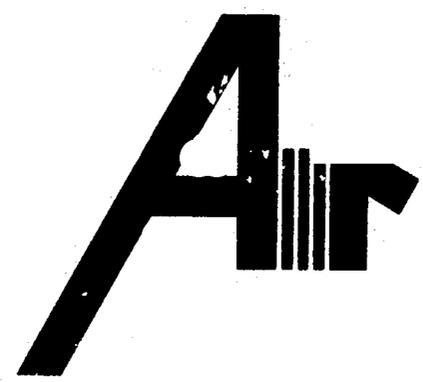


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**test development
and research:
west african
examinations council
(1969-1973)**



FINAL REPORT

Subject: Test Development and Research:
West African Examinations Council

Reporting Period: 1 January 1969 through 31 August 1973

Recipient Organization: The West African Examinations Council

Member Countries: Nigeria, Ghana, Sierra Leone, and The Gambia

Appropriation Number: 72-1121004

Allotment Number: 254-58-625-00-69-21

Issuing Office: United States Agency for International Development
Bureau for Africa
Washington, D. C. 20523

Contract: AID/afr-595

PIO/T Numbers: 698-169-3-6190059
625-169-3-00027
625-169-3-10026(1)
625-169-3-20016(1)

Project Number: 698-11-690-169

Contractor: American Institutes for Research
710 Chatham Center Office Building
Pittsburgh, Pennsylvania 15219

Prepared by: John E. Bowers, Ph.D.

Date: 13 November 1973

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APPENDIX

I. INTRODUCTION

This is the final report of a regional technical assistance project conducted in West Africa by the American Institutes for Research (AIR), to implement a Grant Agreement between the United States Agency for International Development (USAID) and the West African Examinations Council (WAEC). The purpose of the Grant Agreement was to facilitate human resource development within the four emerging member nations served by this regional educational organization. Specific targets were addressed at assisting WAEC to improve and expand its manpower testing and selection capability, extend its testing services into all of its member countries (Nigeria, Ghana, Sierra Leone, and The Gambia), and develop within the member countries an institutional framework for the effective use of manpower testing and selection services by educational, training, and governmental institutions. This broad goal was effected by the development and improvement of WAEC's Test Development and Research Office (TEDRO) and by implementation of an extensive and coordinated Staff Training Program sponsored by the Ford Foundation (A Staff Training Programme in Educational Measurement, Grant 63-272B, 1967).

The present project represents the fourth and final phase of a program of training, test development, and research conducted by AIR in West Africa since 1960. This program was accomplished through a series of contracts funded by USAID and its predecessor agency, the International Cooperation Agency. Work on the present project focused primarily on the further development and consolidation of TEDRO, which had been established during the previous 4-year project through the merger of the AIR-established Nigerian Aptitude Testing Unit (NATU) and the already existing Objective Testing Unit within WAEC (Contract AID/afr-199, Task Order No. 3). Six advisory positions were originally specified for this fourth phase of the program, with five posts assigned to TEDRO in Lagos, Nigeria, and one post in Accra, Ghana. A seventh position was added in July 1971 to assist WAEC directly in the management of its Data Processing Department.

Twenty-four principal contract targets were clustered within four major activity areas: (1) Test Development – the development of new examinations, revision of existing ones, and the maintenance and improvement of objective examinations conducted by WAEC; (2) Research – the validation of the objective examinations administered by WAEC; (3) Institution Building – the further consolidation of TEDRO and expansion of its services and resources; (4) Service – the extension of manpower assessment and selection within the WAEC member countries. Specific targets within each activity area were as follows (see pages S-4 to S-7 of contract):

A. Test Development Targets.

1. Maintain and improve all current annual objective testing programs.
2. Develop an Oral English Examination.
3. Develop a battery of managerial selection tests.
4. Develop a Primary School Leaving Certificate Examination for Nigeria.
5. Revise the University Series of Tests.
6. Revise the Law Faculty Admissions Test Battery.
7. Revise the Civil Service Entrance Examination.

B. Research Targets.

1. Conduct University Series validity studies.
2. Conduct Nursing Council Common Entrance Examination validity studies.
3. Conduct Teacher Training College Battery validity studies.
4. Conduct Technical Training College Battery validity studies.
5. Conduct Common Entrance Examination Battery validity studies.
6. Conduct Oral English Examination validity studies.

C. Institution Building Targets.

1. Develop and mobilize TEDRO.
2. Establish a branch office of TEDRO in Accra.
3. Expand in-service training in TEDRO, in-house seminars, on-the-job training.
4. Establish a computer program library serving the two WAEC National Offices and TEDRO.
5. Conduct item-writing and test administration courses as requested by participating WAEC countries.

6. Coordinate the Ford Foundation Staff Training Program with project goals.
7. Develop the TEDRO professional library.
8. Foster TEDRO in-house research capability through supervised research.

D. Service Targets.

1. Expand manpower selection services within Nigeria.
2. Establish and expand manpower selection services in Ghana, Sierra Leone, and The Gambia.
3. Provide consulting services on research projects in WAEC countries related to educational and psychological research.

The primary set of targets are those related to the institutional development of TEDRO as an indigenous research and test production unit of WAEC. Success in the attainment of this set of goals is demonstrated by TEDRO's present capability to program its work to meet the objectives of WAEC, its professional influence in the definition of new and modified objectives, its existing relationships with important educational, governmental, and professional organizations within West Africa, and by its unique expertise and resources now available for the solution of problems brought to it both by WAEC and by outside organizations.

Each of the twenty-four targets is intrinsically important. In a programmatic sense, however, each varies in its relative importance, the sequencing of project activities devoted to it, the allocation of project time and effort given to it, and its completion schedule. Achievement on service targets is a natural consequence of successful early achievement in institution building. While test development targets and research targets serve as direct and immediate guidelines for action in the early and intermediate stages of institution building, these often change from targets to routine ongoing activities as the institution becomes more firmly established. At such a time necessary development, maintenance, and research tasks become absorbed into the regular technical activity schedule of a test development and research organization.

To provide the reader a clearer overview of the context within which the present project was conducted, it is useful to initially describe briefly the role and the history of the West Examinations Council, to outline the development and the organizational structure of TEDRO, and to present an overview of the 13-year program in test development conducted by AIR in West Africa. This is done in Section 2, which follows immediately and which summarizes the purposes, organizational and committee structure, examination programs, and growth of WAEC since 1951.

Section 3 reviews the staffing and organizational structure of TEDRO as it was at the end of the project, and describes the functions of its various Departments and Branch Offices. Developmental work conducted in West Africa since 1960 by AIR under USAID sponsorship is discussed in Section 4, which also specifies all technical advisors who have served on this project and discusses target priorities as they were affected by the reduction in a number of contract man-months and the transfer of TEDRO management from AIR advisors to trained West African specialists.

Section 5 summarizes project activities of TEDRO and AIR technical advisors under each target. Institution building in an organization such as TEDRO is a cooperative effort drawing upon the resources and abilities of every staff member. The previous project had trained TEDRO's West African staff for the positions they held when this project began, so that only two line positions of administrative direction were actually held by AIR advisors during the period of this project. One of these, the position of Acting Director, was fundamentally crucial for the accomplishment of target objectives, but none of the contract objectives could have been realized without the cooperation and the skills of the West African professional staff.

Finally, Section 6 presents a summary discussion. Sixty-three TEDRO research reports, issued since the inception of the project, are abstracted in the Appendix.

II. THE WEST AFRICAN EXAMINATIONS COUNCIL

A. Brief Historical Overview

The West African Examinations Council is an international educational and professional testing organization established by statute in 1951 in Ghana and similarly in the following year in Nigeria, Sierra Leone, and The Gambia. Liberia joined the Council officially as an Associate Member country in 1969 and as such is represented at the annual meeting of WAEC, receives requested WAEC services on a cost basis, and sends observers to certain subcommittees of WAEC.

Ordinances passed in 1951 in Ghana (then the Gold Coast) and in 1952 by the Governments of Nigeria, Sierra Leone, and The Gambia established WAEC as a corporate body, charged with determining and conducting the examinations required in the public interest in West Africa, and empowered WAEC to award certificates in them that represent standards of attainment equivalent to certificates awarded by examining authorities in Great Britain. Mr. K. Humphreys assumed his appointment as the first Registrar of WAEC in Accra in March 1952 and WAEC's Accra Office opened in February 1953. At the first meeting of the Council in March 1953, four additional staff members were appointed and the formation of committees and a staff establishment was considered. Later in 1953, WAEC opened an office at Lagos, National Committees met for the first time, and WAEC assumed responsibility for the Common Entrance Examination in Ghana.

The West African School Certificate Examination was first administered in the four member countries in 1955, a step beginning the collaboration between WAEC and the Cambridge Syndicate. Development during 1956 continued with pilot-testing of objective-test items in English, Arithmetic, Geography, and History. In 1957 WAEC first began the machine-processing of test results at Lagos with the installation of unit-record equipment which included punchers, verifiers, a tabulator, a sorter and an interpreter, and the establishment of a key punching section. Expansion continued in 1958 with the openings of the National Office in Freetown and the London Office.

The ordinances were amended in 1959 making WAEC an autonomous body with power to appoint its Chairman and to delegate its authority to committees. The same year saw the establishment of the Objective Testing Unit of WAEC with trial testing of objective tests started in English Language, Mathematics, Geography, and Biology. The School Certificate Examination was first administered in 1960 in Ghana and Sierra Leone. In 1961, the Registrar was authorized to conduct studies into the use of objective tests. The same year, Mr. J. Deakin succeeded Mr. Humphreys as Registrar. By the end of 1962, new offices in Lagos were occupied, and the first training courses for examiners began.

The Nigerian Aptitude Testing Unit (NATU) was established by AIR in 1964. The work of NATU in some respects paralleled that of WAEC's Objective Testing Unit. Development of WAEC's G.C.E. Advanced Level Examinations began in 1964, and WAEC's G.C.E. Ordinary Level Examinations were taken for the first time in June 1965 in The Gambia, Ghana, and Sierra Leone. Mr. J. A. Cronje was appointed Registrar in 1965, replacing Mr. Deakin.

Three major events occurred in 1966. The Nigerian Aptitude Testing Unit and the Objective Testing Unit of WAEC were merged to form TEDRO; multiple-choice objective tests were introduced for the West African School Certificate and G.C.E. O-Level Examinations in Biology, Chemistry, English Language, Mathematics, and Physics; and the Council became fully responsible for the School Certificate Examinations, ending the 11-year collaboration with the Cambridge Syndicate. WAEC first administered its own G.C.E. Advanced Level Examinations in Economics, Economic History, and Government in June 1967. The same year, WAEC's National Office in Freetown was opened and Liberia sent its first observers to WAEC's fifteenth Annual Meeting. The TEDRO Accra Office was founded in 1968. Liberia was accorded Associate Membership in the Council in 1969, and was represented as an Associate Member country at the eighteenth Annual Meeting of the Council held in 1970.

Mr. V. C. Ike became Registrar of WAEC in 1971, upon the retirement of Mr. Cronje. Branch Offices of the Council were opened in Nigeria in late 1971 at Kano, Kaduna, and Enugu, and the new TEDRO Freetown Office was opened in November with responsibilities for TEDRO activities in Sierra Leone

and The Gambia. Dr. S. A. Akeju assumed duties as Director of TEDRO in early 1972 and by the end of 1972, TEDRO staff members returning after completion of their advanced graduate training under the Ford Foundation Staff Training Programme were heading all Departments of TEDRO. The Bathurst Office of WAEC was established in 1972 in The Gambia and was formally opened in January 1973. The twenty-first Annual Meeting of WAEC was held in Accra in March 1973.

B. The Governing Body.

The governing body of WAEC consists of its Chairman, who is presently Dr. S. T. Matturi, and a group of thirty-one full members and three associate members. Council membership is composed of four members nominated by the Government of the Federal Republic of Nigeria, eight nominated by the Nigeria National Committee, four nominated by the Government of Ghana, five nominated by the Ghana National Committee, three nominated by the Government of Sierra Leone, two nominated by the Sierra Leone National Committee, two nominated by the Government of The Gambia, one nominated by The Gambia National Committee, and one representative each from the University of Cambridge and the University of London. Liberia is represented by three Associate Council members. This governing body meets for several days in March of each year with the venue rotated among the member countries.

C. Committee Structure.

There are eight major committees of WAEC: the School Examinations Committee, the Administrative and Finance Committee, the Senior Appointments Committee, the International Test Development and Research Committee, and a National Committee for each of the four member countries. Subcommittees of both the Administrative and Finance Committee, and of the International Test Development and Research Committee, meet in each of the four member countries. Within each country the Administrative and Finance Subcommittees are advisory to that country's National Committee. The National Committee in each country has four subcommittees, respectively, for Teacher Examinations, Common Entrance Examinations, Public Service Examinations, and Technical and Commercial Examinations. The Administrative and Finance Subcommittee

in each country also has subcommittees for Building and Appointments. This committee structure was reorganized during the past year, with the creation of national subcommittees for the International Test Development and Research Committee and the abolition of what were formerly national subcommittees of the School Examinations Committee. Because of its size and educational system's structure, Nigeria has twelve additional State Committees that are advisory to the Nigeria National Committee.

D. WAEC Executive Staff.

The chief executive of WAEC is its Registrar, Mr. V. C. Ike, who has served in this capacity since August 1971, succeeding Mr. J. A. Cronje who was Registrar from 1965 until his retirement in 1971. WAEC has five international offices and four national offices. The five international offices are the Headquarters Office in Accra, the International Examinations Department in Accra, the International Examinations Department in Lagos, the London Office, and the Test Development and Research Office (with its Head Office in Lagos and a Branch Office in Accra and in Freetown). National offices of WAEC are located in Lagos, Accra, Freetown and Banjul (formerly Bathurst). Total professional and executive staff for the nine offices as of April 1973 are listed in Table 1 (following page).

E. Examinations of WAEC.

WAEC's primary purpose is to award certificates for educational achievement based on syllabi whose development it supervises and approves. Like the Commonwealth system of education, secondary school achievement in the four member countries is certified by examinations conducted by an external testing body (i.e., in this case WAEC). WAEC also certifies teacher training courses, primary school completion in four states in Nigeria, and middle school completion in Ghana. Besides the certification examination programs it conducts, WAEC prepares and administers examinations used for the selection of students into secondary schools within all four countries (the Common Entrance Examinations) and, through its TEDRO Offices, conducts a wide-spectrum aptitude testing program for the selection of candidates to technical courses, professional training courses, and for selection into clerical, technical, managerial, and supervisory positions in industry and government.

TABLE 1
WAEC Executive Staff

Office	Number
Headquarters (Accra)	9
International Examinations (Accra)	6
International Examinations (Lagos)	9
London	2
TEDRO Head Office (Lagos)	16
TEDRO Branch (Accra)	5
TEDRO Branch (Freetown)	1
Nigeria National	24
Ghana National	15
Sierra Leone National	3
The Gambia National	<u>1</u>
TOTAL	91

The most widely known examination program of WAEC is the Joint Examination for the School Certificate and the General Certificate of Education Ordinary Level. WAEC has been fully responsible since 1966 for the preparation and grading of this examination, previously known as the Cambridge Syndicate School Certificate Examination. This examination program presently covers forty-four subjects with syllabi common to the member countries and is administered to candidates completing five years of an approved secondary school as well as to private candidates. School Certificates are awarded to candidates who achieve a satisfactory level of performance in six subjects and who either pass in six subjects with at least credit (a better grade than a pass) in one, or pass in five subjects with credit or higher in two. The General Certificate of Education Ordinary Level (G.C.E./O-Level) is awarded to candidates who either do not qualify for the award of the School Certificate or else enter the examination on a single subject basis and earn credit in at least one of the subjects taken. The School Certificates and the G.C.E./O-Level Certificates are recognized by the Universities of Cambridge and London as equivalent to the certificates issued by the British General Certificate of Education Boards.

WAEC is further developing its examination system by completing the take-over from both the Cambridge Syndicate and the University of London of the more advanced examinations for the Higher School Certificate and the General Certificate of Education at the Advanced Level. Twelve subjects are currently prepared and administered by WAEC for awarding the Higher School Certificate and the General Certificate of Education at the Advanced Level. At the twenty-first Annual Meeting of WAEC in 1973, the Registrar set a target date of 1975 for WAEC to assume full responsibility for the testing of all O-level and A-Level candidates in Nigeria.

Other certificate examinations administered by the Council are the Nigeria Teachers' Higher Elementary (Grade II) Certificate Examination, the Teachers' Certificate 'A' Examination in Ghana, the Ghana Middle School Leaving Certificate Examination, and the First (Primary) School Leaving Certificate Examination in Nigeria (four states). Selection examination programs administered by the Council include the Nigeria National Common Entrance Examination, The Gambia Common Entrance Examination, the Sierra

Leone Selective Entrance Examination, the Ghana Common Entrance Examination and the Combined Examination for Entry to Four-Year Teacher Training Colleges, and for Pupil Teachers' Selection in Ghana.

WAEC also administers the University of London G.C.E. O-Level and A-Level Examinations still taken by many students in West Africa, the Higher School Certificate Examination of the Cambridge Local Examinations Syndicate, examinations of the Royal Society of Arts, and the examinations of the City and Guilds of London Institute. These last two examination programs are targeted for WAEC take-over no later than 1978.

III. TEST DEVELOPMENT AND RESEARCH OFFICE

TEDRO was originally structured into departments organized on the basis of examination programs, and service and research activities: (1) Professional and Higher Academic Examinations; (2) Secondary Achievement Examinations; (3) Technical and Commercial Examinations; (4) Secondary Selection, Guidance, and Evaluation; and (5) TEDRO/Accra. In October 1969, these departments were reorganized into the structure shown in Table 2 on the following page.

The Director of TEDRO reports to the Registrar. The TEDRO Head Office is located in Lagos and is organized into the Director's Office, the Aptitude Testing Department, the Item Preparation Department, the Research Department, the TEDRO Library, and the Administration Office. Branch offices of TEDRO were established in 1968 in Accra and in 1971 in Freetown. Table 3 lists the professional staff of TEDRO in all three of its offices. Of the twenty-seven professional staff of TEDRO, five hold Ph.D. degrees earned during the period of this project under the Ford Foundation Staff Training Programme. An additional TEDRO staff member is currently on study leave completing doctoral work at the University of Wisconsin.

A. Director's Office.

Dr. S. A. Akeju is the Director of TEDRO. After completing work for his Ph.D. in Educational Measurement at the University of Southern California in 1969, he returned to TEDRO and assumed duties as Head of the Aptitude Testing Department until his appointment as Director in January 1972. Until this time the Acting Directors of TEDRO during the period of this project had been Dr. J. G. Snider (January 1969 until July 1971) and Dr. C. O. Agbenyega (July 1971 to January 1972).

B. Item Preparation Department.

The Head of the Item Preparation Department is Dr. J. K. Majasan. He was appointed to this position after completing his Ph.D. at Stanford University in 1972. This department is responsible for the preparation of all objective multiple-choice tests required in the certification and

TABLE 2
TEDRO ORGANIZATIONAL CHART

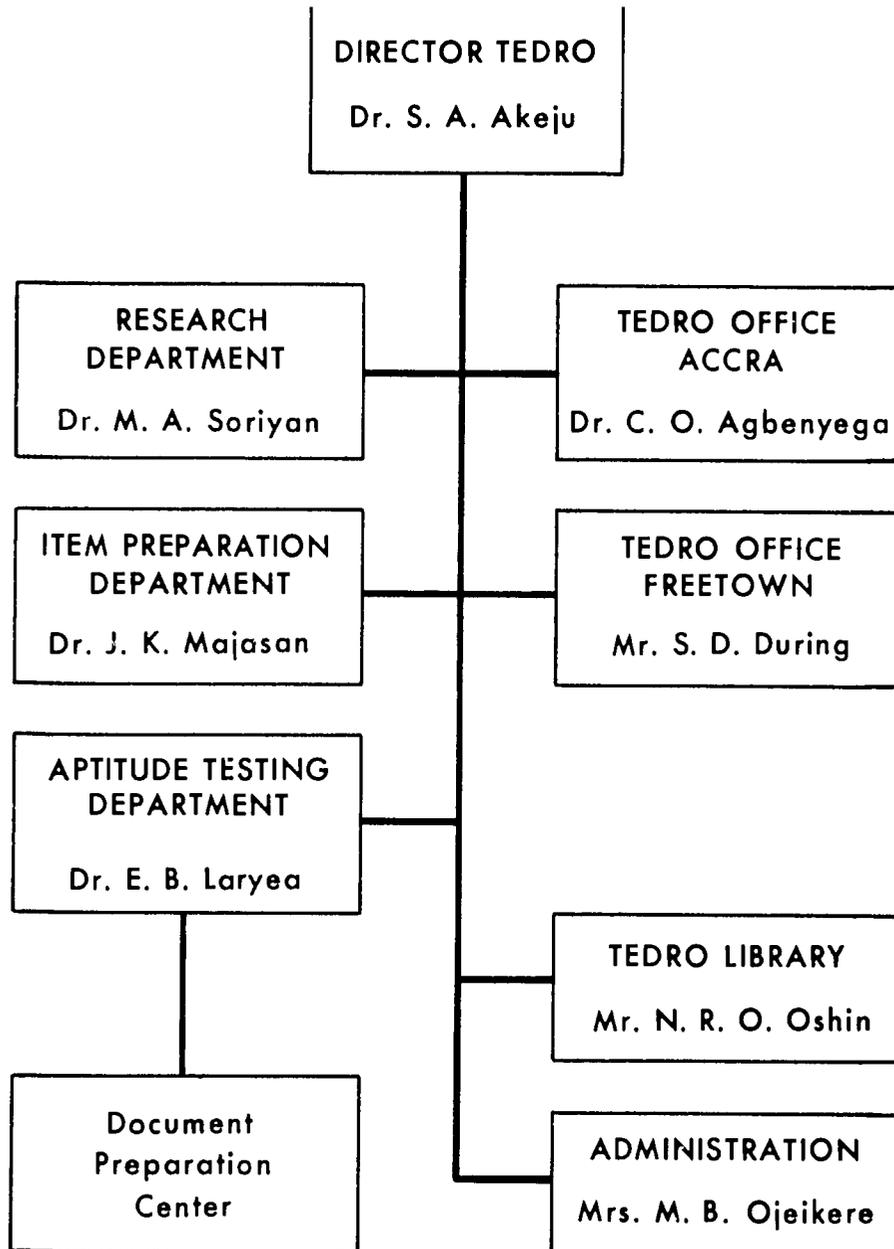


TABLE 3

TEDRO Professional Staff: 31 August 1973

<u>Location and Staff</u>	<u>Position</u>
<u>LAGOS OFFICE</u>	
<u>Director's Office</u>	
S.A. Akeju, Ph.D.	Director
<u>Item Preparation Department</u>	
J.K. Majasan, Ph.D.	Head
F.O. Guobadia, B.Sc., M.Ed., M.A.	Senior Research Officer
J.A. Esi, B.Sc., M.Sc.	Research Officer
E.A. Oyelese, B.Sc.	Research Officer
A.S. Deen, B.A., Dip.Ed.	Research Officer
F.M. Eshun, B.A., M.Ed.	Research Officer
J.E. Obi, B.Sc., Dip.Ed.	Research Officer
A. Osundiran, B.A., Dip.Tch.Engl., M.A.	Research Officer
A.C. Okonkwo, B.S., Dip. d'Etude Francaises	Research Officer
E.I. Okoli, B.Sc.	Research Officer
N.F. Oluyeba, B.A.	Research Officer
A.A. Omotoso, B.A.	Research Officer
<u>Aptitude Testing Department</u>	
E.B. Laryea, Ph.D.	Head
O.C. Atuzieogu, B.Sc.	Research Officer
A.O. Oloyede, B.Sc.	Research Officer
<u>Research Department</u>	
M.A. Soriyan, Ph.D.	Head
<u>Administration</u>	
A. Adedeji, B.Sc.	Accountant
M.B. Ojeikere, B.A.	Executive Officer
S.A. Adeyemi	Acting Executive Officer
<u>Library</u>	
N.R.O. Oshin, Dip. Lib.	Librarian
<u>On Study Leave</u>	
J.A. Osanyinbi, B.A., Post.Dip.Engl.	Research Officer
<u>ACCRA OFFICE</u>	
C.O. Agbenyega, Ph.D.	Deputy Director
L.A. Brown, B.Sc.	Research Officer
V.Y. Kofie, B.A.	Research Officer
E.N. Safo, B.A., M.Ed.	Research Officer
<u>FREETOWN OFFICE</u>	
S.D. Daring, B.Sc., M.Ed.	Head

selection testing programs conducted by WAEC. This work involves training item writers, commissioning items, editing commissioned items, conducting trial testing, analyzing trial test statistics, revising and selecting final test items, consulting with moderating committees in compiling the final test forms, and preparation of camera-ready test copy.

