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Meeting of Directors of Middle Level
Statistical Training Centres
Addis Ababa, 16 - 20 April 1965

STATISTICAL TRAINING CENTRE

ACHIMOTA

ACCRA

B R O C H U R EStatistical Training Centre, Achimota

The Statistical Training Centre at Achimota, Ghana, is a project in the programme for regional co-operation in statistical training in Africa. It is intended to provide training facilities for middle level staff in the statistical organisation of West African governments. It provides an intensive course for one academic year in elementary statistics and related subjects. Special emphasis is placed on practical aspects of work as carried out under local conditions.

The Centre opened in October, 1961. Details of the facilities provided are given in the following paragraphs and it is hoped that countries will make the fullest possible opportunity for improving the strength and efficiency of their statistical personnel.

At the First Conference of African Statisticians, held at Addis Ababa in September, 1959, it was recommended that the United Nations Economic Commission for Africa should take the initiative in providing adequate training facilities for middle-grade non-professional statistical personnel throughout Africa. The ECA and the Government of Ghana have co-operated in establishing the training centre at Achimota to meet the needs of Ghana and other English-speaking countries of the West African region in this respect. The Centre is sponsored by the Government of Ghana and United Nations, acting through the Economic Commission for Africa, with the co-operation of the Food and Agriculture Organization, the International Labour Office and other interested specialised agencies of the United Nations. The overall responsibility for the Centre is vested in Advisory Board consisting of the following members:

The Government Statistician, Ghana (Chairman)

A Representative of the Executive Secretary
of the U.N. Economic Commission for Africa

The Resident Representative of the U.N. Technical
Assistance Board, Ghana

The Director of the School of Administration,
Achimota, or his representative.

The Principal Secretary (Establishments), Ghana
or his representative.

The Director of the Institute of Statistics,
University of Ghana, Legon, or his representative

The Director of the Centre.

The courses are open to personnel of the statistics office and other government and quasi-government bodies in Ghana, Nigeria, Liberia, Sierra Leone and Gambia. Suitably qualified English-speaking candidates from other African countries will also be welcome.

The United Nations is making available a limited number of fellowships to enable trainees from countries other than Ghana to attend the courses. Information about the nature of the fellowships is given below. It should be noted that final responsibility for the acceptance of trainees under this scheme rests with the Executive Secretary of the U.N. Economic Commission for Africa.

Administrative arrangements:

For administrative purposes the centre is attached to the School of Administration/University of Ghana, where accommodation, medical and recreational facilities are provided. The full session extends from October to June with breaks at Christmas and Easter. Students from outside Ghana may remain in their accommodation at the College hostel during these breaks.

Entrance requirements:

The trainees are required to take an entrance test arranged by the Director of the Centre in the subjects English and Mathematics, of approximately School Certificate standard.

Curriculum:

1. English

A. Grammar & Structure

Countable & uncountable nouns

Tenses of the verb

Words of Quantity
Participle and infinitives
Direct and infinitives
Direct and reported speech
Word order
Number; prepositions
Phrasal verbs
Phrases and clauses
Synthesis

B. Colloquial (Social) English

Meeting people for the first time;
Parting greetings.
Introducing people
Responses involving 'yes' and 'no'.
Making polite requests

C. Writing

Compositions
Summaries & Comprehension
Simple official letters, reports and memoranda.

2. French:

The course aims at equipping students with a reasonable reading knowledge of the language.

3. Mathematics:

1. Indices and logarithms - basic rules of indices, multiplication, division, and extraction of n^{th} root of expressions by means of logarithms; theory of logarithms.
2. Use of tables of squares, square roots, reciprocals, cubes, cube roots, reference to the use of Barlow's tables.
3. Substitution and change of subject of formulae. Limits and the use of summation symbols.
4. Permutations and combinations. Binomial Theorem - expansion by means of the theorem, determination of greatest term etc.
5. Introduction to series, A.P. G.P. H.P. summation and determination of n^{th} term, no. of terms etc. of such series.

Cartesian Coordinates, distance between 2 pts.

