NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF EDUCATION

COURSE CODE: EDA 844

COURSE TITLE: Educational Statistics for Educational Managers

Course Guide

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1.0 Introduction

The course guide will also serveas your companion when you have questions about the course. Such questions include how to plan your time in studying the course; when to submit your assignments; and the various supports that are available for you.

2.0 **Objectives**

On the completion of this section, you will be able to:

- explain the importance of the course guide;
- explain the purposes of the course;
- describe the activities expected of you in the course;
- understand how to plan your time in studying the course;
- outline the available support services to you in the course; and
- explain the mode of assessment of the course.

3.0 **Main Content**

3.1 Introduction

You are welcome to EDA 844: Statistical Analysis and Quantification in Educational Planning. It is a two (2) credit unit course and it is offered at the Doctoral (Ph.D) level. There are fifteen (15) Study Units, including your Course Guide in this course.

This course guide is for you as a distance learner in the Ph.D Educational Planning Programme of the National Open University of Nigeria. This course guide is one of the many resource materials available to you to assist you to successfully complete this course and your programme in this university.

This course guide consists of useful information that will assist you. Such information includes: aims; objectives; what the course is all about; the course materials you will be using; available support services to assist your study; information on assignments and examination. It also offers you direction on how to plan your time for study; the time period of each study unit; and your tutor-marked assignments.

I strongly recommend that you go through this course guide and complete the feedback form at the end before you begin your study of the course. The feedback form must be submitted to your tutorial facilitator along with your first assignment. This guide also provides

ve further questions.

Please do not assume that the course is difficult because of its quantification characteristics. It has been simplified for your easy learning and understanding. You must show interest in the course as it is the major tool for operation in the hands of the educational planners, which you are now preparing to be.

I wish you the best in your learning experience and successful completion of this course.

3.2 **A Guide through the Course**

3.2.1 Course Aims and Objectives

Course Aims: This course, EDA 844 aims to develop the learners to understand and be able to use the various statistical and quantification techniques and skills in educational planning to solve education problems.

Course Objectives: There are objectives to be achieved in each study unit of this course. You should read them carefully before studying each unit. On completion of this course you should be able to:

- explain the role of data, information and statistics in educational planning,
- classify the types of data and statistics needed for educational planning,
- use various planning quantification models in solving education problems,
- acquire knowledge, skills, competence and practice in statistical and quantitative analysis, and
- apply the knowledge gained to conduct problem-solving researches/studies in education.

3.2.2 Course Materials and Structure

Course Summary

Module 1: Issues and Concepts in Educational Planning Statistics and Quantification

Unit 1: Concepts and Nature of Educational Planning Statistics and Quantitative Methods
Unit 2: Data Requirements for Statistics and Quantitative Analysis in Educational Planning
Unit 3: The Role of Statistics and Quantification in Educational Planning.

Module 2: Parameters For Demographic and Student Flow Analysis

Unit 1: Demographic Analysis and Educational Planning
Unit 2: Population Growth and School Enrolment Projection and Forecast
Unit 3: School Age Determination from Un-clarified and Incomplete Data
Unit 4: Enrolment Ratios Analysis
Unit 5: Indicators of Educational Planning
Unit 6: Intra-System Student Flow Analysis
Unit 7: Efficiency and Cohort Flow Analysis
Unit 8: Standard Progression Analysis and Wastage Reduction

Module 3: Methodologies of Student Enrolment, Teacher/Manpower and Cost Analysis

Unit 1: Student Enrolment Analysis and Forecast
Unit 2: Teacher/Manpower Analysis and Projection
Unit 3: Education Cost and Financial Analysis

Study Plan/Course overview

This table is a presentation of the course and how long it should take you to complete each study unit and the accompanying assignments.