Ten major examination programs of WAEC include objectives tests which require new forms each year. Table 4 lists these programs and indicates for each the number of objective tests and test items that are annually needed for each program. Preparation of each test involves the production, trial-testing, and post trial analysis of at least twice the number of items actually used in the final version of the test.

C. Aptitude Testing Department.

Dr. E. B. Laryea was appointed Head of the Aptitude Testing Department in the summer of 1972 upon his return to TEDRO after finishing his work for the Ph.D. at Columbia University. The Aptitude Testing Department is responsible for administering the aptitude testing program in Nigeria and conducting related research for personnel selection, placement, and advancement in technical and professional training courses in industrial and commercial firms, and in public service and government. Staff are also called upon to consult with clients about the use of tests for selection, the interpretation of test results, the validation of tests, and the construction of rating forms. Most of the tests administered in the aptitude test program are those in the I-D series first developed by the American Institutes for Research. An annual 2-week course for the administration and interpretation of the I-D test series is conducted by this department. The Aptitude Testing Department also administers the TEDRO-developed Managerial Selection Tests, and the University Series. With an average of approximately six tests administered to each candidate, the total number of individual tests administered approaches a total of close to 546,000 over the past four and one-half years.

The Aptitude Testing Department also arranges for the administration of testing programs for the Educational Testing Service, whose tests are taken for college admission throughout the world on specifically scheduled dates.

TABLE 4

Objective Tests and Total Items for Major WAEC Examination Programs

Examination Program	Tests	Total Items
School Certificate/GCE November	8	617
School Certificate/GCE June	8	617
Teacher's Certificate Grade II	3	160
Ghana Teacher's Certificate A	1	100
Ghana Middle School Leaving Examination	5	250
First School Leaving Certificate	4	180
Nigeria and The Gambia Common Entrance	5	250
Ghana Common Entrance	5	200
Sierra Leone Selective Entrance	4	200
Ghana Four-Year Teacher Training Entrance	<u>3</u>	<u>170</u>
TOTAL	46	2,744

These tests include the Test of English as a Foreign Language (TOEFL), the Scholastic Aptitude Test (SAT), the Graduate Record Examinations (GRE), and the Aptitude Tests for Graduate Schools of Business (ATGSB).

D. Research Department.

The Head of the Research Department is Dr. M. A. Soriyan who returned to TEDRO after completing his Ph.D. at the University of Pittsburgh in July 1971. He was appointed Head of the Item Preparation Department and held this position until July 1972 when he assumed his present position. The Research Department was until this time directed by Technical Advisors who served as its Acting Head. These were Dr. D. J. Fitch for most of 1969, Dr. A. J. Fiks from 1969 to late 1971, and Dr. J. E. Bowers from then until Dr. Soriyan's appointment. Dr. B. A. Axtell worked on many of the studies carried out within the Research Department during the last year of his tour. Although the Research Department has been and is currently understaffed, the appointment in June 1973 of Dr. E. B. Awuwoyeye, a recent graduate of the University of Illinois who was a Ford Foundation Research Fellow in TEDRO in 1969, will be a valuable and productive addition to the Research Department.

The Research Department organizes monthly seminars to present topics in educational and psychological research of interest to WAEC staff and invited guests. The department, with the assistance of Mr. N. R. O. Oshin, the TEDRO Librarian, has also been mainly responsible for the editing and review of articles submitted for publication in the West African Journal of Educational and Vocational Measurement, issued twice yearly by TEDRO. Members of the Research Department throughout the course of the project have consulted with numerous colleagues in the universities and ministries, with researchers in the Nigerian Army, and with industrial and educational personnel interested in the application of tests to their work.

Dr. Soriyan's future work plan calls for the department to direct its research program toward three broad areas: (1) psychometric research and computerized applications; (2) manpower assessment and commercial and technical applications; and (3) educational research. Studies have already been conducted in these areas and will be described under appropriate project goals.

E. TEDRO Accra.

Dr. C. O. Agbenyega, who has been Deputy Director of TEDRO and Head of the TEDRO Accra Office since April 1972, completed his doctorate in 1971 at Syracuse University in the area of curriculum development. Dr. Agbenyega was the first TEDRO Officer posted to Accra when the TEDRO Office was opened there in 1968. The TEDRO Accra Office is responsible for conducting all professional activities of TEDRO in Ghana. These include aptitude testing, the training of item writers, commissioning of items for certain of WAEC's examinations, carrying out research on WAEC examinations, and extending the services of TEDRO to the professional, technical, commercial, government and education sectors of the nation. Item writers' workshops are held and seminars are conducted on various topics related to testing.

WAEC has an IBM 360/20 Data Processing System in the Ghana National Office which is used by TEDRO Accra for the routine item analyses it conducts on WAEC tests administered in Ghana, Sierra Leone and The Gambia; analytic programs identical to those used on the Lagos 360/20 system are available for TEDRO Accra's research analyses.

Dr. L.S. Skurnik served as the Contract Technical Advisor in Accra during his entire 3-year tour in West Africa. He in effect directed TEDRO activities in Accra while Dr. Agbenyega was studying for his doctorate at Syracuse University. Despite chronic understaffing during Dr. Skurnik's first two years on the project, the work of TEDRO Accra was greatly extended and the office put on a secure footing due to his considerable efforts over a wide range of activities. With Dr. Agbenyega's return and with recent staff additions, it can confidently be expected that TEDRO Accra's influence will continue to grow.

F. TEDRO Freetown.

Mr. S.D. During, who returned to West Africa in the summer of 1971 after advanced graduate study in measurement at the University of Toronto, opened the TEDRO Freetown Office in November 1971 and now directs its activities. WAEC established this branch office in Freetown at the request of the Sierra Leone Ministry of Education and charged it with the major responsibilities to plan and to coordinate all TEDRO activities in Sierra Leone and The Gambia. The volume of work has grown in this new office, not

only in relation to the work started in the two member countries it serves, but also by extending consulting services to Liberia. The work developed in TEDRO Freetown has so far involved promoting of aptitude testing services, conducting trial testing exercises, commissioning items, meeting with Ministry and other officials to discuss test applications, initiating locale-specific research studies, conducting courses in test administration, and giving lectures to interested groups on the use of tests. It is expected that TEDRO Freetown's effect will increase as its services become more widely known and appreciated.

IV. USAID ASSISTANCE PROGRAM

The American Institutes for Research has conducted a series of test development and research projects in West Africa since 1960, sponsored by the United States Agency for International Development, with the present contract representing the fourth phase in this overall program.

A. The First Three Phases.

The first phase (Contract ICAC-1434) began with an initial pilot project lasting from May 1960 through June 1961. This was a feasibility study to assess the use and the implementation of group-administered objective aptitude tests in West Africa. Twelve tests were constructed and tried out in Nigeria. These tests measured general ability, clerical and technical abilities, and manual skills. The study indicated that reliable objective aptitude measures were adaptable cross-culturally and could be developed in the West African locale, and that these tests were valid for selection in academic and employment situations. A finding of primary importance was that test development in a cross-cultural setting requires a great deal of detailed preparation regarding the standardization and prescription of highly controlled administrative conditions. These encouraging results led to an extension of the program for two years (Contract ICAC-2155). During the period from 1961 to 1963, more tests of abilities essential for manpower classification and selection were developed, testing procedures were further refined, and research was widened. At the completion of the first phase, a complete set of testing materials was available for use; these materials included more than 125 test forms, practice tests, test papers, scoring stencils, visual aids required for the highly standardized administration procedures, and technical manuals in both English and French.

The second phase of support (Contract AID/afr-199) was started in 1964 by USAID/Nigeria to establish and develop the Nigerian Aptitude Testing Unit (NATU). The plan for NATU was developed at a workshop held in Lagos in 1963 to determine how the instruments constructed during the first phase could best be applied for manpower assessment. Since there were no local

institutions to administer a comprehensive aptitude testing program, and no trained indigenous staff to conduct it, the second phase had three objectives: (1) the further development of an operational set of aptitude tests for use in the less developed countries; (2) the recruitment and training at the graduate level of West African counterparts to continue the work of AIR staff posted to West Africa; and (3) the establishment of NATU to coordinate these activities. Twenty-one I-D (for "Internationally Developed") Tests were produced. Under a USAID coordinated participant training project, six West African Education Officers earned Master's Degrees in Educational Measurement at the University of Pittsburgh. NATU's testing activities, especially in the development of tests for secondary school selection, were seen to duplicate parts of WAEC's examination program, so it was efficient to merge NATU with the Objective Testing Unit of WAEC and create a new office within WAEC: The Test Development and Research Office.

The work of establishing and maintaining TEDRO comprised the program's third phase (continuation of Contract AID/afr-199) which lasted from January 1965 to December 1968. TEDRO's three primary objectives related to testing are: (1) to initiate and evaluate all objective test development within WAEC; (2) to establish aptitude testing services within WAEC member countries; and (3) to initiate, plan, and conduct research on tests and testing procedures. During this third phase, the objective test assessment of educational achievement grew rapidly; TEDRO-developed objective tests were administered for awarding the Primary School Leaving Certificate Examination; for selecting secondary school students in the four member countries; for awarding the Ghana Middle School Leaving Examination; and also for the selection of candidates into teacher training colleges, nursing training schools and technical training colleges. TEDRO also broadened the aptitude testing program for the selection of personnel for positions in commercial and industrial firms and for government services.

The impact of TEDRO is reflected in the increasing volume of objective tests administered each year during the third phase: 1965 (38,000); 1966 (308,000); 1967 (1,273,000); and 1968 (1,591,000). Of the total number of individual test papers produced and administered by WAEC, approximately two-thirds are of the objective type, with the majority of these in the large

entrance examination, primary school certification, and middle school certification programs. During the third phase, TEDRO's institutional research capability was strengthened with the establishment of the TEDRO Professional and Technical Library, through the Ford Foundation Staff Training Programme to develop a West African expertise in test development and research, through the production of a set of analytic computer programs, and through the systematic development, validation, and revision of existing and new tests.

B. The Present Project.

The present project, lasting from January 1969 through August 1973, represents the fourth phase of this extensive development program. Its main thrust has been to consolidate the role and functions of TEDRO as the test development and research arm of WAEC, with support additionally provided to WAEC's Data Processing Department, a vital department in any large testing organization.

To assist TEDRO and the Council in accomplishing the objectives of the project, nine Technical Advisors from the American Institutes for Research have served in West Africa under Contract AID/afr-595. These are listed in Table 5, which indicates each Advisor's period of field service.

The nine advisors spent 210 man-months on post, or approximately 17.5 man years. Because of a cutback in contract funding in 1971, the projected total of 228 man-months in the initial contract agreement was reduced, the actual reduction being approximately 18 man-months or 1.5 man years. Obviously, work plans needed to be modified midway through the project. Two courses of action are open to a contractor in such a situation; some targets either must be abandoned altogether or else work on some of the targets has to be reprogrammed. It was decided on this project that activities for all remaining uncompleted targets would continue, although situational realities dictated a reduction of originally-planned effort for certain targets based on a close examination of priorities.

Institution building targets were seen as the paramount set of goals for the entire life of the project, followed by the closely related goals of service and test maintenance. Fundamental changes in the

TABLE 5

USAID/AIR Advisors from 1 January 1969 to 31 August 1973

Advisor	Dates	Principal Post
J.G. Snider, Ph.D.	Jan 1969 - Jul 1971 ^a	Chief of Party
A.I. Fiks, Ph.D.	Oct 1969 - Oct 1971	Advisor for Academic Operations
S.C. Cho, Ph.D.	Aug 1969 - Aug 1971	Director of Research and Training
L.S. Skurnik, Ph.D.	Mar 1970 - Mar 1973	Technical Advisor (Accra)
B.A. Axtell, Ph.D.	Sep 1970 - Sep 1972	Advisor for Commercial and Technical Operations
M.J. Quirk, M.S.	Apr 1971 - Jun 1973	Advisor for Computer Operations
J.E. Bowers, Ph.D.	Aug 1971 - Aug 1973	Chief of Party
D.J. Fitch, Ph.D.	Jan 1969 - Dec 1969 ^a	Advisor to the Research, Evaluation, and Statistical Section of TEDRO
S.I. Frenkel, Ph.D.	Jan 1969 - Sep 1969 ^a	Director of Research and Training

^aTour continued from previous contract AID/afr-595, Task Order No. 3.

administration of TEDRO were soon to occur at this time. Dr. J. G. Snider, who was Acting Director and had served in this position since the project began in January 1969, was preparing for his departure from post, and for the first time since TEDRO was established in 1966, the position of Director of TEDRO was to be transferred on a permanent basis to West African management. Overseas Ford Foundation Trainees with newly-acquired Ph.D.'s were returning to duty and were scheduled for TEDRO positions as Department Heads. Therefore, the planning of TEDRO's activities was expected to be redirected gradually into those areas where the returning West African professionals believed it should be headed. One of the critical set of contractor tasks, during the changeover within TEDRO from advisory to indigenous leadership, was that of shifting from directing roles to advisory and support roles.

Contractor support of the new institutional administration and advisory contribution to the new ideas and plans of the returning Ph.D.s is an essential aspect of institution building. Also, at this time it was expected that TEDRO's direction would be brought even more closely within that of WAEC as a whole by its newly-appointed Registrar. This expectation was realized when the Registrar on the assumption of his office requested 5-year plans of proposed action from all WAEC offices. TEDRO's future role in the Council was seen not only to efficiently conduct its ongoing production tasks, but also to intensify its efforts to extend its public service and research functions throughout the community. It was therefore important that the contractor staff during the 2-year phase-out period of the contract contribute to TEDRO's influence on WAEC's examination programs and to work with West African TEDRO management in planning its institutional program within WAEC.

The area where reduction could occur without seriously undermining these top priority objectives was that of validity research. It was decided therefore that the scope of activities in some validity targets would be modified downward. This necessary curtailment of effort in validity research for certain of the tests can be now viewed in hindsight as undamaging to the overall success of the project. These targets fall essentially within the scope of activities conducted by the Aptitude Testing Department of TEDRO, and Dr. Laryea, who directs the work in this department, is bringing validation research into the regular routine of departmental work in aptitude testing.

Therefore, reduced activity for some of the validity targets is a starting point for his ongoing work in this direction.

It should be emphasized that curtailed effort in the validity research area does not mean that all test validation targets were uniformly reduced. Criteria for reduction is sensibly made by determining the numbers of examinees affected by each type of test, the importance of and influence of the test target in the wider context of national development, the immediacy with which changes resulting from the analyses may be expected to occur (and this includes possible resistance to recommended change stemming from research that alters traditional and well-established procedures), and the likelihood of securing within a tighter time budget the necessary logistical cooperation to conduct and complete the analyses. A consideration of these factors suggested that activities related to the Common Entrance Examination, used by all member countries to admit candidates to secondary school, was the most important validity target and that validation of examinations for admission to Nursing Training Schools was also very important. Validation of the Teacher Training College Battery was restricted to Ghana only. Work on validating the Technical College Battery was started early, then delayed while the tests used for selection in this type of training were being revised, and is now restarted within the Aptitude Testing Department. The final validity target with respect to the Oral English Test has awaited action by WAEC to administer this test, which had been constructed during the early years of the project as a test development target.

V. ACCOMPLISHMENT OF PROJECT OBJECTIVES

A. Test Development Targets.

1. Maintain and Improve all Current Annual Objective Testing Programs of the West African Examinations Council.

This broad activity target has been a prime objective throughout the entire project, for it describes one of TEDRO's uniquely professional contributions to the work of WAEC. Because of its generality, it is useful to summarize project activities associated with this target according to successive stages in the production-administration-processing-analysis-feedback cycle that annually recurs in testing programs.

a. Production.

Objective item preparation was well organized within TEDRO at the completion of the previous contract. When the current project began, objective test construction, and the related maintenance of the annual testing cycle, was a routine program. By 1969, objective tests for the Common Entrance Examinations, the Primary School Leaving Certificate Examination, and the Ghana Four-Year Teacher Training Entrance Examination were being produced annually by TEDRO's Secondary School Selection Guidance and Evaluation Section. In addition to these, seven objective tests for the SC/GCE Examinations were also produced each year by TEDRO's Secondary Achievement Examination Section. Altogether at that time, 36 objective tests with a total of 1,220 items were annually produced by TEDRO. During the term of this project the yearly production schedule has grown to 49 objective tests with a total of approximately 2,600 items.

An early project activity to improve objective test production was TEDRO's design and conduct of item writers' courses in Lagos and in Freetown in April 1969, attended respectively by 109 and 23 university graduates with teaching experience. Sample item materials were prepared and lectures were presented on objective and essay testing, reliability and validity, and item analysis. The reorganization of TEDRO in late 1969 also

effected economies in item preparation by bringing together all objective test production within a single department. The Item Preparation Department has since expanded its scope of activities by the appointment in 1971 of a Research Officer responsible for preparing the objective French Examination added to the SC/GCE Examinations that year and by the more recent appointment of Research Officers who will prepare objective tests for the SC/GCE Examinations in Statistics, Business Methods, and West African Languages at the O-Level, and in Economics at the A-Level.

b. Administration.

Though TEDRO is not directly involved with administering WAEC's annual testing programs, its regularly scheduled course in test administration conducted by the Aptitude Testing Department and its research on the I-D Tests will produce beneficial spread effects relevant to all WAEC testing programs. As one example, Dr. Akeju conducted a study which compared mean score differences for Form II students administered the I-D Verbal Analogies Low and the I-D Reading Comprehension Low Tests, half of whom responded on the standard I-D format with the test printed on the answer sheet and half using a separate answer sheet (25)¹. Examinees recording their choices on a separate answer sheet scored significantly lower on both tests than did examinees using the standard I-D answer sheet. Similar results were reported by Miss Agboro, Dr. Akeju, and Dr. Bowers in a related comparison of scores on the I-D Arithmetic Test and the PAT Arithmetic Test (an alternate form of the I-D Test) for 134 students at Yaba Trade Centre. Mean scores on the PAT Test were significantly lower than those on the I-D Test, due partly to the use of separate answer sheets. This type of finding has obvious general implications for the norming, timing, and administration of other WAEC objective test programs.

c. Processing.

TEDRO's contribution to the maintenance and improvement of WAEC's test programs extends into data processing and reporting. A TEDRO library of computer programs is routinely used for summarizing test results and for research. A 1969 paper by Dr. Fitch outlined the advantages of a standardized, continuous, two-part answer sheet for examination programs requiring

¹ Numbers in parentheses refer to abstracts of Technical Reports in the Appendix.

objective tests; this form was ordered for the Common Entrance Examination program, with the result that computer processing time for this very large testing program was reduced by one-half (1). Dr. Skurnik, and Mr. Sisam of the Accra National Office, revised the TEDRO item analysis program so that item statistics are now listed in serial order, a minor change but one that saves several hours of professional time during the course of a year. Also, TEDRO staff have examined the possibility of introducing an MRC 1501 answer card as a replacement for the IBM answer sheets now used for the objective tests. The primary advantage of the answer card is a quantum reduction in scoring speed.

Mr. Quirk's arrival on the project in April 1971, as Technical Advisor for Computer Operations, provided exceptionally strong support needed in the vital area of systems analysis, data processing, programming, and test reporting. Until his tour ended in June 1973, Mr. Quirk had served since December 1971 as the Systems Development Manager of WAEC's Data Processing Department. In this position, he was responsible for directing work in the two data processing installations, in Lagos and in Accra. His assignment included monitoring existing programs and designing new ones, and developing individualized training at both locations. Efficient data processing is crucial to WAEC's operation. Mistakes not only delay the reporting of the affected test program, but also disrupt the processing schedule of following programs. Mr. Quirk increased efficiency in the data processing area by completing a quality control section for the 1972 SC/GCE post examinations processing in Lagos, and by programming, testing, and documenting the modifications necessary for the 1973 SC/GCE. Individualized instruction in Assembler Language coding, as well as instruction in systems design and analysis, was given by Mr. Quirk to the computer staff in Lagos. He also designed sample scoring sheets for the Common Entrance Examination, the Primary School Leaving Certificate Examination, and all objective tests of the SC/GCE Examinations.

