sequences of questions in place of single questions is a novel departure in testing technique. However, the special problems of primary testing strongly indicate that some such technique is needed. Accordingly, it is imperative that the sequences be thoroughly pretested to ensure that they will be reliable and valid components of a final test form. This is particularly important in the case of the experimental sequences which are designed to measure reasoning ability at this age level. The first stage of the pretesting should be in-depth studies, in which the sequences are administered to five or six children with a considerable range of academic abilities. Afterwards, each child would be carefully interviewed to find out as much as possible about his or her thought processes during the test. If words, phrases, or pictures are misleading, they should be detected at this point. It should also be possible to determine if, indeed, the children are doing the type of thinking which the sequence is designed to measure. Preferably, this pretesting should be done by an experienced interviewer working with African children who have just completed the Primary Three course. Since it may not be possible to send an interviewer to Africa for this purpose, an alternative procedure would be to have the interviewing done by a particularly competent African teacher making use of a manual of instructions prepared by an experienced interviewer who has tried the sequences on comparable children in the U.S.A. Under any circumstances, these in-depth studies should be an essential part of the pretesting procedure.

After the sequences have been appropriately re-worked on the basis of the in-depth studies, they should then be pretested in the usual manner in 10-12 classes so that the sequences themselves can be statistically validated. It is hoped that the in-depth studies would be carried out during the winter 1965-66 and the pretesting in the early summer. The sequences could then be assembled into test forms during the 1966 summer Workshop.

The exact nature of the final test forms will depend upon the pretest results. Tentatively, it is contemplated that the test would require two 30-minute testing periods. The test form for each period would consist of three or four sequences. In order to accomplish the three objectives outlined above, sequences covering traditional material would be included as well as sequences appropriate for the experimental curriculum.