Equation of a curve.

The straight line - equation of line in gradient form, intercept form and general form.

Parallel and perpendicular straight lines.

The circle: Equation, centre and radius.

Conditions that general eqn of second degree represents a circle.

Trigonometry: Definition of the circular functions of 90° .

Simple problems on height and distances.

Relations between the circular functions; simple identities.

Definition of circular functions of the general angle.

Determination of laws from experimental data.

Calculus: Differentiation of rational functions and simple trig. functions.

Application of the derivative to tangents, maxima and minima, calculation of rates and errors.

Introduction to Integration.

The exponential function: - Definition and differentiation.

Logarithmic differentiation.

Integration of exponential function, $\int \frac{dx}{x}$

Approximate Methods of Integration: - Trapezoidal and Simpson's Rules.

4. Elements of Economics:

The subject of economics.

Problems of choice, production possibilities, factors of production, laws of return, types of economic organisation, basic concepts and measurement of national income.

Business organisation - types of business units, the size of the firm.

Elements of the theory of demand.

Markets, demand and supply curves, supply and demand relationship.

Concepts and measurement of elasticity of demand
Marginal utility and indifference curves.
Costs, costs of production, price and output under perfect competition and cost, price and output under monopoly;
determination of the national income; the distribution of income; nature and function of money. Selected problems of economic development. Meaning of development. Main features of less and more developed countries. Cases of development policies.

TECHNICAL COURSES:

1. Elementary Statistical Methods

The meaning and uses of statistics.
Statistics as a method of research.
Errors of method and interpretation.
Statistical investigation: Determining the purpose.
Definition of units.
Preparation of dummy reports.
Preparation of questionnaires and schedules.
Editing of questionnaires.
Classification problems
Use of internationally prepared classifications.
Distinction between population and samples.
Measurements of central tendency:
Arithmetic geometric and harmonic mean, median, mode.
Measurement of Dispersion and Skewness.
Elementary probability.
Addition and Multiplication theorems.
meaning of independence.
Conditional probability
Random variables
Mathematical expectation of random variables & their functions
Moments.

The binomial distribution. The moments of the distribution.

The normal distribution. The standard form. Normal variates.

Use of table of areas under normal curve. Normal approximation to binomial distribution.

The Poisson distribution. Moments of the distribution. Use of the distribution.

Fitting of binomial, normal and Poisson distributions to empirical data.

Sampling theory. Concept of randomness. Random numbers.

Sampling with and without replacement. Sampling distributions of means, proportion, differences and sums. Central limit theorem.

Estimation theory. Estimation of parameters. Concept of bias. Unbiased estimates of means, proportion and variances. Concept of efficiency. Efficient estimates. Point estimates. Interval estimates. Confidence intervals for means, proportions, differences and sums.

Tests of hypotheses. Null hypotheses. Type I and type II errors. Level of significance. Hypothesis and its alternative. One and two-tailed tests. Tests of means and proportions. Test of differences and means and proportion. Operating characteristic curves.

Small samples. "Students" t distribution. Concept of degrees of freedom. Use of t tables. Confidence intervals. Tests of hypotheses for means, and differences of means and proportions.

The Chi-square Test.

Time series. Components of time series: trend, seasonal, cyclical and irregular. Estimation of secular trend. Semi-average method. Moving average method. Least squares criterion. Trend estimation by analytical approach. Normal equations for a straight line. Short cut methods. Interpolation and extrapolation of trend values. Concept of seasonal fluctuations. Methods of estimating seasonal fluctuations. Computation and seasonal index. Specific and typical seasonal. Adjustment for seasonal fluctuations. Scatter diagrams. Fitting of a curve in a scatter diagrams.

Linear regression. Standard error of the estimate. Concept of curvi linear regression. Concept of multiple regression. Coefficient of determination and its meaning. Coefficient of correlation. Relation between coefficient of correlation and regression. Test of statistical significance of coefficient of correlation. Fisher's Z transformation. Calculation of confidence limits.