Unit	Title of Study Unit	Weeks/ Activity	Assignment
	Course Guide	1	Course Guide Form
	Module 1: Issues And Concepts In Educational Planning Statistics And Quantification		
1	Concepts and Nature of Educational Planning Statistics and Quantitative Methods	2	Assignment
2	Data Requirements for Statistics and Quantitative Analysis in Educational Planning	3	Assignment
3	The Role of Statistics and Quantification in Educational Planning.	4	TMA to be submitted
Module 2	Parameters For Demographic And Student Flow Analysis		
1	Demographic Analysis and Educational Planning	5	Assignment
2	Population Growth and School Enrolment Projection and Forecast		Assignment
3	School Age Determination from Un-clarified and Incomplete Data	6	Assignment
4	Enrolment Ratios Analysis		Assignment
5	Indicators of Educational Planning	7	Assignment
6	Intra-System Student Flow Analysis		Assignment
7	Efficiency and Cohort Flow Analysis	8	Assignment
8	Standard Progression Analysis and Wastage Reduction	9	TMA to be submitted
Module 3	**Methodologies of Student Enrolment, Teacher/Manpower And Cost Analysis**		
1	Student Enrolment Analysis and Forecast	10	Assignment
2	Teacher/Manpower Analysis and Projection	11	Assignment
3	Education Cost and Financial Analysis	12	TMA to be submitted

References/further Readings

Your course material is the main text for this course. However, you are encouraged to consult other sources as provided for you in the list of references and further readings below.

References

Adeyemi, J. K. (1998) "Costs in education" in Nwadiani, M. (Ed), Educational management in Sub-Saharan Africa, Benin City: Nigerian Society of Educational Planning, pp. 66 – 80.

Adeyemi, J. K. (2006) "Introduction to educational planning" in Aghenta, J. A. and E. O. Omoregie (eds), Fundamentals of Educational Management, pp. 19 – 53.

Aghenta, J. A. (1993) Principles and practices of educational planning: Focus on the developing countries. Benin City: Nigerian Society of Educational Planning.

Babalola, J. B. (ed) (2003) Basic text in educational planning. Ibadan: Department of Educational Management.

Blang, M. (1970) An introduction to economics of education, Middlesex: Penguin.

Chau, T. N. (1969) Demographic aspects of educational planning. Fundamentals of Educational Planning, No. 9, Pans, UNESCO – IIEP.

Chesswas, J. D. (1969) Methodologies of educational planning for developing countries – 1 (Text). UNESCO, IIEP, pp 16 – 20.

Nwankwo, J. I. (1981) Educational planning: Theory and methods. Lahore/Karachi: IZAHRSONS.

Omoregie, O.S.B. (1989) Essentials of educational planning. Benin City. NERASO Publishers.

3.2.3 **How to Get the Most from this Course**

In open and distance learning, the study units replace the university lecturer. The advantage is that you can read and work through the course materials at your pace, and at a time and place that suits you best. Think of it as reading the lecture instead of listening to a lecturer. Just as a lecturer might give you in – class exercise, your study units provide exercises for you to do at appropriate times.

Each of the Study Units has common features, which are designed to aid your learning. The first feature is an introduction to the subject-matter of the unit and how a particular unit is integrated with other units and the course as a whole. Next is a set of learning objectives. These objectives enable you to know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study.

When you have finished the unit, you should go back and check whether you have achieved the objectives. Self Assessment Exercises are interspersed throughout each Study Unit and answers are given at the end of the course.

These exercises are designed to help you recall what you studied and to evaluate your learning by yourself. You should do each Self Assessment Exercise as you come to it in the study unit. The summary at the end of each unit also helps you to recall all the main topics discussed in the main content of each unit. There are also tutor-marked questions at the end of each unit. Working on these questions will help you achieve the objectives of the unit and prepare you for the assignments, which you will submit and the final examination.