With an increasingly heavier test volume creating overload problems for WAEC's present 360/20 computer system, Mr. Quirk prepared, at the Registrar's request, an analysis of future staffing and equipment needs. These projections were discussed at several committee meetings and, as a result of the Registrar's decision to upgrade the present system, Mr. Quirk

compared the costs and characteristics of competing systems proposed to replace the present one. WAEC placed an order with IBM this past Spring to install an IBM 370/125 system in the Lagos National Office. Faster on-line optical scorers have also been ordered to replace the present IBM 1230's.

Although staff have been recently added to the Data Processing Department, Mr. Quirk's departure has left a significant vacancy in top-level management. The Registrar has sought the assistance of the Commonwealth Secretariate for Technical Assistance in locating a data processing manager and has discussed the staffing problem with testing organizations abroad. There is the potential for a rather serious problem if a manager is not found in time to plan for and supervise the changeover to the newer and more sophisticated system. Present staff do not possess the experience needed to operate the new system and their training either must be started now or experienced staff will need to be recruited and hired.

d. Analysis.

Posttest analyses of the SC/GCE Examinations and the Common Entrance Examinations have been and are being routinely conducted by TEDRO. (Studies of the Common Entrance Examination will be discussed under Target B-5.) Analyses of the SC/GCE Examinations have involved estimation of their reliabilities, estimation of the relationships among the objective and traditional papers in SC/GCE subject areas containing both types of tests, and the weighting of objective and traditional scores.

Descriptive statistics, subtest contributions to final grade, subtest intercorrelations, and reliability estimates were reported by Dr. Skurnik for the 1970 SC/GCE Examinations (17). Based on sample sizes varying from 18 to 933, 14 of which exceeded 100, reliabilities ranged from .13 to .93, averaging .76. This paper also discussed the relative contribution of each subtest to the final grade in a subject and concluded that the objective subtests in the seven SC/GCE subject areas, where they are used together with the traditional examinations, are relatively reliable. Dr. Akeju and Mr. Oyolede reported Kuder-Richardson Formula 20 reliability estimates ranging from .78 for Health Science to .93 for English Language Examinations (40). The median reliability was .87 for eight objective tests in the 1971 SC/GCE Examinations, with results based on random samples of 453 to

849 examinees for each test. The authors suggest that reliabilities should be improved for some of the tests, even given that the Kuder-Richardson formulas are lower-bound estimates of reliability.

Dr. Skurnik also compared the reliabilities of the 1971 SC/GCE objective tests for a sample of students tested in Ghana and for all students tested in Sierra Leone and The Gambia (38). He concluded that reliabilities in the three countries were equivalent for the objective tests, ranging from .64 to .84, even though there were major differences in the quality of the schools and teachers among the countries and in local spoken languages. He also examined the reliability of the 1971 SC/GCE Examinations for all three groups combined. These results demonstrated that most examinations were adequately reliable with the exception of Cookery. Other reliabilities ranged from a low of .67 for Commerce to .98 for Entebbe Mathematics.

In 1970 seven subjects of the SC/GCE examinations included both objective and traditional parts. Dr. Bowers reported on the relationships between the two parts for these seven subjects (34). Mr. Quirk had written a computer program to systematically sample the computer tape records containing results for all Nigerian examinees, and sample sizes thus obtained varied from 523 to 1,626. Correlations between the two types of test ranged from .62 in Chemistry to .76 in Mathematics.

In a study of the 1972 SC/GCE Examinations, objective test reliabilities were separately reported by Dr. Skurnik for Ghanaian examinees classified by enrollment in A Schools, in B Schools, and in private schools (59). No differences were found among the three groups, with the resulting implication that future reliability estimation could be based on overall random samples. Setting .85 as a satisfactory standard of reliability, Dr. Skurnik concluded that 13 subjects showed satisfactory reliabilities, whereas 20 did not. The standard used for reliability was the level necessary to reduce the standard error of measurement on a stanine scale to a degree where the likelihood is .95 that an examinee's observed scores will vary by no more than one stanine on repeated testings. A summary of SC/GCE O-Level reliability studies was prepared by Dr. Skurnik (58) and a list of suggested changes for either lengthening or shortening the times of the tests was

given, based on a standard reliability of .85 and the well-known relationship between test length and reliability (39).

Internal consistency reliability estimates were also reported by Dr. Skurnik for six Advanced Level School Certificate subjects based on a 10 percent random sample of candidates tested in Ghana in 1972. Reliabilities ranged from a low of .57 in Economics to a high of .75 in Physics (57). Several suggestions for improvement of reliability were given, with the understanding that the reported reliabilities may be underestimates of the true reliabilities.

Within a short note on the relative contributions of subtests in a test battery to total battery score, Dr. Soriyan and Dr. Bowers reviewed a procedure to calculate a set of subtest weights so that each subtest's contribution to the total score is at an intended level, and also reviewed a procedure which maximizes total score reliability in the calculation of subtest weights (51). A draft paper discussing the weighting problem and comparing various weighting schemes was prepared by Dr. Bowers for TEDRO circulation and comment prior to presentation to the School Examinations Committee. The major point emphasized was that weighting should be intentionally prescribed and not determined by chance factors. Various weighting procedures were compared, and it was suggested that weighting to maximize total score reliability may be the most effective scheme. Dr. Soriyan also discussed the relative contributions made by subtests to total score, in a paper dealing with the 1972 SC/GCE award meetings (47). In another paper he analyzed differences between actual and expected subtest contributions to total score variance, for 13 SC/GCE Examinations taken in 1971 (53).

e. Feedback.

Dr. Fiks proposed a method to report objective test results to educators in a way facilitating diagnosis of errors and consequent improvement of teaching (22). With a computer system having sufficiently extensive memory, such as the new system to be delivered to WAEC in January of 1974, the percentage of examinees passing each item in a test can be calculated separately for examinee groups classified by school, state, general area, or nationally. Item statistics can be grouped according to content topic area within a subject. School administrators and teachers may thus

relate their pupils' achievement on parts of any test, and on the test as a whole, to the achievement of pupils in other schools, to schools within a particular region, or to national norms.

Dr. Axtell examined the possibility of creating an objective test item bank in TEDRO and reported estimates of the reliability with which TEDRO subject officers classified items according to the taxonomy used for the present TEDRO test specification tables (45). Low inter-classifier reliabilities were found and Dr. Axtell recommended that the number of categories in the specification tables be reduced and the objectives to be measured by each item be further clarified.

2. Develop an Examination in Oral English Capable of Being Administered to Large Numbers of Candidates at the West African School Certificate Level.

Beginning in 1965, WAEC studies of its optional School Certificate Oral English Examination, the so-called McCallien Test, led to the conclusion that the test's major shortcoming was difficulty in test administration and, more importantly, that its use did not influence better teaching of English in the classroom. Staff of TEDRO during the previous contract had thus been assigned the responsibility to produce an objective Oral English Test to be a compulsory School Certificate Examination and which was to: (1) be simple to administer; (2) assess and diagnose difficulties West African children find in speaking English as a second language; (3) measure language components clearly understood by classroom teachers and components that were teachable; (4) be reliable and content and predictively valid; and (5) lead to improved standards in the teaching and speaking of English in West Africa.

With the assistance of African and British linguists in West African universities, TEDRO's test construction began. The work was carried out by Dr. Snider and Dr. Fitch of AIR, Mrs. H. Laurie of the Ford Foundation, and Mr. P. Connell of the British Council, all of whom were then on the staff of TEDRO. Examination items were based on the analysis of linguistic errors actually occurring with significant frequency in classrooms. Items were grouped into nine specific types: consonant discrimination, vowel discrimination, mixed consonant and vowel discrimination,

rhyming recognition, consonant cluster discrimination, sentence stressing, intonation, and comprehension. The test was designed to be presented on audio-tape with sufficient clarity for in-class administration within a 1-hour time limit. Intermediate trial test analysis and revision had been completed by late 1968 and work for further revision and final moderation carried over into 1969. The test for final revision was prepared on tape for administration. Voices for the final revision were West African speakers, three of whom were commercial and news broadcasters. The results of the administration of this examination, to representative groups of approximately 300 Nigerian secondary school pupils, showed a reliability of .91 for the total score with reliabilities for the nine subscores ranging from .41 for Intonation to .84 for Sentence Stress (3, 5, 15). Items were selected on the basis of their discrimination values and the test was reduced to 150 items requiring a total administration time of only 55 minutes. Administration of the final test form in Ghana to 196 fifth form students in somewhat selective schools gave a reliability of .85, average item difficulty of .57, and average item-total score point-biserial correlations in the low .30's range.

The validity of the test was evaluated in three ways, pending the time when the test was to be administered as a School Certificate Examination by WAEC. First, analyses of the relationships between scores on the McCallien Test and the TEDRO Oral English Test carried out in Ghana and in Nigeria obtained correlations of .48 and .56 respectively, the level reduced by a sizeable extent because of unreliability of the McCallien measures. Second, a correlation of .61 was reported between teachers' ratings of English proficiency and scores on the TEDRO Oral English Test, indicating substantial agreement between the two tests despite the typically low reliability of ratings given by a single teacher on any classroom behavior trait. Third, two other analyses compared group mean differences in scores on the TEDRO Oral English Test for native English speakers and West African second language speakers. Large mean differences were found between British VSO's and West African secondary school pupils, and between pupils in the Lagos American community school and West African secondary school pupils. These differences were consistently large for every subtest in the TEDRO Oral English Test (16).

The Oral English panel in late 1969 accepted the final test that resulted from TEDRO's development work. It remains for the test to be introduced into the School Certificate Examinations. This has taken a great amount of planning time by various offices and committees of WAEC. Not only must examiners be trained to administer this test, but also cassettes have to be purchased and distributed throughout the member countries. The Ford Foundation has agreed to partially support this expensive testing program so that it now seems certain that the Oral English Test will be given as part of the School Certificate Examinations in 1974. TEDRO has strongly recommended that the introduction of the Oral English Test be accompanied by the production and distribution of supplementary texts and learning materials for teachers and students.

3. Develop a Battery of Tests for Selection into Positions at the Managerial Level.

The rationale and development of the Managerial Selection Test Battery began with planning meetings held in 1965 with high level business and industrial managers in Nigeria. It was decided to develop scales using the critical incident technique developed by Dr. J. C. Flanagan of the American Institutes for Research. Briefly, this procedure entails the systematic observation and recording of actual on-the-job behaviors that reflect either good or poor job performance activities of the persons being observed. Approximately 1,500 critical incident recording forms were distributed in Lagos and another 200 forms were distributed in other regions of Nigeria. By September 1967, approximately 800 forms had been returned and these were classified into the seven broad categories of sales and finance, administrative skills, personnel relations, planning, production and technical development, training and personnel development, and customer relations. The first item writers' meeting was held in July 1967 to discuss research and development to date, review the critical incident technique, consider item samples, and determine the item specifications for the proposed test. Participants were Dr. Yoloye of the University of Ibadan; Mr. Babalola of the University of Lagos; and Dr. Cieutat, Dr. Frenkel, and Mr. Majasan of TEDRO. In October 1968, Mr. Majasan, Mr. Safo, and Dr. Frenkel of TEDRO met and decided that the 180 items developed to date should be expanded to an item pool of 300 items for final scale development, with item revisions

to be circulated in TEDRO to Dr. Snider, Dr. Fitch, and Dr. Aleyedeino for review and comment. Three scales were developed in 1969: the 68-item Administrative Decisions Scale, the 62-item Sales Judgment Scale, and the 66-item Supervisory Judgment Scale.

To develop scoring keys for the three scales, an 18-item job performance rating scale was constructed and arrangements for trial-testing and key construction were started in January 1970. Letters requesting cooperation were sent to 28 major firms in Nigeria and Ghana; 107 completed scales were returned to TEDRO. All firms, however, were reluctant to supply the information requested on the job performance rating form. In the absence of external criteria, keys were constructed on the basis of internal consistency or reliability; scales were then revised and reduced to a final test length of 20 items each, with each item accompanied by four multiple-choice alternatives.

The new Administrative Decisions and the Supervisory Judgment Scales were administered to practicing managers attending a 1971 workshop in Lagos. Comparison of responses made by this group, with responses of the group tested in 1970, supported the choice of items included in the shorter 20-item scales. In addition, testing time had been reduced from one and one-half hours to 30 minutes per scale. The Supervisory Judgment and Administrative Decisions Scales were then administered to a group of WAEC staff members in Lagos and in Accra who were engaged in administrative activities. This group, though perhaps not a representative cross-section of managers, was chosen primarily because of the likelihood that criterion data would be available for validation. Dr. Axtell completed a pilot validity study of these two scales based on returns from 62 WAEC officers, using years of managerial experience and job performance evaluations as criteria. Neither scale was related to either criterion in this sample. Dr. Axtell observed that the results could have been affected by the substantial number of subjects lost from the analysis due to missing criterion ratings and he suggested that future studies focus on the question of developing appropriate criterion measures (52).

At the present time, the TEDRO-developed Managerial Selection Test is administered on an experimental basis as part of its aptitude testing

program. Dr. Akeju has well-established relationships with the Nigerian Institute of Management, and it is expected his close collaboration with this organization will increase TEDRO's opportunity to extend the use of the test battery and obtain the necessary criteria data to validate its utility in different settings.

4. Develop an Examination for the Primary School Leaving Certificate in Nigeria.

The development of a truly nationwide Primary School Leaving Certificate Examination has not been possible because all twelve States in Nigeria have yet to agree to administer a common certificate examination at this level. The First School Leaving Certificate, annually produced by TEDRO, is an objective test battery administered each year in four Nigerian States to approximately 120,000 pupils. The examination has recently been changed from December to June because of a shift in the Nigerian school calendar. With four papers administered in English Language (50 items), Arithmetic (40 items), a General Paper (50 items), and Modern Mathematics (40 items), this program yields a sizeable processing and reporting volume reaching nearly a half million test papers annually.

From 1968 to 1970, this TEDRO-developed test battery was administered by WAEC in Lagos State, South-Eastern State, and the Mid-West State. In 1971, the Mid-West State elected not to administer the test battery, but in that year the Benue-Plateau State introduced the test battery for certifying the primary school completion of its pupils. In 1972 the Mid-West State decided once again to reintroduce the battery.

WAEC would have no operational difficulty in conducting such an annual examination at the national level; TEDRO can continue to develop an objective test battery as it now does for four states, but with specifications common to all twelve states, and the increased processing load can readily be accommodated on the IBM 370/125 computer system due to be installed in Lagos early next year. Development of a national level Nigeria Primary School Certificate Examination depends upon the adoption by the remaining states of a certifying examination measuring school outcomes for all states with a fairly uniform curricula. This would require elaborate preparation,

discussion, and cooperation at the State and Federal Ministry level. Once these steps are taken, the actual annual development and administration of the national examination program would quickly follow as an extension of the present program for primary school certification.

5. Revise the University Series of Tests for University Selection.

The University Series Tests, measuring higher scholastic abilities, is administered by the Aptitude Testing Department of TEDRO. It consists of nine tests: Antonyms (48 items), Reading Comprehension (21 items), Verbal Analogies (44 items), Principles and Cases (13 sets of problems), Quantitative Reasoning (44 items), Reading Speed (18 items), Science Information (49 items), World Information A (49 items), and World Information B (49 items).

The first revision was completed in 1969. It involved rewriting of items according to the past testing experience of TEDRO staff. Following an initial concurrent validity study conducted in 1970 (reported under Target B-1), a second revision was made. Until a thorough, large-sample validity study at the university level can be conducted and completed, further revision should not be attempted on fragmentary small-sample evidence. Large sampling is required, since various tests in the University Series may be differentially valid for predicting success in different college curricula, and only large curricula groups will provide stable estimates of overall battery predictability.

Work in further revision under this Target (A-5) and on Target B-1, the validation of the University Series Battery, has been curtailed primarily because of delays in scheduling the administration of the battery to large samples of university students. Meetings were held by Dr. Soriyan and Dr. Bowers over a year ago, with staff of the University of Ife, to plan administration of four of the University Series Tests - Reading Comprehension, Verbal Analogies, Reading Speed, and Quantitative Reasoning - to approximately 2,500 students at the University. Test scores were to be correlated with background measures, performance data, and presently-used university admissions test scores. Repeated requests by TEDRO to the University of Ife to set a definite testing date have so far been unsuccessful despite initial acceptance of the planned project.

Patience is necessary to obtain the approval of faculty and administrators, and to overcome the resistance of some faculty to a testing program they regard as possibly tampering with accepted and working admissions practices. University faculty willing to cooperate and plan an objective experimental testing program are usually outnumbered by their conservative colleagues on any campus. In the United States for example, where objective psychological testing has a long history, the decision by university admissions committees to introduce objective selection tests is compelled more by enrollment pressure than by enthusiasm for objective testing, despite the overwhelming evidence supporting its utility for college selection. The best one can hope for at this particular time in Nigeria, and in the other member countries of WAEC, is the possibility of conducting small studies with cooperating colleagues at the universities and using the evidence of this initial research to gain the support of faculty for more extensive investigations. Thus, exploratory studies are clearly more strategic than scientific, and are realistically inappropriate for full-scale revision of existing university selection batteries.

6. Revise the Law Faculty Admissions Test.

The Law Faculty Admissions Test consists of five tests selected from those in the University Series Battery - Antonyms, Reading Comprehension, Verbal Analogies, Principles and Cases, and Reading Speed - plus an additional objective test called the Nigerian Legal Information Test. Scores for the battery were gathered for entering Law Faculty students at the University of Ife in 1965, 1966, and 1967 for use as predictors of success in courses of study in the Law School. Sample sizes for entering students from these three years were, respectively, 17, 109, and 108. Achievement criteria were eventually obtained for only a portion of these entering groups and a preliminary validity study by the TEDRO Aptitude Testing Department, which has assumed responsibility for work in revision and validity analysis of the Law Faculty Admission Test, reported statistically non-significant correlations between test scores and completion of university study. This evidence, however, is inconclusive. Additional performance criteria should be obtained for further analysis. Advisory time during the final year of the contract was not allocated either to collect

additional data or to initiate new studies needed for revision, since other targets were considered to have higher action priorities and greater institutional development payoff. Furthermore, TEDRO Research Officers can capably arrange these kinds of studies under the direction of the Department Heads, in either the Aptitude Testing Department or the Research Department, who have assumed responsibility for such validity studies and who can accommodate them within their own work schedules.

It is recommended that revision of the Law Faculty Admissions Test be included as part of the studies planned to validate the University Series Test Battery and which may lead to its revision. As discussed in the previous target, it is necessary that revision be based on large samples. Within a suitable program of testing at the university level, further study of the Law Faculty Admissions Test is simply an analysis of an additional university group in the overall study of differential predictability.

7. Revise Civil Service Entrance Examinations.

Revisions of the Nigerian Civil Service Entrance Examinations were underway in TEDRO in 1969. In 1970 the name of the examination was changed to the Public Service Examinations and included a 50-item objective test of Current Affairs. The revision of this objective test is an annual production activity of the TEDRO Aptitude Testing Department, which is responsible each year for item commissioning, item editing, trial-testing, item selection, and final production.

The Ghana Civil Service Commission introduced for the first time, in 1970, a 1-hour TEDRO-developed objective test for the selection of University graduates applying for government service. This test measures high-level general ability and consists of item types such as opposites, analogies, quantitative word problems, conclusions, word substitutions, and deductive reasoning. In theoretic terms, these are measures of convergent thinking, evaluative thinking, and flexibility. A study by Dr. Skurnik reported moderate item difficulties and a Kuder-Richardson reliability estimate of .82 for the test administered to 92 graduates in 1970, mostly in Ghana (33). The total score was correlated with several university achievement criteria for this group: number of and average grade for A-Level School Certificate subjects taken prior to university admission, number of and

average grade in O-Level School Certificate Examinations taken before university study, class and degree awarded, and type of university course taken, either honors or general. Total score on the Civil Service Graduate Entry Test was significantly correlated with class of degree earned (.40) and with number of O-Level School Certificate Examinations taken (-.40). This latter negative value possibly reflects the fact that lower ability students may attempt more O-Level than A-Level subjects at the end of their secondary school study. The paper concludes with a section detailing the item analysis conducted to revise the test. This examination, like the Current Affairs Test in Nigeria, is annually produced, item analyzed, and revised by TEDRO Accra.

B. Research Targets.

1. Conduct Validity Studies of the University Series.

The concurrent validity study mentioned under Target A-5 was conducted by Dr. Fiks in 1970 and its results were presented by him at the Seventeenth International Congress of Applied Psychology (Liege, 1971) (30). His presentation discussed present West African university level admissions practices, which derive historically from the British educational model. For example, five passes at the School Certificate O-Level and two at the School Certificate A-Level are generally required for admission, with the further restriction that one subject must relate to a candidate's intended course of study. He emphasized that the use of objective examinations for admissions decisions is largely in the proposal stage. As was pointed out in the earlier discussion of Target A-5, this implies that planning the experimental use of objective tests for this purpose may encounter resistance to change in well-established traditional practices.

The study was a postdiction of two criteria for a group of 70 university graduates: their class of degree, and their ratings on motivation and attitude. Scores on eight of the University Series Tests were correlated with these criteria. Intercorrelations among the test scores were moderately low, averaging approximately .30. Multiple correlations of the best-weighted composite of the eight test scores were .35 (corrected to .18 for shrinkage) and .41 (corrected to .22), respectively, with the two criteria. Since university selection in West Africa is highly competitive, with only about one in eight candidates admitted, the resulting restriction in range reduces the true relationship between predictors and criteria for an unrestricted population. Ratings of willingness to work and of dependability correlated

.40 (corrected to .27) and .50 (corrected to .44), respectively. When the total group was classified according to university curricula taken into Arts, Social Science, and Natural Science, mean test scores for the three groups on Quantitative Reasoning, Science Information, and World Information varied significantly in expected directions among the three groups.