Variance of regression coefficient. Statistical significance of regression coefficient. Concept of multiple and partial correlation coefficients. Rank correlation. Association between attributes. 2 x 2 contingency tables. Calculation of the degree of association. The degrees of freedom in contingency tables.

2. Sample Surveys:

Sample Surveys - Why Do We Use Them?

The idea of sampling. Sample surveys versus complete enumeration censuses. Some historical comments. The sampling design. The main problems of sampling: the accuracy of the results. Sampling error and bias. The use of supplementary information provided by censuses to improve the accuracy of sample surveys.

Basic Notions of Sampling

Definitions of population, unit of population, sample, sampling frame, sampling fraction, random variable, population value, estimate. Demonstration by means of simple examples.

Equal Probability Selection

Recapitulation of the elements of probability theory. Selection of the sample with replacement and without replacement. The number of possible combinations. The probability of selection of a given unit.

Measures of the Sampling Error

Demonstration of the equal probability sampling procedure with estimation of the population mean and total value. Frequency distribution of the sample mean. Variance and standard deviation of the sample mean. The concept of confidence interval.

Simple Random Sampling:

Definition. Selection technique. How to use the table of random numbers? Systematic sampling. Conditions for systematic sampling to be equivalent to simple random sampling, and conditions when this method is recommended. List sampling and area sampling. Simple unbiased estimate of means, proportions and totals from the sample. Calculation of the standard error. Calculation of the sample size. Use of supplementary information to improve the precision of the results. Ratio estimates.

Stratified Random Sampling:

Definition. How does the stratification improve the precision of the results? Stratum and domain of study. The allocation of the sample into strata. Proportional stratification (constant sampling fraction). Variable sampling fraction. The method of estimation from a stratified sample. The gain of stratification: calculation of the standard error.

Multi-Stage Sampling:

Definition. Characteristics of the two-stage selection technique. First-stage unit and sampling frame. Second-stage unit and sampling frame. The estimation process. Arithmetic mean remains unbiased estimator. What is the effect of two-stage sampling on the standard error? The role of homogeneity in designing multi-stage samples.

Systematic Error and Sampling Bias:

Sources of systematic error in statistics. Types of errors that may occur in both complete census and sample survey: ambiguous definition of the population, biased (prejudiced) answer, non-response, processing errors. The concept of biased sample. Purposive selection of the sample. Imperfect sampling frame. Imperfect supplementary information. Quota sampling. Cut-off method. Other sources of bias. Methods of control of the bias.

Two-Phase Sampling (Double Sampling)

The purpose of two-phase sampling. The technique of subsampling. The adjustment (calibration) of the large-sample estimates using the information provided by the subsample. The sampling error of the calibrated estimate. The use of two-phase sampling to diminish bias.

Some Remarks on the Efficiency of a Sample Design:

Concept of size efficiency and cost efficiency. The introduction of the cost-function and various types of cost-functions. The idea of optimal allocation of the sample between strata. Optimal allocation of the sample in a two-stage model.

3. Sampling Project:

Practical sampling survey undertaken with the purpose of teaching the problems involved in sampling design, preparation of questionnaires and enumerators instructions, actual enumeration, editing, coding, tabulating and writing the report.

4. Statistical Organisation and Procedures:

1. Brief history of Statistics and Statistical Organisations.
2. Objects of Statistics.
3. Functions of a national statistical system.
4. Types of Statistical Systems:
 - (a) Statistical system decentralized by subject with a minimum of control or co-ordination.
 - (b) Statistical system decentralized by subject with a co-ordinating authority.
 - (c) Statistical system with a major operating office for the general statistics and a co-ordinating authority.
 - (d) Statistical system with one Department responsible for statistics.