It should take you about three hours to complete a study unit, the exercises and assignments. When you have completed the first study unit, take note of how long it took you and use this information to draw up time-table to guide your study for the rest of your course. The wide margins on the left and right sides of the pages of your course book are meant for you to make notes of main ideas or key points at which you can use when revising the course. If you make use of all these features, you will significantly increase your chances of passing the course.

3.3 **Course Delivery**

As an open and distance learner, you learn through several ways. You learn when you interact with the content in your course materials in the same way a student interacts with the teacher in a conventional institution. You also learn when you are guided through the course. However, you are not taught the course. Instead, your course material is your teacher; as such you will not be able to get answers to any questions, which may arise from your study of the material. It is for this reason that, in addition to the course materials, which you have received, the delivery of this course is supported by tutorial, facilitation, and counselling support services. Although these services are not compulsory, you are encouraged to take maximum advantage of them.

3.3.2 Tutorial Sessions

The total number of tutorial hours for this course is 8 hours. Tutorial sessions form a part of your learning process as you have an opportunity to receive face-to-face contact with your tutorial facilitator and to receive answers to questions or clarifications, which you may have. Also, you may contact your tutorial facilitator by phone or mail.

On your part, you wll be expected to prepare ahead of time by studying the relevant Study Units. Write your questions so as to gain maximal benefit from tutorial sessions. Information about the location and time schedule for facilitators will be available at your study centre.

Tutorial sessions are a flexible arrangement between you and your tutorial facilitator. You will need to contact your study centre to arrange the time schedule for the sessions. You will also need to obtain your tutorial facilitator's phone number and e-mail address. Tutorial sessions are optional. However, the benefits of participating in them provide you a forum for interaction and peer group discussions, which will minimise the isolation you may experience as a distance learner.

3.3.1 **Facilitation**

Facilitation is learning that takes place both within and outside of tutorial sessions. Your tutorial facilitator guides your learning by doing the following:

- provides answers to questions during tutorial sessions, on phone or e-mail;
- coordinates group discussions;
- provides feedback on your assignments;
- poses questions to confirm learning outcomes;
- coordinates, marks and records your assignments/examination scores; and
- monitors your progress.

The language of instruction for this course is English. The course material is available in print or CD format, and also on the university website.

On your part, you will be expected to prepare ahead of time by studying the relevant Study Units, write your questions so as to gain maximum benefit from facilitation.

Information about the location and time schedule for facilitation will be available at your study centre. Time of facilitation is a flexible arrangement between you and your tutorial facilitator. You should contact your tutorial facilitator if:

- You do not understand any part of the study units.
- You have difficulty with Self Assessment Exercises.
- You have a question or a problem with an assignment or with the grading of an assignment.

3.3.3 **Counselling**

Counselling forms a part of your learning because it is pro vided to make your learning experience easier. Counselling is available to you at two levels, academic and personal. Student counsellors are available at the study centre to provide guidance for personal issues that may affect your studies. Your study centre manager and tutorial facilitators can assist you with the questions on academic matters, such as course materials, facilitation, grades and so on. Make sure that you have the phone numbers and e-mail addresses of your study centre and the various individuals.

3.4 **Assessment**

There are three components of assessment for this course: Self Assessment Exercises and assignments at the end of each study unit; the Tutor – Marked Assignment; and a written examination. In doing these assignments, you are expected to use the information gathered during your study of the course. Below are detailed explanations on how to do each assignment.

3..4.1 Self Assessment Exercises (SAEs)

There are Self Assessment Exercises spread out through your course material. You should attempt each exercise immediately after reading the section that precedes it. Possible answers to the exercises are provided at the end of the course book, however, you should check the answers only after you must have attempted the exercises. The exercises are for you to evaluate your learning. They are not to be submitted. There are also questions spread through each study unit. You are required to attempt these questions after you have read a study unit. You are not required to submit the answers for SAEs.

3.4.2 Tutor – Marked Assignments (TMAs)

There are four Tutor – Marked Assignments for this course. The assignments are designed to cover all areas treated in the course. You will be given your assignments and the dates for submission at your study centre. You are required to attempt all four Tutor-Marked Assignments. You will be assessed on all four, but the best three performances will be used for your continuous assessment.