Delay in conducting the large-scale University of Ife study has been discussed above under Target A-5. Planning for this study, which was to be conducted in late 1972 or early 1973, occupied considerable TEDRO professional time. The study was not planned to simply estimate overall validities, but to provide meaningful information regarding the use of the University Series Tests for differential academic prediction, placement, and guidance. Furthermore, the design permitted estimates of the comparative merits of objective and traditional admissions criteria for the prediction of university success in various curricula. Even though the study did not begin before the project ended, planning time given to it was not wasted. When arrangements for administering the tests are scheduled, TEDRO will immediately conduct the administration and complete the analyses specified in the design.

Two small-scale administrations of subtests of the University Series were conducted by TEDRO in late 1972 at the University of Lagos. Four University Series Tests - Antonyms, Verbal Analogies, Quantitative Reasoning, and Reading Comprehension - were administered to 126 first-year students enrolled in the National Certificate of Education program in the College of Education. Three University Series tests, all of the above except for Reading Comprehension, were administered to 146 second-year students in this same program. This produced data for a small validity study jointly implemented by TEDRO and Dr. E. O. Obe of the College of Education.

2. Conduct Validity Studies of the Nursing Council Common Entrance Examination.

Approximately 8,000 candidates annually apply for admission to Nursing Schools in Nigeria. The annual candidate population is somewhat larger in Ghana. The examinations used for selection to nursing training, together with other admissions criteria, vary in the two countries and have

been revised from time to time. Most of the tests included in the entrance examination, however, have been those from the I-D series of aptitude tests. Selection is highly competitive; approximately 3 percent of the candidates in Ghana, and 5 percent of the candidates in Nigeria, are annually admitted to training. Admission in Nigeria is controlled by the Nursing Council of Nigeria and in Ghana by the Central Recruiting Bureau of the Ghana Board of Nurses. The TEDRO Aptitude Testing Department administers all tests in Nigeria, and testing in Ghana is handled by TEDRO Accra. Validity studies are especially important in both countries, since the allocation of scarce professional training resources should be given to those candidates most likely to succeed. Also, because the lives of many thousands of candidates are affected by the examination results, validity must be established publicly.

A validity study was conducted in 1969 by Dr. Akeju, based on the test results of 55 nurses in training at the Lagos University Teaching Hospital (10). Correlations ranged from $-.18$ to $.36$ between scores on eight selection tests in the battery and various nursing school grade criteria, and from $-.25$ to $.49$ for criteria based on scores for various practical tasks. Dr. Akeju also analyzed the test-retest correlations for scores achieved by candidates who failed to be selected at the first test administration and repeated the test after six- and twelve-month intervals. He reported a general decrease in score stability with increasing time between testings, and a general increase in test scores over time.

In Ghana, Dr. Skurnik and Dr. Aghenyega conducted a validity study of scores of four I-D selection tests against two criteria of achievement in nursing school for a sample of 272 students admitted in 1969 and 1970 to 12 schools of nursing (49). The predictor tests were I-D Verbal Analogies, I-D Reading Comprehension, I-D Memory, and I-D Arithmetic. Criteria were grades at the end of the last year in training and instructors' ratings of overall success in training. Validities for the two verbal tests were approximately $.20$ for both criteria which, when corrected for restriction due to extreme selectivity, were estimated to be in the $.60$ to $.70$ range. The two non-verbal tests did not usefully predict either of the criteria, so the decision was made to continue use of the two verbal tests for future selection, but to replace the non-verbal tests with the I-D Table Reading and Science Information tests.

Two studies were completed in Nigeria in 1973 by Dr. Laryea and Dr. Bowers. In the first, scores on the eight-test selection battery were correlated with scores on the State Final Examination Test in nursing given at the end of the 3-year training course (62). Data were based on 175 trainees who in 1969 had been admitted to seven nursing schools. Validity coefficients ranged from $-.02$ for I-D Verbal Analogies to $.30$ for I-D Graph Reading, with three of the predictor tests having significant validities at the $.05$ level: I-D Graph Reading, a Nursing Information Test, and the total battery score. Stepwise regression analyses indicated that the first two of these predictors accounted for most of the predictive validity of the entire battery. Possible reasons advanced for the low observed validities were range restriction due to selection, predictor and criteria unreliability, the attrition of low ability students following admission which may further restrict range, and the lengthy time interval between the administrations of the selection tests and the criterion test.

The second study in Nigeria was essentially a replication of the first, with the major difference being that subscores on the Final Examination criterion test were also obtained. Subscores on the criterion test were highly intercorrelated, in general, except for the practical subpart which was also uncorrelated with all eight predictor tests. The other criterion tests were uniformly and significantly related to I-D Graph Reading, I-D Manual Dexterity, I-D Verbal Analogies, and I-D Reading Comprehension. Significant correlations ranged from $.17$ to $.30$ for this sample of 211 nurses trainees admitted to nursing schools in 1970. Stepwise regression analyses indicated that I-D Graph Reading and I-D Verbal Analogies accounted for most of the predictive efficiency of the battery.

It appears from these two related studies that a verbal factor and some perceptual-space-motor factor is significantly predictive of success in nursing school. Due to the different predictors found by these two studies, additional evidence is needed to clarify the nature of the important trait measures. The one recommendation that can be made on the basis of current data, however, is that the present test battery should be shortened by the elimination of tests unrelated to achievement in training as evidenced in the two Nigerian studies and the two Ghanaian studies.

3. Conduct Validity Studies of the Teachers Training Institutional Battery.

Two 4-year follow-up validity studies were conducted in Ghana with respect to this target by Mr. Safo, Mr. Kofie, and Dr. Skurnik. They studied the relationship between final examination grades in teacher training school and entrance test scores. Their first study examined the relationships between scores on the Examination for Entry to Four-Year Teacher Training Colleges, taken by 686 students in 1965, and their scores on the National Teacher Training Council Certificate A Examination taken in 1969 (46). The same predictor and criterion scores were obtained for a sample of 752 students tested in 1966 and 1970, respectively. Combined results showed that males scored higher than females on both examinations. Within-sex, within-year pooled correlations were computed among all predictor and criterion scores. English Composition scores on the selection test were significant predictors of Certificate A scores in English, Geography, and History for both the male and female 1965 entrants. English Composition scores on the selection test and Certificate A English scores were significantly related for the male and female 1966 entrants. Validities were low and were undoubtedly attenuated by restriction in range, since only about 8 percent of the candidates annually tested for admission are selected for teacher training. The length of the time interval between the administration of the selection test and the Certificate A Examination also affects the level of score intercorrelations, since changes resulting from the interaction of student abilities and instructional programs take place in all learning situations. While additional data should be routinely analyzed for subsequent groups, the studies conducted in Ghana suggest that the arithmetic parts of the entrance tests might be discounted, for scores on it neither correlate with the criterion of teacher training achievement nor logically operate as suppressor variables. Further study is also suggested for identifying the language ability factors that appear to remain stable during training time.

4. Conduct Validity Studies of the Technical Training College Battery.

A single validity study in Nigeria was conducted with respect to this target. In addition, related work was also completed on the construction of alternate versions of the I-D tests, called the Potential Abilities Tests (PAT), from which the Technical Training College Battery tests are selected.

In 1972 Dr. Akeju and Dr. Axtell correlated I-D test scores with class grades at the completion of two years of school for 561 pupils enrolled in Form II in 32 secondary schools in the Mid-West State of Nigeria and 41 students enrolled in the Ibadan College of Technology (37). Secondary school examinees were grouped into five courses of study, with the College of Technology group comprising a sixth technical group. Stepwise regression analyses were calculated and multiple correlations between the best-weighted linear composite of the significant predictors for each group were found to be .26 for the commercial group, .33 for the general group, .37 for both the academic and accounting groups, .46 for the secretarial group, and .30 for the technical group.

Eleven to nineteen tests were administered to the various groups, and the important finding was that different combinations of the I-D tests administered at admission were best for predicting classroom grades in different programs of study. While not an unexpected result, this does confirm the rationale for the use of a multiple aptitude battery such as the I-D series, which rests on the assumption that the tests are differentially predictive of success in varied settings. The best predictive tests, for two years of technical training, in order of stepwise entry, were I-D Graph Reading, I-D Mechanical Information, I-D Memory, I-D Science Information, I-D Coding, I-D Reading Comprehension High, and I-D Figures. These tests match all but one of the four tests in the highest Basic I-D Technical Series, and two of the four used in the second highest Basic I-D Technical Series. The study confirms the use of the present battery for selection into academic programs at the advanced technical and scientific level rather than at the semi-skilled or skilled trade level. However, significant predictors of success in the technical program group in this study also include measures of mechanical information, memory, and coding that are not included in the high-level I-D Technical Series. This suggests that these transformation and experience-acquired abilities are also important predictors of success in an academic technical setting. It should be emphasized that the multiple correlation of .80 is unquestionably inflated by considerable error-fitting, but would nevertheless be significant after correction for shrinkage and closer to the .40 validity levels reported in the I-D Technical Manual.

Although validity studies on this target were reduced in scope for reasons mentioned earlier, work done on the development of alternate versions of the I-D tests has relevance for further investigations of validity. PAT development was conducted in the Research Department of TEDRO during the period of this project; an extension of work began in this area under the previous contract. All subsequent printing of the PAT series will be done locally.

All but seven of the PAT alternate tests for the I-D tests can be administered as quickly as final copy is ready for printing. The alternate PAT versions that have been developed to date include all eight tests in the two high-level Basic I-D Technical Series and seven of the eight tests found to be significant predictors of technical school achievement in the study by Dr. Akeju and Dr. Axtell (37). Until further work indicates that machine-scored versions of the following three I-D Dexterity Tests can be successfully produced, they will continue to be used in their original form: Manual Dexterity, Finger Dexterity, and Marking. Work has not begun to any substantial degree on Checking, Mechanical Information, Similarities, and Spoken English.

The present status of PAT development is summarized below:

- a. Tests item-trialed and developed: Eight tests are developed, trial-tested, and ready for printing; Verbal Analogies Low, Verbal Analogies High, Reading Comprehension Low, Reading Comprehension High, Memory, Names, Science Information, and World Information.
- b. Tests having parallel forms developed, with item-trials unnecessary: Six tests were prepared by following the basic I-D test format and by specifying strict rules for the generation of stems, alternatives, and item arrangement: Boxes, Graphs, Figures, Coding, Arithmetic, and Tables.

It should be mentioned that when local printing of the PAT series begins, suitable standards of printing precision for machine-scoring may not be available in West Africa. Use of a separate answer sheet will

be introduced into the PAT aptitude testing program to avoid this problem. This factor will alter the testing situation and affect reliability, which will in turn affect validity. Therefore, it is very possible that validities for the PAT series will differ from those found for the I-D series. When the decision to change to the PAT series is made, validities will need to be reestablished for the PAT series.

5. Conduct Validity Studies for the Common Entrance Examination Battery.

In terms of its importance in the lives of children and parents in West Africa, the Common Entrance Examinations used to select pupils for admission to secondary school is second only to the School Certificate Examinations. Success on this examination is necessary if the examinee's education is to continue in an academic program beyond the primary school level. In many respects, the selection of those who are to advance to secondary school study in less developed countries is parallel to college selection in countries having a longer history of public education: pressures are intense to do well, and status and social mobility often depend on whether or not the student is among those selected for further education.

The Common Entrance Examination is a completely multiple-choice objective test battery. Four common tests administered throughout each of the member countries are English Language, Arithmetic, Verbal Aptitude, and Quantitative Aptitude; Nigeria also tests Modern Mathematics and Ghana tests Social Studies. In 1972, the number of students tested in the four countries was approximately 234,000. In 1968, the year before the present project began, approximately 184,000 students took the Common Entrance Examinations in the four countries. Growth is expected to continue and to accelerate as the base of the educational system expands with national growth and development. The size of the examination program and its importance to individuals and to the countries demands WAEC's careful attention to its measurement characteristics and especially to its effectiveness in validly selecting candidates for admission to limited secondary school facilities.

In 1970, a validity coefficient of .30 was reported by TEDRO between the total score on the Common Entrance Examination and grades in English, Mathematics, Education, Geography, and History for a sample of 686 teacher training school graduates in Nigeria. The correlation is low, partly due to the effects of restriction in range, a factor operating in every validity study involving the Common Entrance Examinations, since each is a follow-up study of student performance after the battery has been used to select them. It is probably impossible to state a precise value for the degree of selectivity that usually operates, since other factors enter into the selection decision. At the present time, however, it is likely that the overwhelming majority of students selected into secondary school score at the 75th percentile or higher on the Common Entrance Examination.

Dr. Akeju, in examining frequency distributions for the Common Entrance Examination administered in Nigeria in 1970, recommended that: (1) difficulty levels on the various subtests should be equalized; (2) subtest scores should be standardized to a common scale before a total score is derived; and (3) average item difficulty should be placed at a somewhat higher level since the best discriminations made by the test are those among the more academically able students (11). Subtests are presently standardized, to a scale with a mean of 50 and a standard deviation of 15, before the total score is determined.

Dr. Skurnik and Mr. Safo reported correlations between scores on the Common Entrance Examination taken by 637 Ghanaian pupils in 1964 and their subject grades in School Certificate Examinations taken five years later. The Common Entrance Examination (CEE) English Test was the best predictor of School Certificate (SC) English Composition with a correlation of .40. CEE Arithmetic was the best predictor of SC Mathematics with a correlation of .35. The best predictor of grades in other SC subjects was the CEE Total Score, showing correlations of .42 with SC Physics, .27 with SC Chemistry, .48 with SC Biology, .35 with SC Geography, .32 with SC History, and .38 with SC General Science. These are very impressive validity coefficients considering that selectivity was extreme and that five years intervened between the two testings (19).

Dr. Akeju reported correlations between scores on the Sierra Leone Selective Entrance Examination (SEE), taken by a sample of 278 pupils enrolled in five secondary schools in Freetown, and their grades on specially developed first year achievement tests that he constructed with the cooperation of teachers in Freetown. He reported an interaction between sex and predictability; SEE scores predicted English and Mathematics achievement for boys and girls, but were predictive of achievement in general science and social science only for girls. It is possible that different selection factors operate for the two sexes.

In Ghana, Dr. Skurnik correlated scores on the 1971 CEE with teachers' ratings of the first year achievement of 126 pupils in four secondary schools (48). To eliminate possible criterion contamination, ratings were obtained from the teachers before the CEE results were released. For five groups (two sections in one school), CEE total score correlations with teachers ranking ranged from .77 to .83 and the subtest correlations on the CEE with teachers' rankings ranged from .18 to .47.

In 1972, Dr. Axtell completed a validity study of the CEE administered in The Gambia using secondary school overall class ranking for three years as a criterion of achievement for a sample of approximately 650 pupils. The median correlation for four school groups was .68, corrected for the effects of selection (36).

Among other studies of the CEE conducted by TEDRO staff, Dr. Axtell and Dr. Bowers reported a study in 1972 based on a sample of primary schools, in six northern states of Nigeria, that were classified as rural or urban by the State Ministries (55). Data collected were 1972 CEE scores of pupils in these schools. Significant rural-urban effects in favor of the rural schools were found for the CEE English and the CEE Verbal Aptitude scores. A detailed post hoc analysis showed the presence of sex by type of school interaction: rural-urban effects were present only within the female group, and sex differences were present only within the schools classified as urban. A possible explanation advanced for this unexpected result was that girls enrolled in rural primary schools in these states represent a more selective group, on the basis of their verbal abilities, than do the girls enrolled in urban schools. Dr. Soriyan is now planning a

further TEDRO study of possible rural-urban effects on CEE performance and has started work on a survey of State mean differences on the CEE administered in Nigeria in 1972.

A 1972 study by Dr. Agbenyega investigated whether the introduction of the CEE Social Studies Test in that year resulted in significant gains for pupils in schools of differing instructional quality (50). The notion had been advanced that children in the more advantaged schools scored higher on the verbal and quantitative tests of the CEE because the teachers in these schools were devoting more time to teaching for the test by directing their pupils' learning toward material related to CEE content. Since the CEE Social Studies Test was introduced in 1972, it was believed social studies teaching was more similar that year across all types of schools, and that pupils' scores on the CEE Social Studies Test in the different types of schools would be more similar than on the other tests. Thirty-three schools were classified as rural, urban, experimental (all public), and preparatory and international (all private). An additional random sample of 12 schools was chosen as representative of the nation as a whole. Mean differences favored the preparatory and international school group over the other groups in English and Verbal Aptitude, with the mean for students in rural schools slightly lower than the rest. Mean scores for rural schools were lower than the national sample of schools in English and Verbal Aptitude. On the Social Studies Test, mean differences favored rural over urban schools, rural over experimental schools, and rural over the national sample of schools. The international and preparatory school group was superior to all other groups on the Social Studies Test despite the short period following the introduction of this test. The important finding in this study is that differences do exist among schools. The fact that there is a common set of examinations that are valid indicators of scholastic ability at the late primary school level enables researchers to estimate school effects on pupil performance that are independent of pupil ability.

In summary, the several validity analyses and related studies described above show the Common Entrance Examination to be a valid test of scholastic ability in all four member countries of WAEC. With the installation of the new computer system in WAEC, validity studies and sample surveys of

schools involving the CEE can be accomplished each year as a routine activity directed toward the continuous monitoring of this important examination.

6. Conduct Validity Studies of the Oral English Examination for the West African School Certificate Level.

Research on the validity of the 150-item Oral English Examination was discussed under Target A-2. Three types of validity assessment confirmed the content, construct, and concurrent validity of this examination. Test scores were internally consistent and were significantly related to the optional McCallien Test administered as part of the School Certificate Examinations, were also significantly related to teachers' ratings of English Language proficiency, and sharply discriminated between native speakers of English and second language speakers in West Africa.

Further validity analyses are necessary to evaluate the effectiveness of the test over a variety of schools and settings, but these studies still await the replacement of the McCallien Test by the TEDRO Oral English Examination in the School Certificate Examinations. This will take place in 1974. Delays in earlier introduction resulted because of the equipment costs involved, and the vast amount of administrative planning and on-site preparation needed to administer an audio-taped examination throughout four countries.

C. Institution Building Targets.

1. Develop and Mobilize the Test Development and Research Office.

This activity target is the project's central objective and is the general objective that encompasses the remaining six institution building targets. As mentioned earlier, Dr. Snider was Acting Director of TEDRO from January 1969 until July 1971, when TEDRO came under the permanent direction of West African staff for the first time since its establishment in 1966. From July 1971 until project completion in August 1973, contractor activities with respect to this target were advisory and supportive to the West African staff. These activities involved overall forward planning, conducting of existing research and development activities, strengthening of TEDRO's identity and capability within WAEC's institutional framework, and extension of TEDRO's relationships with outside organizations.

a. The Institution.

At the beginning of this project, Dr. Snider established regular meetings of the professional staff, the Section Heads, and senior officers. Meetings were held with prescribed agendas, committees were formed, and administrative responsibilities were distributed on a wide basis. The committees within TEDRO dealt with matters of finance, administration, and support staff. At this same time, new equipment was purchased, including a vehicle, typewriters, and a copying machine; TEDRO letterhead stationery and forms were updated. TEDRO's departmental structure was reorganized along more functional lines in 1969 when its previous sections, basically defined in terms of specific examinations programs, were replaced by the present departments with the specialized functions of research, aptitude testing, and item preparation. This resulted in economies both of effort and of purpose.

A major institutional activity in 1970 was TEDRO's move from older premises at 1 Hagley Street in Yaba to the newly-constructed 12-story Examinations Building of WAEC's Nigerian National Office at 21 Hussey Street, Yaba. TEDRO occupies three floors in this building, with its Library housed on one floor of the Examinations Building Annex. In addition, there is secure storage space located elsewhere in the Examinations Building. A second major institutional development step was taken in 1970 by the posting of Dr. Skurnik, AIR Technical Advisor to the TEDRO branch office in Accra, to conduct and expand the activities begun in 1968 by Dr. Agbenyega while the latter took study leave to obtain his Ph.D. degree at Syracuse University.

Planning for yet broader extensions of TEDRO activities was effected in 1971 when WAEC established a TEDRO branch office in Freetown. This office was formally opened in November 1971.

b. Staffing.

A major landmark in institutional development occurred in mid-1971 when Dr. C. O. Agbenyega assumed the position of Acting Director of TEDRO upon his return from study in the U.S. Dr. Akeju had been the first Ph.D. returnee under the coordinated Ford Foundation Training Program, in

1969, and had also at various times served as Acting Director and Head of the Aptitude Testing Department. Beginning in July 1971, however, the office of Acting Director was permanently placed in West African hands with the departure of Dr. Snider. In the summer of 1971, Dr. Soriyan, who returned from his doctoral training program at the University of Pittsburgh, was assigned the position of Head of the Item Preparation Department. Mr. During, who had completed his master's program at the University of Toronto, was made Head of the TEDRO Freetown Office. By the end of 1972, Dr. Laryea and Dr. Majasan had also completed their doctoral programs, returned to duty in TEDRO, and were posted as Department Heads. In January 1972, Dr. Akeju was appointed by WAEC as Director of TEDRO and Dr. Agbenyega was appointed Deputy Director and Head of the TEDRO Accra Office. Thus, by 1972 TEDRO staffing was complete and stabilized for its work ahead. Planning meetings involving TEDRO management, advisors, and other offices of WAEC have since worked to develop plans for TEDRO's role within the Registrar's overall 5-year plan for WAEC.

Recent staff additions to TEDRO were made in 1971 by the appointment of a French subject officer, and in 1972 and 1973 by the appointment of additional subject and research officers at both the TEDRO Head Office and the TEDRO Accra Office due to the increase in the number of objective tests to be administered in the School Certificate Examinations. Other important additions to the TEDRO staff have been the appointments of two Executive Officers and a TEDRO Accountant to handle budget, administration, and personnel details.

c. Professional Linkages.

All of the TEDRO staff have developed numerous contacts with university faculty members and with allied professionals in other institutions; many of these are discussed in a later section of this report under appropriate targets dealing with the extension of services to the member countries.

During the period of this project, TEDRO staff have published articles in professional journals and have presented papers at professional meetings. Several of their accomplishments are listed on the following page.