5. Types of Co-ordinating Bodies.
 6. Legal provisions for national statistical systems.
 7. Main characteristics of a good statistical legislative system.
 8. Examination of the structure and functions of the Central Bureau of Statistics of Ghana with comparisons being drawn with similar statistical organisations in other countries.
5. Demography:
- (a) The field of demography
 - (b) Census - Why they are necessary; history of censuses, census procedures and techniques; method of enumeration: De-facto and de-jure counts; place of enumeration; collection of data - canvasser and householder methods; Planning of an actual Census: pre-Census and post-Census procedures:
Data processing; Post-Enumeration Survey.
 - (c) Vital Registration - Vital Registration systems and population registers; why we lack them in West Africa; problems in setting up a vital registration system in African countries; sample techniques.
 - (d) Demographic Rates and Ratios - Sex Ratio; Age Composition and its influence on births and deaths; age pyramid and simple percentages; importance of age in demographic analysis; Territorial distribution and density of population, child - woman ratio; Crude Birth rate; Crude death rate; Age specific birth rate; Age-Specific death rate; General fertility ratio; Infant death rate. Growth of population - size of population - rates of growth.
 - (e) The life-Table - Generation and current life tables; uses of the life table; problems and construction of the life-table; United Nations Model life-tables for under-developed areas.
Migration - Urban/Rural: International migration.
Health Statistics - Field of health statistics and importance:

morbidity statistics: sources of morbidity statistics: Field surveys, hospital statistics: Special statistics - mental health statistics: tuberculosis and cancer statistics: maternity and child welfare statistics.

Population Projections - mathematical methods and component method of projections.

6. Economic and Social Statistics:

Labour & Employment

Definition of Labour force, Determination of Labour force,

Statistics of Labour force engaged in different sectors,

Employment Statistics in agriculture, industry, trade and use of

statistics of registration with employment exchanges for

determining demand for labour and determining unemployment - Sample

survey to determine unemployment, structure of wages, statistics

of wages and other benefits in different sectors of the economy.

Statistics regarding trade disputes and lock outs, frequency and

duration of trade disputes, Statistics of man hours lost due to

trade disputes.

Educational Statistics:

Literacy statistics, statistics of adult education.

Statistics regarding primary and secondary education - i.e.

the enrolment of students classified by age, sex, region.

Statistics of educational institutions and statistics of teachers.

Statistics regarding university education, forecasting demand for

education. Statistics regarding libraries, publication and

circulation of newspapers and periodicals.

Statistics of publication of books.

Statistics regarding entertainment and recreation.

Theory and use of index numbers -

Meaning of index numbers, the need for the construction of

index numbers of prices and quantities, consumer prices,

wholesale prices, agricultural production, industrial production, etc. Problems involved in the construction of index numbers - choice of base year, choice of weights, the base weighted and current weighted index number formulae, Fisher's ideal index number formula. Tests for index number formulae - Time reversal test and factor reversal test.

Consumer price index number - Determination of the weighting diagram from a family budget inquiry, organisation for collection of consumer prices, construction of the index numbers of consumer prices.

Transport Statistics -

Statistics of road transport, railways, shipping, inland waterways and civil aviation. Methods of calculation of freight and passenger traffic. Regional assessment of traffic. Estimating demand for transport facilities in relation to development. Demand for urban transport.

International trade and balance of payments -

The pattern of international trade by commodities and areas. Classification of imports and exports - standard international trade classification - classification of imports by end use - problems of valuation - c.i.f. and f.o.b. valuation, index numbers of volume and prices of international trade. Definition of terms of trade. Balance of trade. Balance of payments.

Fiscal and Financial Statistics -

Government accounts and their reclassification. Calculation of Money Supply. Banking Statistics.

Agricultural Statistics -

1. The organisation and purpose of agricultural statistics, with the description of organs, of coordination, of the difference between surveys and current reports, of the need of statistics, of the general situation in African countries.

2. The holding as statistical unit in agricultural surveys, its delimitation;
3. The usual information obtained by censuses, divided in chapters according to the FAO World Agricultural Census Programme, with the emphasis on tables explaining their items. The main stress was given to understanding the following notions:
 - holding versus household,
 - belonging of livestock to a holding,
 - land use and harvested area in case of mixed uses and crops,
 - employment versus population
 - number of machinery versus number of holdings using machinery.
4. Organization of a census and survey;
5. The selection of holdings in the field;
6. The main characteristics of questionnaires in order of chapters in the FAO Programme - and of density and crop cutting samples.