Articles:

1. Akeju, S.A. Recording aptitude test responses on separate answer sheets in Nigeria. British Journal of Educational Psychology, 1971, 41(3), 324-326.
2. Akeju, S.A. The reliability of General Certificate of Education Examination English Composition papers in West Africa. Journal of Educational Measurement, 1972, 9(2), 175-180.
3. Akeju, S.A. The relationships between Selective Entrance Examination scores and secondary school achievement. Sierra Leone Journal of Education, 1972, 7(2), 17-21.
4. Akeju, S.A. Reliability of the multiple-choice tests of the West African Examinations Council. West African Journal of Education, 1972, 16(2), 167-169.
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2. Cho, S.C. Procedure for group test administration in developing countries. NATO Conference on Mental Test Development, Istanbul, Turkey, July 1971.
3. Fiks, A.I. Validity and associated findings of a higher intellectual aptitude test battery in West Africa: The University Series Tests. NATO Conference on Mental Test Development, Istanbul, Turkey, July 1971.
4. Majasan, J.K. College students' achievement as a function of student-teacher cognitive compatibility. Cross-Cultural Conference on Psychology, Ibadan, Nigeria, March 1973.
5. Soriyan, M.A. Statistical characteristics of June 1971 WASC/GCE Examination Papers. Cross-Cultural Conference on Psychology, Ibadan, Nigeria, March 1973.

Work in establishing a new professional journal, the West African Journal of Educational and Vocational Measurement, was begun in 1971 by TEDRO advisory and West African staff. An editorial board was formed that included West African educators, guidance specialists, TEDRO staff, and AIR Advisors. Articles were received, circulated, and edited; details of production and costs were handled within TEDRO and involved the TEDRO Librarian and its Executive Officer. The first issue of the journal, which will be published semi-annually, appeared in March 1973. The editorial policy is to publish articles principally dealing with practical applications of educational and psychological research to problems of interest to West African practitioners. The establishment of this new journal will increase TEDRO's visibility throughout the educational community and bring the attention of its readers to the fact that an institutional and professional capability for research and test development exists in West Africa. TEDRO technical reports in the series abstracted in the Appendix are distributed to Ministries, libraries, and other WAEC offices.

During the period of this contract, advisors and West African staff of TEDRO have also taught courses at the university level in educational and psychological measurement. In 1969, Dr. Fitch conducted weekly seminars at the University of Ibadan, and Dr. Akeju taught in the College of Education at the University of Lagos. Dr. Soriyan, Dr. Axtell, and Dr. Bowers taught sections of a course in applied psychology at the University of Lagos in 1972 and 1973. These activities are beneficial for the opportunities they provide for the exchange of research ideas with university colleagues.

WAEC's committee structure was reorganized in 1973 so that National Subcommittees of the TEDRO International Committee were established in each of the member countries, bringing TEDRO staff into closer ties with the educators and professionals in each country and enabling TEDRO to plan and to deliver research and testing services more directly to the respective countries. WAEC's preeminent position among the developing countries of the Commonwealth, as the longest-established and certainly the largest Examinations Council, results in its advice being sought by other Examinations Councils. TEDRO's contributions to these exchanges involved Dr. Agbenyega's presenting an item writers' course for the East African

Examinations Council staff in 1972 and by Dr. Skurnik's, Dr. Akeju's, and Dr. Soriyan's participation in the Commonwealth Conference on Public Examinations hosted by WAEC in March 1973 at Accra.

The above activities, plus those described under Target D-3, highlight the overall institutional impact of TEDRO, and illustrate its linkages with significant individuals and institutions. With its staff and delivery capability, TEDRO is a unique organization in all of Africa. Its establishment within WAEC enables it to operate with purpose and effectiveness in the educational, professional, and governmental sectors of the member countries.

2. Establish and Develop a Branch Office of TEDRO in Accra.

Work in the TEDRO Accra Office has grown steadily since its opening in 1968. The office is now well established and active within WAEC, conducting TEDRO activities in Ghana and collaborating closely there with other educational and professional organizations.

The TEDRO branch office was opened in 1968 by Mr. C. O. Agbenyega, the single TEDRO Principal Research Officer then assigned in Ghana to develop and promote aptitude testing, to carry out related research, and to provide services. During the initial year, work was begun on trial testing, item preparation, and the training of item writers. Two additional Research Officers were posted to TEDRO Accra in 1969: Mr. E. N. Safo and Mr. I. K. Nyamekye. Later that year, Mr. Agbenyega was granted study leave to work toward his doctoral degree at Syracuse University. The staff was further expanded that same year by the assignment of two Ford Foundation Research Fellows. Dr. L. S. Skurnik arrived in Accra in March 1970 to begin his 3-year tour there as the AIR Technical Advisor. Following the 1970 expiration of the Ford Foundation Research Fellow Program at TEDRO Accra, and the resignation of Mr. Nyamekye during 1971, all work of TEDRO Accra was conducted from July 1971 through April 1972 by Mr. Safo, Dr. Skurnik, and one Research Fellow whose attachment to TEDRO was extended to alleviate the staff shortage. Dr. Agbenyega assumed duty in TEDRO Accra as Deputy Director and Head of the TEDRO Accra Office in April 1972. Two Research Officers, Mr. Kofie and Mr. Brown, were appointed in early 1973. In March 1973, Dr. Skurnik completed his tour.

The work of the four professional staff members of TEDRO Accra consists of TEDRO's general activities in (1) research, (2) test development, (3) aptitude testing, and (4) consultation services to public and private organizations.

a. Research.

Research conducted by TEDRO Accra with respect to the analysis of the School Certificate Examinations and the validity of the Common Entrance Examinations, the Nursing Selection Examinations, and the Teacher Selection Tests, has been detailed in the earlier discussions of Targets A-1, B-2, B-3, and B-5. Other research by TEDRO Accra includes a study comparing standards of English and Mathematics, which has applicability to the difficult question of cross-cultural equivalency in certification standards (18).

In 1973, Dr. Agbenyega reported on the effects of grouped-subject requirements on the awarding of different certificate levels in Ghana. Briefly, the highest Division I School Certificate requires a high aggregate grade in six subjects with at least one subject from each of four groups: languages, general subjects, mathematics, and natural science. Dr. Agbenyega examined the records of students with a sufficiently high aggregate score for a Division I Certificate but who did not meet the subject-group requirements. Of 256 candidates studied, 170 did not achieve Division I status because of not passing English and Mathematics, and 86 others because of not passing Mathematics. Implications of this policy are discussed in terms of the different interests of students and relevancy of their courses for future careers. Recommendations are made to review and perhaps modify present regulations (56).

b. Item Preparation.

Training of item writers by TEDRO Accra is discussed under Target C-6. As part of its routine annual production schedule, TEDRO Accra prepares three tests for use by the Ghana National Examinations Department for Ghanaian Public Services Examinations. These are the General Paper (test), the English Paper for the Graduate Entry Competitive Examination, and the General Paper for the Clerical Officers Competitive Examination.

Tests are also prepared each year for the Four-Year Teacher Training Entrance Examination, the Teachers' Certificate A English Examinations, the Middle School Leaving Certificate Examination, and certain of the Common Entrance and School Certificate objective tests. Trial testing is conducted for the objective portions of the Ghana Middle School Leaving Certificate Examination, the Ghana Common Entrance Examinations, and the School Certificate Examinations. The new TEDRO Research Officers are now also responsible for the commissioning of items for the Statistics and Business Methods objective tests to be introduced next year in the School Certificate Examinations.

c. Aptitude Testing.

An extensive aptitude testing program is conducted by TEDRO Accra, and a major part of this is concerned with the selection of nursing trainees. Each year the TEDRO Accra Office administers tests for the selection of Senior Registered Nurse trainees at Korle Bu Nurses Training College, for the selection of nursing trainees on behalf of the Ghana Nursing Recruitment Board, the selection of Public Health Inspectors on behalf of the Ghana Ministry of Health, and the selection of students to post-basic nursing courses at the University of Ghana in Legon. Tests for these programs were administered in 1972 to approximately 11,000 candidates and to an equal number in 1973. Other aptitude tests were administered in the latter half of 1972 to 270 candidates for selection to apprenticeship courses in motor vehicle maintenance and electrical work, and to 250 candidates to a copy-typists course in the National Vocational Training Institute. In addition, aptitude tests were administered for the selection of administrative trainees for positions with the Volta River Authority, and for positions with Ghana Airways, Lufthansa Airways, and the Ghana Cocoa Marketing Board. Details of these testings are discussed under Target D-2.

d. Consultation.

Consultation with respect to the selection of appropriate tests and the interpretation of results must be provided as part of aptitude testing programs, because agencies and institutions involved with such programs need assistance in applying the tests to their specific selection and placement goals. Many relevant institutional ties have

been developed by Dr. Skurnik and Dr. Agbenyega. For example, Dr. Agbenyega established a strong early relationship with the Curriculum Research and Development Unit of the Ghana Ministry of Education. Lectures, seminars, and workshops on testing applications have been given by TEDRO staff to the National Vocational Training Institute of the Ministry of Labour and Social Welfare, the University of Ghana, the Ghana Association of Mathematics Teachers, the Ghana Association of French Teachers, the British Council, the National Clerical Training Board, and the Opportunities Industrialization Centre. Dr. Skurnik, just prior to the end of his tour in the Spring of 1973, organized a workshop in item-writing for the faculty of the Medical School of the University of Ghana in Legon. Since his return from graduate study, Dr. Agbenyega has served on several University and Ministry committees; these are discussed under Target C-5.

In summary, the TEDRO Accra Office is a strong and stable unit of TEDRO, carrying out now well-established schedules of test development, research, aptitude testing, and delivering services to the community through a growing network of relationships with significant organizations in Ghana. With the combined effort of the West African staff and Dr. Skurnik on a wide variety of tasks, the return of Dr. Agbenyega to direct the activities of the office, and the increase of needed professional staff, the work done on this target activity is one of the highlights of the project and one whose effects will multiply and expand in the years ahead.

3. Expand In-Service Training within TEDRO to Develop Skills in Test Development and Research.

All of the work undertaken by the AIR Advisors in TEDRO is in some respects indirectly related to in-service training.

Formal in-service training was provided at TEDRO Lagos and at TEDRO Accra to 24 Research Fellows supported by the Ford Foundation Training Grant awarded in 1967 (see Target C-6). In-service training to regular TEDRO staff is carried on continually, as in all testing organizations, through the professional interaction of staff in research seminars, manuscript preparation, and nearly all day-to-day research and development activities. In Lagos, the development of the Management Selection Test

Battery (Target A-3) was a joint effort by advisory and regular staff on a professional objective, as was test development in connection with the revision of alternate forms of the I-D tests (Target B-4). Both of these projects represented work requiring staff direction and training.

Throughout the life of the project the Research Department has organized a series of TEDRO Research Seminars. Topics of interest and relevance to professionals in educational testing and research are presented at these seminars to WAEC staff and to invited outsiders. A list of these previously-held seminars is shown on the following page (Table 6). These seminars are now routinely presented the last week of each month.

The most comprehensive formal in-service staff seminar was a concentrated program of testing and research topics presented during the first two weeks of July 1972. Topics covered were test construction, trial testing, use of the library, computer applications in TEDRO's work, and course evaluation. All staff members contributed to this program, which was attended by TEDRO staff and officers from other departments of WAEC.

In-service training at Accra during the period of this project has rested mainly with Dr. Skurnik's direction and assistance in all phases of the work of that office, and in his individualized training in the writing of items, data analysis, item-editing, design of research studies, and drafting of research reports. He has also maintained a strong working relationship with the Data Processing Department of the Accra National Office, so that all of the TEDRO Accra staff have had the opportunity to gain experience with this aspect of contemporary research.

Dr. Skurnik has also prepared a short summary of effective item-writing practices, called "The Item-Writer's Cookbook" which is useful to all TEDRO item-writers.

4. Establish a Computer Library for the Council's IBM 360/20 Computer.

The computer library, which is a collection of statistical and processing programs for summarizing data on WAEC's IBM 360/20 system, was essentially completed and available for use by the end of 1969. This contract target by necessity had to be completed early in the life of the

TABLE 6

TEDRO Research Seminars

Discussant	Title	Date
1. Dr. N. Frederiksen	The Development of Cognitive Abilities in Nigerian Village Children	Jan 1970
2. Dr. D.W. Dysinger	Adaptation of I-D Tests to Micronesia	Mar 1970
3. Dr. A.I. Fiks	Operating the Friden Calculating Machine	Sep 1970
4. Dr. S.A. Akeju	Methods of Reporting Test Results with Special Reference to Common Entrance Examination Scores	May 1971
5. Dr. A.I. Fiks	Cybernetic Scheme to Relate Test Results to the Direct Improvement of Education in West Africa	Sep 1971
6. Mr. H.H. Shettel	Nationally-Determined Goals for Education: Curriculum Change and Educational Standards	Nov 1971
7. Mr. H.H. Shettel	Evaluating Teacher Training and Classroom Teaching	Nov 1971
8. Dr. J.E. Bowers	Effects of Unreliability in Predictor and Criterion Measures on Regression Weights	Sep 1972
9. Dr. M.A. Soriyan	Statistical Characteristics of June 1971 SC/GCE Examination Papers	Nov 1972
10. Dr. J.E. Bowers	The Use of Point-Biserial and Biserial Correlation Coefficients for Test Construction	Dec 1972
11. Dr. M.A. Soriyan	Contribution of the Papers of a Subject to the Variance of the Total Score in the Subject	Jan 1973
12. Dr. J.E. Bowers	Validity of the Nursing Council Common Entrance Examination	Feb 1973
13. Dr. E.B. Laryea	Measurement of Attitudes	Mar 1973
14. Dr. S.A. Akeju	Staff Rating Scale	Apr 1973
15. Dr. J.E. Bowers	Multiple Predictors of Academic Success	May 1973
16. Dr. J.K. Majasan	College Students' Achievement as a Function of the Congruence between Their Beliefs and Their Instructors' Beliefs	Jun 1973

project since its completion was essential to the work of many other targets. The library of programs is used by TEDRO at both the Lagos and the Accra data processing installations, both in their routine test production tasks and in their statistical analysis of research data. The computer library consists of programs providing the following kinds of outputs:

- a. Means and Standard Deviations.
- b. Standardized Mark and Score Distributions.
- c. Frequency Distributions.
- d. Intercorrelations (Full Data Matrix).
- e. Item Analysis (Difficulty and Discrimination for All Options).
- f. Conversion of Score Distribution to Stanine Scale.
- g. Principle Components Extraction.
- h. Varimax Rotation.
- i. Summation of Part Scores.
- j. Standardized Mark Summaries.
- k. Multiple Regression and Regression Weights.

This set of programs will become obsolete in Lagos when the present computer system is replaced in early 1974 by the IBM 370/125 system, but will continue to be used for some time to come in Accra for the processing of data collected in Ghana, Sierra Leone, and The Gambia. The computer library in Lagos can easily be replaced by one of the standard and more powerful analytic packages such as SPSS or the BMD, and by a more sophisticated item analysis package such as MERMAC (the present system has neither the language nor the size to accept these types of analytic programs). The installation of the larger computer system will enable TEDRO, in its research, to apply more sophisticated analyses to larger samples and get faster results.

5. Conduct and Supervise Courses in Item Writing and Test Administration as Requested by Member Countries of the Council.

Item writing courses were held during April 1969 in Lagos and in Freetown, attended by 109 and by 23 university graduates, respectively. In August 1970, an item-writing course involving 30 participants was held in Lagos in preparation for the introduction of objective tests into the

School Certificate French Examination. Most item-writing for the various objective tests prepared by TEDRO is presently commissioned from experienced item writers outside of TEDRO who have been trained by TEDRO in these courses. Final editing and rewriting, however, continues to be a necessary part of the ongoing work of the Item Preparation Department.

Since TEDRO Accra has responsibility for preparing certain of the objective tests of WAEC, the training of item writers has been a regular part of its activity schedule. In early 1969, Mr. Agbenyega, then the TEDRO representative in Accra, traveled to Monrovia to deliver lectures on objective test procedures to 60 interested teachers and educators in the Department of Education.

TEDRO Accra also presented item writing courses in late 1969 at three Presbyterian Training Colleges, the Methodist Training College in Aburi, the Anglican Training College in Kumasi, the Specialist Training College in Winneba, and the Swedru Secondary School in Kumasi. These courses were specifically directed toward the writing of items for the Ghana Middle School Leaving Certificate Examination, the Common Entrance Examination and the Four-Year Teacher Training Entrance Examination. Altogether 50 teachers were trained in the writing of objective multiple-choice items. At the same time TEDRO trained several nursing tutors, at Korle Bu Hospital in Accra and at Okomfo Hospital in Kumasi, in the writing of attitude items. Fifteen item writers were trained by TEDRO Accra in Bathurst in 1969 for preparation of The Gambia Common Entrance Examination.

Soon after the arrival of Dr. Skurnik in 1970, the Ghana Ministry of Health requested training in objective test construction for nursing tutors. In early 1971, instructional sessions were held by Dr. Skurnik for several teachers and officials in the Ministry of Education in order to develop items for the Social Studies test that was introduced in 1972 into the Ghana Common Entrance Examination. In May 1971, a series of lectures on test construction was given by Dr. Cho and Dr. Skurnik as part of a 1-month training program in test construction and educational measurement offered at Abetifi and Asohore Training Colleges by the Curriculum Research and Development Unit of the Ghana Ministry of Education. Their lectures covered basic descriptive statistics, reliability

and validity, test score interpretation, test administration practices, and objective and traditional testing. In March 1973, Dr. Skurnik and Dr. Agbenyega conducted a workshop in item writing and test construction for faculty of the Medical School of the University of Ghana in Legon. Several seminars were presented, and materials specially prepared by TEDRO Accra were used in the training workshop.

6. Coordinate Ford Foundation Staff Training Program with Goals of the Project.

Earlier sections of this report have referred to sponsorship by the Ford Foundation Staff Training Program in Educational Measurement (Grant 63-272B) of the advanced graduate study of the Director of TEDRO, of TEDRO's three Department Heads in Lagos, and of the Heads of its two branch offices. Although this training represents an important and essential step in institutionalizing TEDRO, it was but one of the several aspects of the overall Ford Staff Training Grant. Five additional areas were funded under the grant: the Summer Participant Training Program, overseas attendance by WAEC senior personnel at workshops and special study courses, the support of special consultants to TEDRO and the Lagos National Office, support of the TEDRO Library, and the sponsorship of TEDRO Research Fellowships.

The Ford Training Grant was negotiated in West Africa by the AIR staff assigned there under the previous contract, Dr. R.R. Rowe, Dr. V.J. Cieutat, and Dr. S.I. Frenkel. As proposed, it was a 7-year program of training, at an estimated cost of \$392,000, coordinated with the development of TEDRO as targeted under the USAID/AIR contract. The grant was awarded in 1967 with its completion extending through the period covered by the present contract. The Grant was administered by TEDRO staff in West Africa with technical support and coordination provided by the International Studies Institute of AIR in Pittsburgh. Dr. Frenkel was responsible for its administration until August 1969 when Dr. Cho assumed this responsibility. When Dr. Cho departed Lagos two years later, administrative responsibilities were handed over to Dr. Agbenyega, then Acting Director of TEDRO, and later to Dr. Akeju, Director of TEDRO.

a. Overseas Graduate Level Training.

Seven TEDRO staff participated in this part of the grant program. Five of these received Ph.D.'s in the United States, one a Masters Degree in Canada, and one participant is now completing his Ph.D. requirements in the United States. Table 7 lists the TEDRO returned participants, their starting and completion dates of graduate training, their earned degree, and the university each attended. Total man-months of training was approximately 194.

b. Overseas Special Training.

Funding of WAEC senior staff attendance at short workshops, IBM training programs, and for a short study tour was also provided by the Ford Training Grant. Participants in these special training activities are listed in Table 8. Total man-months funded was 12.

c. Summer Training Program.

Four summer training courses in educational measurement, of ten weeks each, were presented in Lagos by teaching consultants in the Summers of 1967 through 1970; these consultants for the Summer Training Program were Dr. E. E. Larre in 1967, Dr. S. C. Cho in 1968, Dr. M. E. Orme in 1969, and Dr. M. Rosenfeld in 1970.

The 67 participants and observers in the Summer Training Program are classified in Table 9 by country of origin, except for WAEC staff. All participants were university graduates. Total man-months of training was approximately 130.

d. Special Consultants.

The three consultants listed in Table 10 were funded by the Ford Grant and worked on special projects for WAEC. Only one did so during the period of this contract. The total consulting months was approximately 12.

TABLE 7

TEDRO Returned Participants

Participant	Start	Completion	Degree	University
C.O. Agbenyega	Sep 1969 -	Jul 1971	Ph.D.	Syracuse University
S.A. Akeju	Jan 1968 -	Aug 1969	Ph.D.	Univ. of So. California
S.D. During	Sep 1969 -	Apr 1971	M.Ed.	University of Toronto
E.B. Laryea	Jan 1968 -	May 1972	Ph.D.	Columbia University
J.K. Majasan	Sep 1969 -	Sep 1972	Ph.D.	Stanford University
J.A. Osanyinbi	Sep 1971 -	in study	(Ph.D.)*	Univ. of Wisconsin
M.A. Soriyan	Jul 1969 -	Jul 1971	Ph.D.	Univ. of Pittsburgh

* Mr. Osanyinbi's first 12 months were sponsored by the Ford Training Grant.

TABLE 8
WAEC Senior Staff Special Course Participants

Participant	Date	Program
J.A. Cronje	May 1968 - Jul 1968	Study Tour
T. Boatın	8 - 22 May 1969	ETS Workshop
I.A. Okine	8 - 22 May 1969	ETS Workshop
D. Oyewole	8 - 22 May 1969	ETS Workshop
S.A. Esezeber	8 - 22 May 1969	ETS Workshop
J.M. Nukpe	Jun 1969 - Aug 1969	IBM Regional Educ. Center
O.A. Ufot	Apr 1969 - Aug 1969	IBM Regional Educ. Center

TABLE 9

Ford Summer Training Participants Classified
by Year and by Country

Country	Number of Participants			
	1967	1968	1969	1970
Nigeria	8	7	5	6
Ghana	2	3	4	5
Sierra Leone	1	2	2	1
The Gambia	-	1	1	1
Guyana	1	-	-	-
Iran	-	2	-	-
Liberia	-	-	1	-
WAEC	-	1	4	7
TOTALS	12	16	17	20

TABLE 10

Ford Special Consultants

Consultant	Period	Project
R.T. Johnson	7 Jun 1968 - 2 July 1968	WAEK Computer Dept.
R.T. Johnson	8 Dec 1968 - 27 Dec 1968	WAEK Computer Dept.
M.J. Quirk	1 Aug 1968 - 29 Nov 1968	WAEK Computer Dept.
H. Laurie	Feb 1969 - Aug 1969	TEDRO Oral Eng. Test

e. TEDRO Research Fellowships.

Twenty-four 12-month TEDRO Research Fellowships were funded by the Ford Training Grant. The purpose of this program was to provide, to selected university graduates, on-the-job experience and training in test development and psychological measurement within TEDRO. In effect, this program was the equivalent of a graduate program in educational measurement in the member countries. Several exceptionally able Research Fellows were employed by TEDRO at the end of their fellowships. One of these later left TEDRO for graduate training at the University of Illinois and recently earned his Ph.D. there in Psychological Measurement. By the end of the program in 1971, the total man-months of fellowship support was approximately 300.

f. TEDRO Library Support.

The Ford Grant budget provided \$17,500 for the purchase of books, periodicals, and materials for the TEDRO Library. Financial support was necessarily heaviest in the 1967 fiscal year when the TEDRO Library had been established at a professional operating level. Funding continued at a decelerating rate during the next three years. Further details on the library are given in the following paragraphs.

7. Develop Professional Library within TEDRO.

The TEDRO professional library, established during the predecessor contract, began its professional operation in December 1966 when Mr. Oshin joined TEDRO as its full-time librarian. The development and growth of the TEDRO Library has continued throughout the period of this project, so that it represents an increasingly valuable and unique resource not only for the TEDRO staff who require up-to-date materials found in texts, periodicals, and the technical journals to conduct research, but also for staff of WAEC and other professionals interested in educational, psychological, and measurement literature. During the four and one-half years of this project, the number of books on hand has doubled and periodical subscriptions have increased as shown in Table 11.

TABLE 11

TEDRO Library Acquisitions

Acquisition	End of Period: 1966 - 1968	End of Period: 1969 - 1973 (June)
Books on Hand	2,382	4,658
Bound Periodicals	-	449
Current Periodical Subscriptions	90	99

While the two time periods shown in the table above are not strictly comparable for acquisition data, a comparison for the 1966 - 1968 period with the present contract period from January 1969 through June 1973 indicated in Table 12 nevertheless reveals increased usage.

The TEDRO Library is a member of the Lagos Special Libraries Information Service (LASLIS), an organization of special libraries in and near Lagos with an agreement to mutually share their resources. For example, the TEDRO Library has donated a complete set of WAEC's Annual Reports to the University of Nigeria at Nsukka, and 21 volumes of Russian titles to the University of Ibadan. Donations to the TEDRO Library by various publishers of specimen copies of 117 volumes of Yoruba titles and 284 volumes in the Hausa Language and in English literature, were donated to the University of Lagos and the Lagos State Ministry of Education, respectively, where they would reach a wider audience.

The TEDRO Library was partly funded by a special provision in the Ford Foundation Training Grant until late 1970. Acquisition financing is now included in the TEDRO annual budget. Purchases of outside materials that are not available locally is possible, despite currency exchange restrictions, through UNESCO book coupons that can be bought with local currency. Library Bulletins, circulated each month to offices throughout WAEC, list new acquisitions and note recent journal articles that may be of special interest. In 1972, Education in Nigeria: A Bibliographical Guide was prepared by Mr. Oshin jointly with Mr. H. A. Odetoyinbo, the Librarian of the College of Education, University of Lagos. This exhaustive 450-page volume presents publications listed under 90 headings, ranging over such topics as subject teaching areas, audio-visual education, statistics, supervision and administration, teaching methods, prediction of academic success, handicapped children, and curriculum, to name only a few. Mr. Oshin also prepared in 1969 a shorter bibliography, Education in West Africa: A Bibliography, which is listed in the Appendix as one of the reports issued by TEDRO.

TABLE 12

TEDRO Library Usage

Usage	1966 - 1968	1969 - 1973
Attendance	3,500	13,576
Book Circulation:		
TEDRO	2,621	7,713
National Office	1,036	5,303
Periodical Circulation	3,807	13,027
Pamphlet Circulation	424	864

8. Foster TEDRO In-House Research Capability through Supervised Research.

Supervised research presently is conducted in TEDRO, as in all testing organizations, under the direction of its Department Heads and its Director. TEDRO has established an in-house Research Committee that reviews studies proposed to be carried out by staff. The technical advisors, especially during the phasing-out period of this contract, provided inputs to the technical procedures that were applied to various studies.

Early in the contract, two projects in Lagos provided the opportunity for fostering research capability through in-house supervision. These were the development of the Management Selection Battery, which required considerable item development and editing, and the revisions of the I-D aptitude tests, which was carried out within the Research Department. The series of TEDRO Research Seminars that were presented throughout the period of the project, and which for the past year have been scheduled monthly (see Target C-3), have contributed to the development of research skills of the TEDRO staff.

In the TEDRO Accra Office, all staff members have had experience in data collection, in data analysis involving the use of the computer, and in report writing. Until the return of Dr. Agbenyega to TEDRO Accra in 1972, Dr. Skurnik carried out much of the research and development on a joint basis with professional staff, and he supervised at least one research study completed by each member of the professional staff in the Accra Office.

It is also to be expected that with the installation of WAEC's upgraded IBM 370/125 computer system in Lagos, the availability of more sophisticated research and analytic programs will, under the direction of TEDRO senior staff, lead to supervised advanced research by all junior staff members.

D. Service Targets.

1. Expand Manpower Selection Services within Nigeria.

Manpower selection services in Nigeria are conducted within the Aptitude Testing Department of TEDRO, which administers the I-D tests primarily for this purpose. This department also administers higher level aptitude tests and the Management Selection Battery discussed in Target A-3. The I-D series was developed during an early phase of the overall USAID/AIR program and a full summary of this test series' construction, validation, and application is found in Ability Testing in Developing Countries, by Dr. P. A. Schwarz and Dr. R. E. Krug of AIR (Praeger: New York 1972). A shorter summary description of the I-D series has also been prepared by Dr. Snider (29). Briefly, the I-D series consists of 21 tests, which are grouped into shorter batteries administered for selection in technical, commercial, educational, and clerical positions. The tests measure a variety of abilities related to achievement in a wide range of educational and employment situations.

During the four and one-half years of this project, a total of 91,015 examinees had been tested in Nigeria by the Aptitude Testing Department. These examinees are classified in Table 13 according to the type of test battery administered: commercial, technical, or clerical tests for lower level governmental and industrial employment; commercial training and technical training tests for selection into training programs at the post primary school level; and higher level aptitude tests for selection into managerial and professional positions and for selection to higher academic professional training courses (almost all for nurses training). With an average of slightly more than six tests administered to each examinee, the Aptitude Testing Department thus administered approximately 560,000 aptitude tests during this four and one-half year period.

During this period, nearly 74,000 examinees were tested for selection to educational training programs outside the regular primary-secondary-university stream in Nigeria. TEDRO is the only institution in West Africa capable of providing manpower testing, processing, and reporting services on this scale.

TABLE 13

TEDRO Lagos Aptitude Test Volume in Nigeria
from January 1969 through June 1973

Type of Test	Examinees	Totals
Lower		
Commercial	4,414	
Technical	5,012	
Clerical	5,424	
Commercial Training	19,630	
Technical Training	<u>16,713</u>	
Subtotal		51,193
Higher		
Managerial	767	
Professional	1,622	
Academic	<u>37,433</u>	
Subtotal		<u>39,822</u>
TOTAL		91,015

A promotional effort is needed to alert the wider community to the availability of TEDRO's services, and many of the activities discussed earlier help to spread this public information. A brochure prepared by Dr. Snider, Dr. Fiks, and Mrs. Laurie, titled, TEDRO: A Brief Description, has been circulated.

Table 14 lists in alphabetical order the client organizations that have used the services of the Aptitude Testing Department.

Each year the Aptitude Testing Department conducts a course in test administration and score interpretation attended by officers in Ministries and commercial establishments who are engaged in testing programs. This course, lasting approximately two weeks during August, presents material on objective test administration, reporting, and interpretation. It is especially focused on the I-D series, which requires a high degree of standardization for its administration.

Research on the tests that are administered is also part of the activities in the Aptitude Testing Department and the Research Department. During the period of this contract, research has included a validity study of aptitude test scores as predictors of course grades for 124 Nigeria Navy rated recruits, reported by Dr. Akeju in 1971. Multiple correlations between the best-weighted linear combination of eight TEDRO tests and grades in science, English, navigation, and overall grade, were .44, .43, .44, and .52, respectively. In 1971, Dr. Akeju also reported a multiple correlation of .42 between a measure of overall job performance and the weighted combination of six TEDRO tests administered to employees at Nigerpak. In 1971, Dr. Fiks reported a rank-order correlation of .69 between an IBM aptitude test for programmers and final grades in a basic course for computer programming given in 1970 to 35 students at the University of Lagos Institute for Computer Science (14).

Dr. Akeju conducted an extensive study of the relationships between I-D tests and the first-year course grades of students enrolled in the Federal School of Science in Lagos. Multiple R's were low and generally insignificant between the tests and grades in six subjects, with the exception of physics grades. On the basis of this study, Dr. Akeju recommended that

TABLE 14

Client Organizations in Nigeria
Using TEDRO Aptitude Testing Services

Organization	Organization
Advanced Teachers College, Zaria	Nigerian Breweries Limited
Aiyetoro Comprehensive High School	Nigerian Civil Aviation
Approved Boys' School, Iwo	Nigerian Institute of Management
Bordpak Nigeria Limited	Nigerian Kraft Bags
Briscoe (Nigeria) Limited	Nigerian Navy
CSS Press Limited	Nigerian Police Force
Child Guidance Centre, Yaba	Nigerian Ports Authority
Civil Aviation Training Centre	Nigerpak Limited
College of Technology, Yaba	Nursing Council of Nigeria
Continental Office Products	Overseas Economic Development Limited
Department of Nursing, University of Ibadan	Polytechnic Institute
Dunlop Nigeria Limited	P-E Consulting Group
Elder Dempster Agency	Polytechnic Institute, Ibadan
Esso Standard Nigeria Limited	Public Service Commission
Ewekoro Cement Factory	Remo Divisional High School
Federal Ministry of Establishments	Richware Pottery Limited
Federal Ministry of Transport	Scanship Nigeria Limited
Flour Mills of Nigeria	Shell/BP of Nigeria
Guinness Nigeria Limited	Speco Mills
Gulf Oil Company	Steiner and Company Limited
International Aeradio Limited	Tate and Lyle Nigeria
International Chemical Industries Limited	Technical College, Ibadan
J.I.M. Transport Limited	Thomas Wyatt Company
Kaduna Technical School	Total Nigeria Limited
Kwara State Ministry of Health	U. T. C. Limited
Lagos State Ministry of Education	United Bank for Africa Limited
Lever Brother Nigeria Limited	University of Ibadan
Metropol	University of Lagos
Midwest Library Service	W N B S
Midwest State Ministry of Establishments	W N T V
Mobil Oil Nigeria Limited	Watchmaker of Switzerland
Mokwolo Rubens and Company	West African Examinations Council
N.C.R. Limited	Western State Trade Centre
Nigerian Airways	Yaba Trade Centre

I-D Verbal Analogies, Graphs, Science Information, and Arithmetic subtests continue to be administered, that better guidance is needed and should be based on the differential predictability of the tests, and that criteria of success other than final examination grades should be developed.

Miss Agboro and Dr. Bowers related scores on eight I-D tests for 47 accounting department employees, in Imperial Chemicals Industries of Nigeria, with their supervisor's ratings on ten traits (43). Two ratings were obtained for 42 of the employees. Five of the I-D tests were significantly related to certain of the ratings. In other related studies, Dr. Akeju, Miss Agboro, and Dr. Bowers reported correlations of .70 and .73 respectively for the scores on the I-D and PAT versions of the Verbal Analogies and Reading Comprehension tests for 120 Form I and II enrolled in Trinity Technical College. PAT versions were significantly more difficult due to the separate answer sheet. This same TEDRO study reported significant mean differences on I-D Similarities, I-D Mechanical Information, and I-D Spoken English for pupil groups at Yaba Trade Centre administered the tests under ordinary conditions and for groups administered the tests under audio-taped directions. Examinees who were given the audio-taped versions of the instructions showed higher mean scores on Similarities but lower mean scores on Mechanical Information and Spoken English. Average differences were approximately one stanine.

2. Establish and Expand Manpower Selection Services in Ghana, Sierra Leone, and The Gambia.

The major events relating to the establishment and the expansion of manpower selection services in Ghana, Sierra Leone, and The Gambia were the opening of the TEDRO branch office in Accra in 1968 and the work in consolidating this office during the period of this contract, and the opening of the TEDRO branch office in Freetown in 1971. These two offices, headed by Ford Training Grant participants, bring the promotion and delivery of aptitude testing programs directly into the member countries outside Nigeria.

As noted in the discussion under Target C-2, TEDRO Accra's aptitude testing program is extensive, with the majority of examinees

tested for selection into nursing training schools. A list of client organizations and number of candidates tested during Dr. Skurnik's tour, excluding the first three months of 1973, is shown in Table 15.

During the three years 1970 through 1972, approximately 118,000 tests were administered to nearly 29,000 examinees. It can also be seen from the above figures that the volume of testing conducted by TEDRO Accra rapidly grew each year during this period.

Earlier discussion of the Nursing Selection Tests under Target B-2 mentioned that changes have been made in the tests used for selection on behalf of the Ghana Nursing Board, and that a revised battery will contain some of the alternate PAT versions of the presently-used I-D tests. As the professional staff expands its contacts with other sectors of the country, further increases in aptitude testing will result. The item writing workshop conducted by Dr. Skurnik and Dr. Agbenyega is also a type of promotional effort that will show a spread of effect through the improvement of testing in the Medical School by the addition of objective tests to the present selection practices.

The TEDRO branch office in Freetown has been in existence only since late 1971, but indications are that aptitude testing has become well accepted in Sierra Leone and The Gambia. Much of the first year's work of Mr. During, who is the sole TEDRO representative in the office (with Mr. Deen having served as Acting Head during Mr. During's recent leave), has been devoted to the promotion of interest in the TEDRO aptitude tests. In the latter half of 1972, TEDRO Freetown administered tests for the selection of nursing trainees to 206 candidates in Sierra Leone and to 72 candidates for the first time in The Gambia. Discussions on the use of objective tests for hiring were also held with the Secretary for Recruitment and Training, the Deputy Commissioner of Police, and with the Secretary of the Ports Authority in Sierra Leone. Job descriptions were obtained from the Ports Authority and agreement was reached to begin validation of the TEDRO tests for predicting job performance of currently-working clerical and technical staff. Discussions regarding the use of aptitude tests were also held with the Principals of the Posts and Telecommunications

TABLE 15
TEDRO Accra Aptitude Testing Volume

Client	1970		1971		1972	
	N	Tests	N	Tests	N	Tests
Senior RN Selection	191	1,337	157	1,099	284	1,136
Post Basic Nursing	21	84	46	230	75	300
Nursing Sisters' Course	177	708	-	-	-	-
Ghana Nursing Board	6,179	24,716	8,310	33,240	10,749	42,996
Ghana Air: Clerks	-	-	13	65	-	-
Ghana Air: Stewardesses	118	590	-	-	-	-
Ghana Air: Operations	56	280	75	450	-	-
Lufthansa	77	462	-	-	-	-
Cocoa Marketing Board	-	-	110	550	-	-
Elect. Corp.: Apprentice	961	5,766	-	-	-	-
Ministry Health: Inspectors	92	368	73	292	113	452
Volta River Auth.: Adm. Trn.	25	125	5	20	-	-
Nat. Voc. Trg. Institute	-	-	-	-	520	2,600
U.T.C. Promotion	<u>70</u>	<u>280</u>	<u>80</u>	<u>320</u>	<u>-</u>	<u>-</u>
TOTALS	7,967	34,716	8,869	36,266	11,741	47,484

Training College and the Technical Institute. I-D tests were administered in September 1972 to stream pupils to the Y.W.C.A. Vocational Institute in Sierra Leone. The I-D Technical Series was given to students enrolled in the Sierra Leone Trade Centres in April 1972, and again in the Spring of 1973 to enrollees in the Y.W.C.A. Vocational Institute and to nursing trainee candidates in The Gambia.

Dr. Skurnik consulted with Mr. During in Sierra Leone in January 1973 on problems related to the consolidation of the Freetown branch office. His brief on his consultation contains observations and comments which provide useful guidelines for the continued development of this office.

3. Provide Consulting Services on Research Projects in Educational and Psychological Research in Member Countries.

All professional staff in a testing organization such as TEDRO provide numerous consultations on an informal basis. The more formal contacts will be discussed here, as these are the ones requiring the organization and execution of work plans. Before discussing these, it is important to point out that TEDRO, through the International TEDRO Committee and the TEDRO National Subcommittees, has an effective institutional network that extends into the member countries. The dissemination of TEDRO research reports to libraries, universities, ministries, and National Offices of WAEC also helps to promote further consultation activities. TEDRO staff teaching and the publication of the West African Journal of Educational and Vocational Measurement also foster closer ties with professional colleagues.

Formal research consultation in 1969 was with the staff of Fourah Bay College, Sierra Leone, when technical advisors cooperated in a study of achievement test results with TEDRO providing computer data processing and consultation on the research design. A second consulting effort in 1969 involved the staff of Ahmadu Bello University, Zaria. Sister F. Halligan of that faculty contacted TEDRO for comments concerning the development of an intelligence test for use in Northern Nigeria. Also in 1969, the Child Guidance Clinic of Lagos consulted with TEDRO regarding the suitability of psychological tests for the assessment and

diagnosis of problems ranging from poor school adjustment to physiological damage. That same year the Educational Testing Service of Princeton, New Jersey, requested TEDRO's cooperation in conducting a joint experimental study of the development of cognitive ability in Nigeria. Funding support for this project did not eventually materialize and work on it did not begin, although WAEC fully supported TEDRO's participation. The Ministry of Education in Nsukka in 1969 requested TEDRO's assistance and service in developing a machine-scorable questionnaire for the selection and placement of teachers.

Dr. Fiks in 1970 reviewed a research proposal on programmed materials in geography for Nigerian pupils and suggested design modifications and certain changes in data collection procedures. Dr. Fiks completed an extensive project in 1971, at the request of the Federal Ministry of Education, to design the punched card format and coding schedule for a Teacher Registration and Application Form. Materials were delivered in late 1971. Since then, the Ministry has begun gathering systematic information on teachers in Nigeria and TEDRO has been involved with the Ministry and the Federal Office of Statistics, through consultation with Dr. Soriyan and Dr. Bowers, regarding minor improvements in the original coding schedule. Dr. Fiks in 1971 also consulted with the Opportunities Industrialization Centre on the use of tests for the selection of trainees to its several programs, with the Library Service of the Midwest State to explore the effectiveness of aptitude testing in its selection program, and with Mobil of Nigeria to test job applicants for technical positions. Dr. Laryea and Dr. Bowers have met a number of times with staff of the Opportunities Industrialization Centre.

Dr. Akeju and Dr. Bowers met in late 1971 with the Head of the Nursing Department at the University of Ibadan, and with a representative of the World Health Organization seconded to that Department, to consider the development of attitude scales measuring personal adjustment and satisfaction with the nursing profession. Since that meeting, Dr. Akeju, Dr. Laryea, and Dr. Bowers have met again with these two nursing educators, who have collected background data and biographical information on nursing graduates.

In early 1972, the Federal Ministry of Establishments requested TEDRO's assistance in establishing score equivalencies for its semi-annual promotion tests. Test-retest data were provided to TEDRO and a short report was prepared by Dr. Soriyan and Dr. Bowers. Meetings held by the TEDRO Research Department with faculty of the University of Ife, to finalize a proposal to administer objective tests to its entering freshmen class, were discussed previously under Target B-1. In 1973, Dr. Soriyan and Dr. Bowers provided assistance to Major Adelaja of the Nigerian Medical Corps in developing a coding schedule and summary analysis of a psychological questionnaire administered to army personnel undergoing rehabilitation.

Many of the activities in Ghana, as in Nigeria, have been referred to throughout earlier sections of this report. In April 1969, Mr. Agbenyega, then the TEDRO representative in Accra, visited Monrovia to consult on matters regarding TEDRO's assistance in testing and research projects conducted in Liberia. Mr. Agbenyega discussed aptitude testing programs with approximately 60 top officials in Liberian education invited by the Liberian Department of Education to attend the session.

In 1970, TEDRO Accra was asked to review a study conducted by the Curriculum Research and Development Unit of the Ghana Ministry of Education in the English language attainments of Ghanaian school children, and also assisted by processing the data gathered for this study on WAEC's computer facilities in Accra. Also in 1970, a validity study of the School Certificate A-Level French Examination was conducted by Dr. Skurnik in cooperation with the Ghana Association of French Teachers. Data on the Joint Schools Mathematics Project in Ghana were analyzed by Dr. Skurnik, and the results were discussed in consultation with the project leader. Further assistance was given by Dr. Skurnik during a subsequent phase of the project. Dr. Skurnik also cooperated with the United Nations International Labor Organization team in Accra, and the Ghana National Vocational Training Institute, in reviewing the use of multi-aptitude test batteries for the selection of apprentice trainees in several job areas.

In 1971, Dr. Skurnik met a number of times with the Ghana Association of Science Teachers who were undertaking curriculum revision studies at the secondary school level. Problems of assessment were

examined as well as the coordination of the proposed curriculum changes with the objectives of the School Certificate Examinations. TEDRO Accra also met in 1971 with the Ghana Curriculum Research and Development Unit to present available information on the quality and effectiveness of the Ghana Common Entrance Examination. Later in 1971, Dr. Skurnik developed further consultations with the Ghana Ministry of Education on equitable testing procedures for the selection of secondary school pupils, and with the authorities of the universities in Ghana on the use of tests at the university level.

Dr. Agbenyega represented TEDRO Accra in 1972 on a Ministry of Education committee formed to study teachers' attitudes towards the Ghana Common Entrance Examination. He also consulted with the Faculty of Education of the University of Cape Coast, as a member of its committee established to study the qualifications of teachers in the University-affiliated Teacher Training Colleges. Dr. Agbenyega was appointed to a committee of the Ministry of Education to review the educational structure in Ghana. Other major consultations of Dr. Agbenyega were his assignment to evaluate the new Primary School Syllabus in Lagos State and, at the request of the Registrar, to lead a team to train item writers in Kampala for the East African Examinations Council in June 1972.