Projects in Agricultural Statistics

Measurement with compass and chain

Farm Measurement and determination of crop acreage

Pilot survey of a village.

Industrial Statistics

The scope of Industrial Statistics

The main purpose of the Industrial statistics.

Purposes of the industrial statistics in connection with the national planning.

The basic relationship between the index of production, the index of working labour force and the index of labour productivity.

Basic formula. Analysis of the increment of production.

Problems and exercises.

Individual indices for the actual development of production, the planned development of production and the fulfilment of the plan - targets.

Group indices of industrial production. Aggregate formula. Weighted Arithmetic Mean Formula. Index Ratio Formula. Problems and exercises.

The economic indicators of "Gross output", "value added" "net output".

Methods of their calculation. Evaluation. Component parts by different approaches.

The general plan for introduction of an integrated system of industrial statistics in Ghana.

The Ghana industrial census 1962.

The area Sample Survey of the small industry - 1963.

The annual statistics of medium-sized and large industrial units.

Manufacturing. Main parts of the forms. Definitions and contents of the items to be collected.

The introduction of quarterly industrial statistics in Ghana. Main parts of the instruction. Forms.

Special forms for the coverage of the State-owned and Joint State private industrial establishments. Plan-targets and the statistical control of the progress in the fulfilment of the plan.

Economic analysis which can be regularly carried out on the basis of the quarterly statistics.

7. National Accounts:

(1) Concepts and Definitions:

Circular flow of production, expenditure, income in a closed economy; double and multiple accounting, cash vs. accrual methods, implications for estimating.

Equivalence of income, expenditure, and production, algebraic and graphical illustrations, cancellation of intermediate flows, treatment of exports, imports, income to and from non-residents, taxation and transfer payments.

Gross and Net concepts, national and domestic concepts, market price and factor cost concepts; equality of savings and investment.

(2) General Techniques:

Surveys and censuses; adjustments for coverage, definition and concept, timing and calendar variations. Possibilities of modifications; administrative records, taxation records, special surveys; sample surveys.

Aggregative versus distributive methods, synthetic methods, interpolation and extrapolation, engineering and rule of thumb methods; ratio estimates, gross-up technique, multiplicative methods, number and average, price, and volume, cross checks and articulation, change in stock method; regression methods, residuals and double residuals.

(3) Detailed consideration of income, production and expenditure components; data Sources

Types of classification - occupation, industry, region, sector, size, type, origin.

Income - as income received and income paid, production - as value added, expenditure as sales and as purchases.

Consumption, investment, exports, imports. Residual errors, techniques for handling, origins.

(4) Deflation and Revaluation -

Constant price estimates, double deflation, direct output measurement, miscellaneous welfare adjustments.

(5) Special Problems of Under-Developed Countries

8. Computation & Presentation:

Checking of calculations

Significant Digits

Rounding Procedures

Placing of Decimal Points

Preparation of Tables

Use of Desk Calculators both hand and electrical

Use of slide rules
Scope and principal methods for processing
Punched cards - Their types and design
Punching and ensuring its quality
Punched Card sorting
Punched card Tabulating Machines
Auxiliary punched Card Machines

Graphs and Charts

Choice of the scale and the origin in drawing graphs. Graphical representation of time series data, comparison of two time series.
Use of semi logarithmic and double logarithmic graph papers.
Use of probability paper for the normal distribution. Drawing of histograms and frequency polygons and frequency curves.

Representation of data by pictograms, simple and composite bar charts. Pie charts. Definition of a Nomogram. Construction of simple nomograms. Control charts. Use of control charts. Control charts for variables. Chart for the averages, chart for the range and chart for the standard deviation. Control charts for attributes. Chart for number of defectives and fraction defective.

9. Accountancy:

Function of accounting

The nature of business transaction

Accounting reports: Balance Sheets

Revenue Statements

Double entry system

1. Determination of periodic income:
 - (a) by comparing balance sheets;
 - (b) by compiling a revenue statement.
2. Features of the revenue statement, including a consideration of the all-inclusive statement and the departmentalised statement.
3. Consideration of gross and net trading (or operating) profits or surpluses.

4. Exercises in the construction of the revenue account.
5. The ledger and ledger accounts - exercises in the construction of ledger accounts, balancing and the extraction of the trial balance.
6. The main subsidiary books of account and their uses.

Day Books

- (a) Sales Day Book
- (b) Purchases Day Book

Cash Book

- (a) Simple Cash Book
- (b) Cash Book with Bank column
- (c) Cash Book with Bank and Discount columns.

Ledger

- (a) Postings from day books and cash account
- (b) Balancing the ledger accounts
- (c) Trial Balance

Final Accounts

- (a) Trading and Profit & Loss A/cs.
- (b) Balance Sheet
- (c) Working Capital Computation
- (d) Ascertainment of profit from Capital statements.

Textbooks and reference books

The following will be among the books used during the courses:

Candlin: An English Course for Professional Students

Barton: Modern-Precis Practice

Mauger: Cours de langue et de civilisation française

Neiswanger: Elementary Statistical Methods

Allen: Statistics for Economists

J.L. Hansen: A Textbook of Economics

Brian Magee: Accounting

C.J. Tranter: Advanced Level Pure Mathematics

FAO Programme for 1961 World Census of Agriculture

ILO The International Standardisation of Labour Statistics
Studies and Reports

WHO Classification of diseases, injuries and causes of death

UNESCO Manual of Educational Statistics

Qualifications:

At the end of the course, a certificate of attainment will be granted.

Staff:

The United Nations Organisation has provided a senior Statistician to act as Director of the Centre. Provision is also made for the assignment of part-time and visiting lecturers drawn from the ECA and United Nations Specialised Agencies. In addition, senior personnel of the Central Bureau of Statistics, Ghana, and of the School of Administration, Achimota, will participate.

Fees:

The cost of the course is made up as follows:

Board and Lodging (i)	£120.--
Sports and entertainment fees	-.10.--
Books	25.-- (approx.)
Miscellaneous charges	5.10.--

£151.--

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(i) = Including vacation periods.

In addition provision must be made for travel from and to the home country.

United Nations Fellowships:

The United Nations fellowships enabling trainees from countries other than Ghana to attend the courses will cover board and lodging at the hostel of the School of Administration, Achimota, purchase of text-books, and adequate contribution to pocket expenses and a contribution towards transport to and from the home country. Half the cost of transportation must be borne by the fellows or their governments.

Applications:

Applications, from outside Ghana, for entry to the course and for the award of United Nations' fellowships should be made on the official form of application. They should be submitted to the Executive Secretary of the United Nations Economic Commission for Africa, in the case of Liberia, Nigeria and Sierra Leone through the Resident Representative of the United Nations Technical Assistance Board and, in the case of Gambia through the normal administrative channels.

STATISTICAL TRAINING CENTRE, ACHIMOTA

No. of applicants, students and certificates
awarded by countries in the years
1961/62 - 1964/65

	No. of applicants	No. of trainees <u>chosen</u>	No. of certi- <u>ficates awarded</u>
<u>G H A N A</u>			
1961/62	Not available	15	8
1962/63	18	12	11
1963/64	19	13	10
1964/65	24	10	?
<u>N I G E R I A</u>			
1961/62	11	4	4
1962/63	14	8	8
1963/64	15	9	8
1964/65	34	7	?
<u>S I E R R A L E O N E</u>			
1961/62	4	2	2
1962/63	2	2	2
1963/64	1	1	1
1964/65	2	2	?
<u>L I B E R I A</u>			
1961/62	16	4	4
1962/63	25	6	4
1963/64	11	6	6
1964/65	32	5	?
<u>G A M B I A</u>			
1961/62	-	-	-
1962/63	1	1	1
1963/64	-	-	-
1964/65	1	1	?

MARCH, 1965.