In March 1972, Dr. Akeju, Mr. During, and Dr. Bowers met in Freetown with Sierra Leone Ministry and university staff to discuss the possible structure and broad functions of the TEDRO National Subcommittee. At that time, Mr. During and Dr. Bowers met with the staff of the Central Statistics Office in Freetown to discuss the possible part-time rental of its facilities for processing the Sierra Leone Selective Entrance Examination.

Dr. Akeju has met several times with Ministry officials in Liberia to discuss TEDRO's involvement with research and test production needs. Mr. During also traveled to Monrovia in early 1973 to consult with officials in the Ministry of Education, the Institute of Public Administration, the Tubman Institute of Medical Arts, and the Testing and Evaluation Center of the University of Liberia. In early 1973 Mr. During met with Ministry of Education professionals in Banjul, formerly Bathurst, to plan a testing program for establishing national norms for the I-D series.

VI. CLOSING COMMENTS

Institution development targets comprised the primary set of objectives for this project. Institutional development accomplishments described in the previous section underscore this contract's continuity with the earlier USAID-sponsored projects in West Africa, indicating how this present project is the culmination of an overall program in test development and research in West Africa. The establishment of TEDRO is now completed; it exists as a test development and research organization which is unique in West Africa, and one whose effects in educational and national development will multiply and expand in the years to come.

Thirteen years ago, the first AIR pilot project determined that objective aptitude testing could be reliably and validly applied to the West African setting. Once it was established that such tests were cross-culturally adaptable and useful to West Africa, institution-building was begun. Today TEDRO not only conducts an extensive aptitude testing program in the member countries, but operates as WAEC's objective test production unit and its research arm.

This institutional development of TEDRO is the result of the cooperative planning and effort of four organizations: the West African Examinations Council and the Agency for International Development, who are partners in the grant agreement upon which this project was based; the Ford Foundation, whose grant contribution trained the professional staff of TEDRO; and the American Institutes for Research, who implemented the grant agreement and administered for the most part the Ford Foundation Staff Training Grant. All four organizations directly contributed to the creation of TEDRO's institutional structure, to its professional training, and to its establishment within WAEC's framework and therefore within the larger community.

The last point is important and has not previously been discussed. Compelling reasons can be advanced that confirm the wisdom of having established TEDRO within WAEC rather than as an independent agency or even as a university affiliate. First, WAEC is a highly respected international

organization in West Africa which can serve to shield any office within it that is responsible for maintaining a locally novel and less-traditional approach to educational and aptitude testing. Second, WAEC had begun early study of objective educational testing, so its committees were informed and were receptive to the idea of combining objective and traditional tests in its program. Third, WAEC's position as an international organization permits a wider extension of TEDRO's manpower testing and selection services to all its member countries. Finally, TEDRO's research impact is probably more pronounced and certainly more immediate within WAEC than it otherwise would be.

Without going into unnecessary repetition of the target accomplishments discussed at length earlier, it is perhaps useful to mention five institutional outcomes, among the many institutional changes that have taken place, resulting since the start of the present project in 1969. These changes involve staff, institutional expansion, and organizational identity within WAEC's governing apparatus and as such are outcomes related to TEDRO's viability, competence, and influence.

A. TEDRO professional staff are all highly trained West African professionals; there are no external advisors now serving TEDRO. Its staff, through the Ford Foundation Training Grant, is responsive to changing West African needs and capable of conducting sophisticated research and test development necessary in a period of educational expansion and national development. There is no other similar organization in West Africa or in any group of developing nations that can match TEDRO's institutional vigor or its professional expertise.

B. The establishment of the TEDRO offices in Accra and in Freetown has increased TEDRO's visibility and influence within WAEC's member countries. TEDRO Accra maintains a strong aptitude testing program, conducts research, accomplishes its share of the annual item preparation schedule, and is involved in public service activities through consultation and committee participation. TEDRO Freetown, established in 1971, is starting to exert its influence on testing practices and is beginning to develop a research program in Sierra Leone, The Gambia, and also in Liberia.

C. The TEDRO Head Office in Lagos has been reorganized into three functional departments of Item Preparation, Aptitude Testing, and Research. Economy of effort has resulted, and these more clearly defined departmental activities provide better administrative and budgetary control.

D. TEDRO has founded the West African Journal of Educational and Vocational Measurement, published twice yearly. While this was not an activity target of the present project, it nevertheless reflects a high degree of professionalism. Work in producing the journal results in beneficial collaboration and exchange of ideas and information between TEDRO and other professionals in West Africa.

E. Reorganization of the National Subcommittees of TEDRO moved them to positions of greater prominence and responsiveness to national research needs. These committees now permit TEDRO's research to be more immediately responsive to the needs of each individual member country.

In hindsight, it appears that better earlier planning should have been done in the area of WAEC's computer data processing facilities. In a modern testing organization, computerized data processing is a vital component of all work in annual testing programs. No amount of sophistication and expertise in test production will compensate for or overcome shortcomings in the speed and accuracy with which test scores are processed and reported.

The likelihood of future test processing overloads was pointed out by AIR staff in several discussions held with WAEC senior staff in 1971. This message was repeatedly brought to WAEC staff attention throughout the project, with the strong recommendation that both external advisory management and external training direction be developed for WAEC's Data Processing Department. This is still strongly recommended and becomes even a more obviously needed course of action with the planned introduction of the IBM 370/125 early in 1974. Some staff training is planned for the Fall of 1973, but only an extra-intensive training program will be adequate. It is hoped that WAEC's efforts to secure the services of competent management for this new IBM system will be successful. If not, processing difficulties and breakdowns can be predicted with certainty.

The imminent problem in the Data Processing Department does lead to the strongest recommendation to agencies planning the development of testing organizations such as TEDRO, and assistance to examining bodies as large and nationally relevant as WAEC. Objective testing is primarily introduced because of the necessity to reduce examination costs arising from increasing numbers of candidates. The usual assumption is that numbers will continue to grow. While the workload in test production and construction activities may increase slowly or even remain constant, test scoring and processing activities will nevertheless expand. It is clear that planning must simultaneously be done for both types of activities.

It should be emphasized that the kind of action needed and the amount of assistance required to accomplish WAEC's required data processing training was not targeted under the present contract. In retrospect, it would have been institutionally sounder in terms of WAEC's overall planning, however, to have developed a fifth set of targets in this project. They should have been related to strengthening WAEC's Data Processing Department through more intensive in-service training. While the position of Technical Advisor for Computer Operations was added midway through the project, and though this position was vital to WAEC's work, one position was in reality insufficient to develop needed local management skills and staff expertise.

In conclusion, the success of the present project should be judged by the success with which the essential objective was attained: to establish and consolidate an indigenous, competent, and responsive test development and research organization. TEDRO is productive, staffed by an exceptionally well-qualified group of professionals, is developing its own research program for West African needs, is exerting its professional influence on the deliberations of the Council, and is expanding its network of professional contacts throughout WAEC's member countries.

VII. ADMINISTRATIVE INFORMATION

The American Institutes for Research (AIR) is a nonprofit scientific and educational organization, providing research and services in the behavioral sciences which contribute to the solution of significant social problems. It was incorporated in 1946 under the laws of the Commonwealth of Pennsylvania. The status of AIR, which is not a private foundation, is described in Section 509(a)(2) of the Internal Revenue Code and has been officially recognized as such via a letter from the Internal Revenue Service dated 13 December 1972.

The individual to contact with respect to technical aspects of this project, and for additional copies of this report, is AIR's Principal Investigator:

Victor J. Cieutat, Director
International Studies Institute
American Institutes for Research
710 Chatham Center Office Building
Pittsburgh, Pennsylvania 15219
U.S.A.

Telephone: (412) 281-1100

All contractual matters should be communicated directly to:

David H. Spiegler, Director
Management Systems Office, 4th Floor
American Institutes for Research
10605 Concord Street
Kensington, Maryland 20795
U.S.A.

Telephone: (301) 933-3115

Information about current and future operations of the Test Development and Research Office should be directed to the following officer of the West African Examinations Council:

Director
Test Development and Research Office
West African Examinations Council
P.M.B. 1076
Lagos, Nigeria
Africa

Respectfully submitted,
AMERICAN INSTITUTES FOR RESEARCH
in the Behavioral Sciences



John E. Bowers
Project Director

APPENDIX

Technical Reports Prepared During
Contract AID/afr-595
January 1969 - June 1973

1. "Development of Standard Answer Sheets for IBM 1230." D. J. Fitch, TEDRO, 1969.

The development and use of a standard IBM 1230 answer sheet is recommended for all aptitude and objective tests in WAEC examinations. Answer sheets should be printed front and back in continuous form, with a center perforation. Cost savings are discussed as well as advantages of: (1) stocking a form that is not test specific; (2) reducing printing and design errors; (3) doubling of computer pre-printing rate; (4) having six rather than three tests per sheet; and (5) improving the item analysis program.

2. "Education in West Africa Bibliography." N. R. O. Oshin, TEDRO, 1969.

The 338 separately-listed references are books, newspaper and periodical articles, institutional and governmental publications, pamphlets, and dissertations. Under each heading, references are arranged alphabetically by author or institution. An author index is provided.

3. "Report to International Oral English Panel: Proposed Oral English Test." H. Laurie, P. A. Connell, and D. J. Fitch, TEDRO, June 1969.

A subcommittee of the Oral English panel moderated a new trial test paper prepared by TEDRO and consulted on the tape recording of the Oral English Examination (OEE). 196 Ghanaian fifth form students were administered a revised version of the 55-minute 150-item OEE having eight subtests. Total test reliability was .35, low due to range restrictions. Average item difficulty was .57 and average item r-point biserial reliability was in the low .30's. A separate analysis, in which 74 students were administered both the tape-recorded OEE and the optional Oral English paper of WASC/GSE, determined that scores correlated .56. This completed initial development of the OEE.

There is a review of research on oral production tests in Great Britain, and the administration of production tests to fifth form students in Lagos. Spoken production was taped and judged by an independent examiner: production was elicited by reading a passage and giving a short talk. Neither procedure proved satisfactory.

4. "Report on 1969 Summer Training Course, TEDRO." M. E. J. Orme, TEDRO, 1969.

This summary report of the Ford Foundation Summer Training Program for 1969 presents a course description, daily schedules, materials used, and instructional variables. A list of participants is provided and recommendations are given for course improvements.

5. "Report to International Oral English Panel: Proposed Oral English Test." H. Laurie, P. A. Connell, and D. J. Fitch, TEDRO, October 1969.

The Oral English Examination developed by TEDRO was administered to 69 British Council VSO's who scored 122 on the 150-item test compared to 85 for the Ghanaian sample reported in an earlier study, thus suggesting the validity of the examination since the native speakers (i.e., VSO's) scored consistently higher on all seven subparts than did the second language speakers (i.e., Ghanaians). Scores on the OEE correlated .48 with scores on the WASC/GCE Oral English test for 88 Ghanaian secondary school pupils. A revision of the Intonation subtest was trial-tested on a sample for 135 Nigerian students; item analyses are listed. The paper reviews research done in Great Britain and the United States on English production tests.

6. "Report on Conference on Science Curriculum Development (Forms 3-5)." J. A. Esi, TEDRO, 1969.

This discusses objectives and activities of the Conference on Science Curriculum Development held in Ibadan in August 1969. Objectives were to: (1) arrive at a consensus on major problems in science education; (2) agree on curriculum development principles; (3) gain familiarity with instructional strategies; (4) learn about recent attempts at instructional improvement; and (5) improve basic skills in curriculum development. Sample papers were prepared for curricula in physics, chemistry, and biology. Dr. S. A. Aleyideino at TEDRO spoke to a participating group of teachers.

7. "TEDRO - A Brief Description." J. G. Snider, A. I. Fiks, and H. Laurie, TEDRO, 1969.

This 6-page brochure presents a description of TEDRO's role within WAEC, organizational structure, funding and staffing, activities in achievement and aptitude testing, educational and psychological testing, and research and training.

8. "1970 Training Course in Measurement and Evaluation." M. Rosenfeld, TEDRO, 1970.

The 8-week course covered descriptive statistics (particularly for use in objective testing), measurement theory (validity and reliability), item writing and item analysis, and testing in West Africa. The course was

taught primarily by a consultant supported by the Ford Foundation. That portion of the course devoted to testing in West Africa was taught by WAEC staff members.

Twenty West African participants attended the course, representing five countries. Of these, twelve were formally enrolled in the course and eight (primarily WAEC staff members) were auditors. Achievement tests, which were used for student evaluation, and recommendations for future test and measurement courses, are included.

9. "The Validity of an Examination: French." L. S. Skurnik and C. Pearson, TEDRO, 1970.

O-level examination grades in French, English, and English literature, and candidates' sex, were compared with grades in A-level French for samples of Ghanaian students (average sample size of 81). The sample represented over 90 percent of A-level candidates. A corrected average correlation of .79 was reported between O-level and A-level French examination scores. An average correlation of only .31, however, is reported between A-level French and O-level English language and English literature. No sex differences were found for A-level French performance. These results indicate that performance on GCE O-level French is a valid predictor of success on A-level French, with success in O-level English language and literature being moderately related to French A-level performance. Applications of these results are presented for various kinds of predictions.

10. "Stability of Aptitude Tests Used in Nursing Council of Nigeria Common Entrance Examinations." S. A. Akeju, TEDRO, 1970.

Six I-D tests are used by the Nursing Council of Nigeria for the selection of students. 151 candidates who repeated the admissions testing battery, 67 with a 6-month interval and 84 with a 12-month interval, were the subjects for this study.

Test-retest correlations for the selection tests ranged from .23 to .85. Test-retest score differences were found to be significantly different, with candidates receiving higher average test scores on the second testing occasion. These results raise questions concerning the validity of results from a second administration of the battery.

11. "Comments on the Nigeria 1970 Common Entrance Examination Scores." S. A. Akeju, TEDRO, 1970.

This study discusses subtest scores and the total score obtained by 93,520 candidates who took the 1970 Nigeria Common Entrance Examination for admission into secondary schools. Score distributions suggest that the arithmetic and quantitative aptitude subtests are less difficult and more positively skewed than the English and verbal aptitude subtests. Suggestions are provided for improving the psychometric qualities of future examinations.

12. "Reliability of the Multiple-Choice Tests of the West African Examinations Council." S. A. Akeju, TEDRO, 1970.

This note reports Kuder-Richardson formula 21 reliabilities for the eight objective examinations of the 1969 School Certificate Examination, based on results for Nigerian candidates. KR-21 data was computed for samples of 14,000 to 28,000 with reliability estimates for the eight tests ranging from .85 to .95. These coefficients indicated the objective tests of the School Certificate Examination to be highly reliable.

13. "Bibliography of TEDRO Research Reports." A. I. Fiks, TEDRO, 1970.

This is a list of TEDRO and NATU Research and Informational Reports.

14. "The Relationship Between Aptitude Test Scores and Achievement at the Institute of Computer Sciences: University of Lagos." A. I. Fiks, TEDRO, 1970.

Scores on an IBM Aptitude Test for Computer Programmers, and mid-term grades and final grades in a basic computer programming course, were intercorrelated for 35 students.

The IBM Aptitude Test correlated .59 with mid-term grades and .69 with final grades. The test was considered to be effective for selection into this programming course.

15. "Predicting Success in the Federal School of Science, Lagos, Nigeria." S. A. Akeju, Ph.D. Dissertation, University of Southern California, 1970.

This study reports the validity of the I-D Verbal Analogies High, Reading High, and Arithmetic, for predicting academic performance in a post-secondary science course. Tests were administered to 292 applicants for admission to the Nigerian School of Science; criteria were first-year grades. The multiple correlation was significant only for 84 students enrolled in physics (.32).

None of the tests used alone was significantly related to grades. Recommendations are discussed for improvement of selection using admission tests.

16. "Aural English Examinations in West Africa." P. A. Connell and J. G. Snider, Educational Research, 12, 1970, pp. 235-239. (Published by the National Foundation for Educational Research in England and Wales.)

This is a review of research conducted by TEDRO concerning development of its tape-administered Oral English Examination (OEE). In 1965, WAEC concluded that the McCallien Test, administered optionally as one of the SC/GCE Examinations, could not be easily administered if made compulsory, and probably would not improve spoken classroom English.

WAEC believed that an OEE should be simple to administer, that teachers should be fully aware of language elements being tested, that the test should have content and predictive validity and, more importantly, that the test should influence teaching and lead to the improvement of spoken English in West Africa. Details of the second trial testing of the 238-item TEDRO-developed OEE, based on about 300 Nigerian students tested in 1968, showed a total score reliability of .91. Subpart reliabilities ranged from .41 for Intonation to .84 for Sentence Stress. Items were culled on the basis of an item analysis and test length was reduced to 150 items. Validity was supported by large mean score differences on all subparts between native speakers of English and second language speakers. The authors report a correlation of .61 between scores on the OEE and teachers' ratings. In conclusion, they recommend that supplemental student and teacher texts are needed if the OEE is to raise the standard of spoken English.

17. "Statistical Characteristics of WASC/GCE Examinations: 1970."
L. S. Skurnik, TEDRO, 1971.

Descriptive statistics, subtest contributions to final grade, subtest intercorrelations, and reliability estimates are presented for 23 subjects of the 1970 Ghana WASC/GCE. Sample sizes for the subject areas varied from 18 to 933 (14 exceeded 100); reliability estimates ranged from .13 to .93, with an average of .76. Subtest intercorrelations are discussed regarding their relative contributions to final grades. In the seven subjects which were used, objective subtests were relatively consistent measures.

18. "International Standards in English and Mathematics: A Pilot Study."
L. S. Skurnik and V. Y. Kofie, TEDRO, 1971.

Difficulties inherent in international grade comparisons and standards are discussed, with a brief review of previous related research. This pilot study is based on a sample of 65 lower sixth-form pupils in Ghana who had recently taken the WASC/GCE examinations, including tests in English and mathematics. Two standardized tests in these two subjects were administered, and respondents were asked to provide information concerning the grades they had obtained in the WASC/GCE. The standardized tests had been used in the United Kingdom for comparison of standards, and thus data from several studies were available for further comparisons. Results indicated that WASC/GCE grading standards for mathematics were highly comparable to those obtained in England and Wales, while standards for English were too lenient.

19. "The Validity of the Ghana Common Entrance Examination: A Summary of Current Findings." L. S. Skurnik and E. N. Safo, TEDRO, 1971.

Two validity studies of the Ghana CEE are reported. The first, conducted in one school and based on 36 examinees, correlated 1970 CEE scores with teachers' rankings of scholastic achievement. Validity estimates, not corrected for range restriction, varied from .48 to .69 for the subtest and total scores. Of the subtests, the general paper was the best predictor, with an uncorrected validity estimate of .57. Results indicate the Ghana CEE is a valid predictor of teachers' estimates of achievement.

The second study compared the 1964 Ghana CEE results in seven subjects with the 1969 GCE results for 637 candidates enrolled in 54 schools. Correlations between CEE total scores and grades on the seven GCE subjects ranged from .32 to .48. These validity estimates are comparable with studies conducted in the United Kingdom. A discussion is included of the effects of range restriction in the sample on the reported validity coefficients. Other results were that: males scored higher on the GCE than did females; CEE English is the best predictor of GCE English; CEE arithmetic is the best predictor of GCE mathematics; and CEE total score is the best predictor of overall GCE performance.

20. "The Robustness of the Common Entrance Examination in Nigeria: A Preliminary Study." A. I. Fiks, B. A. Axtell, and A. O. Oloyede, TEDRO, 1971.

This is a pilot study of the possible enhancing practice effect of CEE trial test experience on CEE live test performance, as some students who participate in the CEE trial test take an actual CEE examination several weeks later.

Subjects were 111 students from six primary schools in the Western State. Data were gathered on school location (urban vs. rural) and test experience (trial test experience vs. no trial test experience). Mean differences for CEE subtest scores revealed no significant differences associated with trial test participation or rural-urban location.

21. "Audio Tape Presentation of Three I-D Objective Tests." A. I. Fiks, TEDRO, 1971.

Three I-D tests, Similarities, Mechanical Information, and Spoken English were presented in "live" and audio-taped form to 16 and 12 subjects, respectively. Results were highly similar. It was recommended that the taped version should be used and that TEDRO should upgrade its audio equipment. It was suggested that it may be feasible to audio-tape other I-D tests.

22. "Objective Testing and the Improvement of Secondary Education in West Africa." A. I. Fiks, TEDRO, 1971.

A program is described to provide secondary schools in West Africa with feedback information regarding their students' success on those subjects of the SC/GCE which contain objective subtests. This information would prove valuable to school headmasters and Ministries of Education, in improving their courses of instruction, by specifying particular areas of difficulty encountered by their students in the examinations.

Each school would be provided with two types of data: one would provide subject matter information presented by syllabus topic, and give percentage of correct responses for the school as compared with other schools; the second would summarize achievement on all subjects for

the school as compared with other schools. Similar forms would be provided to the Ministries of Education summarizing test data for all candidates from all schools. A tentative work plan is included for development of this program.

23. "I-D Dexterity Tests. I. Experimental Machine-Scored Forms." B. A. Axtell, TEDRO, 1971.

This reports the evaluation of an experimental machine-scorable form of I-D test #20, Finger Dexterity (FIN). Forms scorable on the IBM 1230 were administered to 60 applicants for factory operative jobs to investigate the scoring capability of the IBM 1230 for these trial forms, the reliability of machine scoring, and the validity of the resultant scores.

The experimental form was found unsuitable for 1230 scoring. The 1230 recorded less than 1 percent of the score obtained by hand scoring, precluding investigation of the second and third questions above. Problems with the current form are discussed and plans are included for an improved design of the answer sheet to allow machine scoring.

24. "I-D Dexterity Tests. II. Stylus Comparison Study." B. A. Axtell, TEDRO, 1971.

An assessment was done of 11 different styluses for use with IBM 1230 scoring of the machine-scorable I-D dexterity test answer sheets. Styluses were obtained locally (Lagos, Nigeria) and varied in color, line width, and kind of mark produced (lead, watercolor, crayon). The experimental form of the Finger Dexterity (FIN) test was used as an answer sheet.

The best stylus was a black medium hard, or #2, lead pencil. Watercolor base styluses would not be sensed by the 1230. These results are consistent with those expected, but are contaminated by the use of the experimental answer sheet which has been found to not produce reliable scores.

25. "Recording Aptitude Test Responses on Separate Answer Sheets in Nigeria." S. A. Akeju, TEDRO, 1971.

An aptitude test was administered to 206 Form II students from three Secondary Schools. One randomly selected group of 101 pupils recorded answers on the test papers and the remaining 105 used a separate answer sheet. Use of separate answer sheets led to significantly lower scores.

26. "TEDRO Reports and Research Papers." B. A. Axtell, TEDRO, May 1971.

This bibliography of the first 69 research reports of TEDRO and NATU gives an indication of projects completed and availability of project research reports. A discussion of TEDRO publication policy is included, with a suggested plan for dissemination of results to interested professional and lay persons, via individual research reports and a TEDRO journal.

27. "Procedure for Group Test Administration in Developing Countries." S. Cho, 1971. Presented at a NATO Conference on Cultural Factors in Mental Test Development, Istanbul, Turkey, July 1971.

Group testing procedures are discussed in four sections: format, security, preliminary arrangements, and testing session. Test booklet and answer sheet formats should be reduced to essentials, with an integrated question/answer space approach. Instructions should be carefully tailored to the subject population in terms of language used and reliance on verbal instructions. General security procedures (printing, packaging, and shipping) are covered, with emphasis on the selection of test administrators and invigilators. Preliminary arrangements should include necessary official clearance, planning for transportation and logistic support, information to candidates regarding the testing session, and arrangements for testing facilities. The testing session itself needs close attention regarding the administrator, the invigilators, and the routine of the session to assure examination security.

28. "Educational Structure and Major Certificates in Nigeria." S. Cho, TEDRO, 1971.

The three basic educational levels are discussed (primary, secondary, and university) with indications of certificates awarded for various educational paths. Primary school is typically a 6-year program (seven years in the Northern States) which may terminate with a First School Leaving Certificate. Secondary school is normally a 5-year program culminating with the West African School Certificate, or the General Certificate of Education - O-Level. The continued education of a student (in University or Teacher Training) is open to several options depending upon the goals and preparation of the student. These options are discussed, together with the resultant training and certificate.

29. "Aptitude Tests for West Africa." J. G. Snider, West African Journal of Education, 1972, 16(2), 171-177.

A series of 21 aptitude measures - the Internationally Developed (I-D) tests - was developed and validated in the early 1960's for use in a variety of selection programs in West Africa. The 21 tests cover a wide range of aptitudes, including language, quantitative ability, dexterity, spatial perception, and mechanical information. They were designed to be used as "building blocks" to provide a test battery responsive to a variety of selection needs and screening situations. Both test content and administration instructions were carefully developed to provide the necessary accuracy for selection purposes, while remaining sufficiently general in nature to allow for easy translation and adaptation to other languages.

Test batteries for selection programs in West Africa have been used extensively since the tests were developed and satisfactory reliability and validity data are reported for selection in the areas of clerical occupations, skilled trades, scholastic success, and higher careers. Data were from five African countries, and work has continued in Brazil, South Korea, Iran, Thailand, and Micronesia, where the necessary translations and adaptations have been completed and satisfactory reliabilities and validities have been reported.

30. "Validity and Associated Findings of a Higher Intellectual Aptitude Test Battery in Nigeria." A. I. Fiks, 1971.

Seventy-seven university graduate applicants for the 1970 Summer Training Program in Measurement and Evaluation, organized by TEDRO and sponsored by the Ford Foundation, completed the University Series of aptitude tests. Criterion measures used were ratings by the applicant's major professor on several motivational and attitudinal factors and the Honors Class of the Bachelor's degree received by the applicant (6-point scale). Biographical information related to employment history, career aspirations, exposure to non-African influences, and basic demographic data were also gathered.

Multiple correlations (corrected for shrinkage) of .18, .44, and .27 were found between aptitude test battery scores and Honors Class, motivational factors, and attitudinal factors, respectively. No relationship was found between exposure to non-African influences and aptitude test performance. It was concluded that the University Series shows some utility for selection at the higher educational levels.

31. "Attitude to Multiple Choice (Objective) Tests in West Africa." S. A. Akeju, TEDRO, 1971.

A Likert scale measuring attitude toward multiple choice tests was developed and administered to 320 students in a 2 x 2 factorial design with two levels each of educational level (secondary school and university) and sex (male and female); 70 percent of the sample were favourable to objective testing, with sex having a non-significant effect. Educational level and the sex by educational level interaction were significant at the .05 level.

It was concluded that educational attainment was related to attitude toward objective tests, with a more positive attitude being manifested at the lower educational levels, and that females (but not males) held more positive attitudes at the secondary school level than at the university level.

32. "The Reliability of General Certificate of Education Examination English Composition Papers in West Africa." S. A. Akeju, TEDRO, 1971.

A sample of 100 June 1970 SC/GCE composition scripts for Ghanaian examinees were independently marked by 10 raters selected from the list of WAEC examiners. Seven examiners each rated 96 scripts. Rater intercorrelations ranged from .51 to .85, averaging .73. Recommendations are made to raise rater reliability and to investigate the measurement of English Composition with objective tests.

33. "Development, Validation and Revision of the Graduate Entry Civil Service Examination in Ghana." L. S. Skurnik, TEDRO, 1971.

Graduate Entry Civil Service Examinations in Ghana in 1970 and 1971 were developed, administered, and analyzed. The aptitude test was the most valid part of the examination. The multiple-choice aptitude test was efficient in discrimination among university graduates and might be

considered as a suitable type of measure for selecting students to the university or for measuring their achievement in university courses. Although some improvements were made in the revised form of the aptitude test, the entire examination can still be further improved.

34. "The Relationships between Objective and Traditional Examination Scores for the November 1970 SC/GCE." J. E. Bowers, TEDRO, 1971.

Samples were from candidates taking all seven of the SC/GCE examinations which included both traditional and objective subtests; sample sizes ranged from 523 to 1,626. Means and standard deviations are reported, as well as the correlations between traditional and objective subtests, and the percentage of total score variance associated with each subtest.

Effects of the two subtests on total score are discussed, with suggestions concerning the psychometric effects of various changes in subtest characteristics.

35. "Analysis of the November 1970 SC/GCE for Nigeria." B. A. Axtell, TEDRO, 1971.

A sample of over 10,000 candidates provided data for the investigation of the eight objective tests of this examination. A stratified sampling plan is presented, outlining procedures used for sampling on the basis of examination center rather than by candidate. A comparison of the sample and the population supported the representativeness of the sample.

Samples ranged from 660 to 2,056 and were each item analyzed. Information was also obtained concerning difficulty level, point-biserial correlations, and distractors. Results for each test were discussed in terms of numbers of acceptable items, those with poor distractors, and items with unsatisfactory difficulty level. An appendix presents item characteristic tables for each of the tests, as well as summary statistics and reliability estimates.

36. "The Validity of The Gambia Common Entrance Examination." B. A. Axtell, TEDRO, 1971.

The validity of CEE test scores was determined for 642 Gambian students tested in 1966, 1967, and 1968. Criteria were secondary school orders of merit for three years, two years, and one year following the entry examination. Correlations, corrected for restriction of range, ranged from .43 to .68 across schools. A separate reliability study of the CEE scores was also carried out and showed the CEE to be highly reliable. The validities indicated that the CEE is an effective predictor of academic success as measured by teachers' ratings of students.

37. "Mid-West Pilot Project." S. A. Akeju and B. A. Axtell, TEDRO, 1972.

Ten to nineteen I-D tests were administered to 561 Form I and II students from the Mid-West State of Nigeria, and 41 students in post-secondary training. Criterion data were school grades two years after testing. An analysis was performed on results for six courses of study in the technical/vocational area.

On the basis of the multiple regression analysis, several batteries of I-D tests were suggested for selection into the several areas of training. Recommended batteries included from two to seven I-D tests for five of the training areas. (Data for the commercial course did not indicate a useful selection battery.) For optimal selection, the I-D tests in each battery may be differentially weighted according to the regression weights. Comparisons with other results and suggestions for future research are also discussed.

38. "The Consistency of Grades in the June, 1971 SC/GCE Examinations."
L. S. Skurnik, TEDRO, 1972.

Three studies deal with the consistency of SC/GCE grades. Random samples were selected of the ten objective papers of the SC/GCE, with sample size ranging from 210 to 1,184, and a sample of approximately 1,000 Ghana CEE papers was also drawn. Four different reliability estimates were computed on the basis of the alpha and Gaylord formulas. Highly similar reliability coefficients were reported. The second study compared Gaylord reliability coefficients for candidates from Ghana, Sierra Leone, and The Gambia. Samples ranged in size from 38 to 3,167 for nine SC/GCE objective examinations in the three countries. Reliability estimates were highly similar, suggesting equal consistency for the three countries. The third study investigated the consistency of each examination as a whole. Samples ranging from 11 to 786 were selected for 32 SC/GCE subjects administered in Ghana, Sierra Leone, and The Gambia. Reliability estimates are presented for each examination as a whole and possible error margins are discussed for examination grades assigned on the basis of the total examination score.

39. "Reporting of Examination Grades with Precision." L. S. Skurnik, TEDRO, 1972.

SC/GCE results are reported on a nine-point grade scale. This paper discusses measurement inconsistency ("error margins") and its effect on interpretation of an observed grade. A table is prepared which relates the reliability of an examination to error margins at several levels of probability, and presents several standard psychometric statistics relevant to examination score interpretation. Also included is a technical discussion of the statistical methods used in developing the table.

40. "Reliability of the 1971 WASC/GCE June 1971 Re-take Examination."
S. A. Akeju and A. O. Oloyede, TEDRO, 1972.

Random samples of 500-600 examinees, who were administered the eight multiple-choice WASC/GCE examinations in June 1971, were selected for this

study. Kuder-Richardson Formula 20 reliability coefficients were calculated for each examination. Reliabilities ranged from .78 for Health Science to .93 for English Language. The writers suggest that improvements in the internal consistency of some of the examinations should be attempted. It should be noted that the Kuder-Richardson group of reliability coefficients are all lower bounds of reliability and may underestimate the actual test reliability, especially when the examination covers a wide range of heterogeneous content.

41. "The Effects of Total Score Selection on Part Score Intercorrelations." B. A. Axtell and J. E. Bowers, TEDRO, 1972.

Under certain conditions of extreme selectivity on total score performance, negative subtest score intercorrelations are encountered where positive intercorrelations exist in the unselected population. With certain assumptions, an analytic explanation is developed where the total score is the sum of two part scores. It is shown that the restricted group subtest intercorrelation is a function of the degree of selectivity, the ratio of the standard deviations of the subtest scores in the unselected group, and the unselected group subtest intercorrelation. A table of selected group subtest intercorrelations is presented for various levels of these three factors.

42. "The Contributions of Two Subtests to Total Score Variance." J. E. Bowers, TEDRO, 1972.

This note discusses psychometric factors which determine the relative contributions of subtest score to total score. Three weighting procedures are outlined and a discussion presented of the consequences of each on the resultant total score. In general, the contribution of a subtest score to total score is a function of the variances of each subtest and the intercorrelations between them. If summation of subtest scores is used to obtain a total score, the assumed equal weighting is rarely encountered due to characteristics of the subtest score distributions; if a priori weights are assigned to the subtest scores, these weights will be affected by the subtest score distributions; if contributions from subtests to total score are desired in a particular proportion, actual weights matching the desired contributions can be generated from distributions obtained on the subtest scores.

43. "I-D Test Relationships with Supervisors' Ratings for Accounting Department Employees." A. Agboro and J. E. Bowers, TEDRO, 1972.

Eight I-D tests and one 25-item experimental number series completion test were administered to 42 accounting department employees of an international chemical products firm in Lagos, Nigeria. Ratings of ten work-related traits were completed by two supervisors. Analysis included intercorrelations between I-D test scores, ratings (the sum of two ratings, each scored 4 to 1), and biographical data.

Examinees scored at an average level when compared with secondary school students, with the exception of lower scores on Verbal Analogies High (VAH)

and Graphs (GPH). Five of the I-D tests were usefully related to supervisors' ratings, suggesting the use of these measures for selection or promotion. Trait ratings were highly correlated with each other, indicating a tendency for the raters to form a general impression which pervades all ratings.

44. "A Note on Equating Two Forms of a Promotion Test." J. E. Bowers and M. A. Soriyan, TEDRO, 1972.

Two forms of a clerical promotion test, used by a Federal Ministry, were administered to the same examinees at two different times. The scores for the two forms were equalized with respect to means and standard deviations and equivalencies obtained, under the assumption that examinees did not change on the basis of the abilities measured.

45. "Development of an Examination Item Bank. I. Item Classification." B. A. Axtell, TEDRO, 1972.

Objective examinations of the SC/GCE are produced following a 5 (type of thinking required) x n (subject content area) matrix for item development. In coding for an item bank, reliability would be necessary in these two factors if used as the basis for coding. The geography examinations for 1969 and 1970, for both Ghana and Nigeria, were coded (5 x 20) by three professional staff of TEDRO. 50 percent coder agreement for subject content area and 25 percent agreement for type of thinking were obtained, raising some question regarding the reliability of coding on this basis. Suggestions for improving reliability include reduction of type of thinking categories from 5 to 3 and clarification of the more unreliable of the subject content areas.

46. "Validity of Teacher Training Tests in Ghana." L. S. Skurnik, E. N. Safo, and V. Y. Kofie, TEDRO, 1972.

This report indicated that the Teacher Training Selection Tests administered in Ghana in 1965 and 1969 were not valid for predicting final examination grades in teacher training institutions. Sex and year were controlled and, although males scored much higher than females on the selection examinations, the results were the same for each sex. Since 1970 TEDRO Accra has been preparing an objective, multiple-choice aptitude test for inclusion in this selection battery and it is expected that inclusion of this test in the selection battery will improve validity.

47. "A Look at the 1972 SC/GCE Subject Award Meetings in Accra." M. A. Soriyan, TEDRO, 1972.

Present SC/GCE subject award practices are examined and discussed. It is recommended that the model employed be strictly adhered to and that, for each subject, the relative contributions of the papers to the variance of the total score be pre-determined.

48. "The 1971 Ghana Common Entrance Examination and Teacher Ratings." L. S. Skurnik, TEDRO, 1972.

The 1971 Ghana CEE scores for 126 students from four schools were correlated with teacher ratings of scholastic ability. The average correlation between aptitude test scores (English and quantitative) and ratings was found to be .69, and between CEE total score and ratings to be .81. When corrected for restriction in range, these correlations become .90 and .95, respectively. These estimates of validity support the continued use of the Ghana CEE as a valid predictor of academic success in secondary school.

49. "The Validity of the Nursing Selection Tests in Ghana." C. O. Agbenyega and L. S. Skurnik, TEDRO, 1972.

This study reports the validity of four I-D tests for predicting two criteria of school performance for 272 students in 12 Ghanaian nursing schools. The four tests were Verbal Analogies, Reading Comprehension, Memory, and Arithmetic. Validities for the two verbal tests were approximately .2 for both criteria. These low values are probably due to the extreme selectivity practiced by the Central Recruiting Bureau of the Ghana Board of Nurses. Estimates of these same validity coefficients in unselected samples range from .6 to .7. The two non-verbal tests were not predictive of school achievement. The recommendation was made to continue use of the I-D tests for nursing training selection with the present two non-verbal tests replaced by the I-D Tables and Science Information tests.

50. "Performance Analysis of Candidates in Public and Private Schools on the Ghana Common Entrance Examination." C. O. Agbenyega, TEDRO, 1972.

This study examined whether the introduction of the social studies test (Ghana CEE 1972) resulted in any significant increase in scores for rural candidates. Five categories of schools were investigated: rural, urban, experimental (all in the public sector), preparatory and international (all in the private sector), and a fifth group of 12 schools selected to be nationally representative. Candidates in social studies from rural schools were compared with those from the other four school categories. Results showed that during the short period that preparatory and international schools were supposed to have been exposed to social studies, their candidates, especially from the international schools, demonstrated superior performance on the social studies test.

51. "A Procedure to Calculate Subtest Weights for Specified Contributions to Composite Score Variance." M. A. Soriyan and J. E. Bowers, TEDRO, 1972.

A mathematical definition of subtest contribution to total composite score, based on the covariance of the subtest with the total score, is presented and explained. A computational routine is developed for determining weights to be assigned to each subtest so that a specified ratio of subtest contributions to total score will result. Computational examples illustrate the use of the method.

52. "Preliminary Evaluation of the Supervisory Judgment and Administrative Decisions Tests with Educational Administrators." B. A. Axtell, TEDRO, 1972.

A preliminary validation study of two management selection tests was conducted using 62 WAEC officers as subjects. Criterion measures were number of years of managerial experience and evaluative rankings of work performance. Spearman rank-order correlation coefficients did not support the validity of the two tests as predictors of managerial success.

Questions were raised concerning the validity of the criterion measures and the substantial number of subjects lost due to lack of criterion data. Suggestions for future validation studies of these two tests are presented, and focus on the choice of criterion measures and development of an empirically-keyed scoring system.

53. "Statistical Characteristics of June 1971 SC/GCE Examination Papers: Subjects Consisting of at Least Three Papers or at Least One Objective Paper." M. A. Soriyan, TEDRO, 1972.

Samples were selected for 13 subject areas of the 1971 SC/GCE and descriptive statistics, reliability, and scores are presented for each subtest of the 13 subjects. A mathematical procedure is provided for computing the contribution of each subtest to the total score variance. Comparisons of actual and expected subtest contributions to total score variance are tabled for each of the 13 subjects. Where these values are dissimilar, weighting procedures for the subtests should be employed.

54. "A Procedure to Calculate Subtest Weights for Maximum Battery Reliability." M. A. Soriyan and J. E. Bowers, TEDRO, 1972.

A method is reviewed and examples are presented to calculate subtest weights that will result in the maximum total score reliability. It is necessary that all subtest reliabilities and intercorrelations be available.

55. "Rural-Urban Effects on the Common Entrance Examination: A Pilot Study." B. A. Axtell and J. E. Bowers, TEDRO, 1972.

Based on a sample of schools identified as rural or urban by the State Ministries in six Northern States, for the annual CEE trial testing, a study was conducted of the mean differences in live CEE test scores for urban and rural schools.

Significant rural-urban mean differences favoring rural schools were found for CEE English Language and Verbal Aptitude, but no significant differences were found for Quantitative Aptitude and Arithmetic. A detailed post hoc analysis showed interaction to be present: rural-urban effects were present only for girls, and sex differences were present only in urban schools. The unexpected results suggest the need for replication to confirm the findings.

56. "Some Undesirable Effects of Certification Due to Grouped-Subject Requirements (The West African School Certificate)." C. O. Agbenyega, TEDRO, 1972.

School Certificate results in Ghana for 1971 and 1972 were analyzed to examine the results for those candidates whose aggregate marks qualified them for a Division I Certificate but who obtained a Division II or Division III Certificate because of failure to satisfy the subject group requirements. The 170 candidates awarded Division II failed to obtain a Division I Certificate because of failure in Mathematics and having obtained only an ordinary pass in English Language; failure in Mathematics was mainly responsible within the group of 86 candidates who were awarded the Division III Certificate.

57. "A Preliminary Study of A-Level Reliability." L. S. Skurnik, TEDRO, 1972.

Internal consistency reliability estimates were calculated for each of six Advanced Level Certificate scores based upon a 10 percent sample of 1972 candidates. Reliabilities ranged from .57 in Economics to .75 for Physics. It is noted that these may be overly conservative estimates, but that there are several ways to improve the reliabilities.

58. "The Reliability of O-Level Examinations." L. S. Skurnik, TEDRO, 1972.

The definition and meaning of reliability is discussed in detail. A study is reported which summarizes the reliability of the SC/GCE for 1970-1972. It was found, for example, that Mathematics examinations could be reduced from five to three hours of examining. French and English Language examinations are of satisfactory reliability but the African Language examinations are in need of improvements to reach the same level of consistency.

59. "The Consistency of the 1972 SC/GCE Examinations." L. S. Skurnik, TEDRO, 1972.

The overall consistency of the O-Level examinations were found to be satisfactory in 13 subjects and below a suggested standard in 20 subjects. The consistency was not calculated for the remaining 9 subjects. Results indicate only slight sample differences for "A," "B," and private candidates, so simple random samples of candidates can be selected for future studies of this kind.

60. "An Analysis of the Direct Costs of Multiple Choice and Essay Examinations." C. O. Agbenyega and L. S. Skurnik, TEDRO, 1972.

Direct costs involved in the production of objective and essay tests in four subjects were examined. Total costs for each subject were divided into 11 percent for the objective paper, 46 percent for the essay, and 43 percent for administrative costs. Discussion centered on the possibility

of strengthening the item preparation sections of TEDRO, the reduction of redundant essay testing, and factors associated with the number of examinees tested at which the objective paper shows lower unit cost.

61. "Bibliography of TEDRO Reports." M. A. Soriyan, TEDRO, 1973.

A listing of 115 NATU and TEDRO reports is presented. This represents an updated bibliography.

62. "Entrance Examination to Nursing Schools in Nigeria: Validity Study." E. B. Laryea and J. E. Bowers, TEDRO, 1973.

This study was undertaken to determine the validity of the entrance battery of eight tests (an Essay Test, a Nursing Information Test, and the I-D Tests of Manual Dexterity, Memory, Verbal Analogies High, Reading Comprehension High, Arithmetic, and Graphs) for predicting the State Final Examination score in nursing given at the end of the three-year course in nursing training schools. Data were based on 175 trainees enrolled in seven schools. Validities ranged from .02 for Verbal Analogies High to .30 for Graphs, with three variables showing significant validities at the .05 level of significance: Graphs, Nursing Information, and the Aggregate Battery score. Stepwise regression analyses suggested that the first two of these three scores accounted for most of the predictive power of the entire battery. Possible reasons for the low validities were restriction of range due to the selection of only 5 percent of the candidates, predictor and criterion unreliability, attrition following admission, and the 3-year length of time between administration of the entrance battery and the criterion test. Data have been gathered for a replication of this study and are now in the process of analysis.

63. "Score Intervals Between Successive Grades." M. A. Soriyan, M. J. Quirk, and J. E. Bowers, TEDRO, 1973.

A procedure is developed for determining the smallest raw score interval that should obtain between successive final reported marks, given that the reliability of the raw score scale either is known or can be estimated, and that an intended degree of true score non-overlap is specified. Examples are drawn from SC/GCE data.