Each assignment carries 10% and together will count for 30% of your total score for the course. The assignments must be submitted to your tutorial facilitator for formal assessment on or before the stipulated dates

for submission. The work that you submit to your tutorial facilitator for assessment will count for 30% of your total course work.

Guidelines for Writing Tutor – Marked Assignments

1. On the cover page of your assignment, write the course code and title, assignment number (TMA 1, TMA 2), and date of submission, your name and matriculation number. It should look like this:

   Course Code:
   Course Title:
   Tutor-Marked Assignment:

   Date of Submission:
   School and Programme:
   Matriculation Number:
   Name:

2. You should endeavour to be concise and to the point in your answers and adhere to word limit where given. Your answer should be based on your course material, further readings and experience. However, do not copy from any of these materials. If you do, you will be penalised. Remember to give relevant examples and illustrations where necessary.

3. Use ruled foolscap sized paper for writing answers. Make and keep a copy of your assignments.

4. Your answers should be hand-written by you. Leave a margin of about 1.5 inches on the left side and about 5 lines before the answer to the next question for your tutorial facilitator's comments.

5. When you have completed each assignment, make sure that it reaches your tutorial facilitator on or before the deadline. If for any reason, you can not complete your work on time, contact your study centre manager and tutorial facilitator before the assignment is due to discuss the possibility of an extension. Extension will not be granted after the due date unless in exceptional circumstances.

3.4.3 Final Examination and Grading

The final examination for EDA 913 will be of two hours duration, will carry 70% of the total course and of questions, which reflect the kinds of Self Assessment Exercises and questions in the Tutor-Marked Assignments, which you have previously encountered. All areas of the course will be assessed. You should use the time between finishing the last unit and taking the examination to revise the entire course. You will find it useful to review your answers to Self Assessment Exercises and Tutor-Marked Assignments before the examination. For you to be eligible to sit for the final examinations, you must have done the following:

1. You should have submitted all the four Tutor-Marked Assignments for the course.
2. You should have registered to sit for the examination. The deadline for examination registration will be available at your study centre. Failure to submit your assignment or to register for the examination (even if you sit for the examination) means that you will not have a score for the course.

Course Marking Scheme

The following table lays out the marks that constitute the total course score.

Assessment	Marks
Assignments 1 – 4 (Four submitted, but the best three of all the assignments selected)	Three assignments selected and marked. Each is 10% totalling 30%.
Final Examination	70% of the overall course score
Total	100% of Course Score

4.0 **Conclusion**

In conclusion, all the features of this course guide have been designed to facilitate your learning in order that you admire the aims and objectives of this course. They include the aims and objectives, course summary, course overview, self assessment exercises and study questions. You should ensure that you make maximum use of them in your study to achieve maximum results.

5.0 **Summary**

EDA 844: Statitical Analysis and Quantification in Educational Planning provides you a knowledge base upon which you develop the mastery and skills of data analysis and quantification in educational planning. It is aimed at equipping you with the skills of relating indicators to benchmarks in decision making process. Upon completing the course, you should be able to make projection, predicting and forecast of enrolment, teachers required, facility required and financial need of the educational system. You should have been fully equipped for the job of policy analysis in education.

I wish you success with the course and hope that you will find it both interesting and rewarding.

6.0 **Tutor-Marked Assignment**

By now you must have gone through your course guide. Write the objectives you think you can achieve in studying this course.

7.0 **References/Further Readings**

Commonwealth of Learning (2005). Creating learning materials for open and distance learning: A handbook for authors and instructional designers. Canada: Commonwealth of Learning.

Inegbedion, J. O. (No date) "Guidelines to course material development" in Peters, F and C. Ofulue (eds).

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Course Coordinator:	
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MODULE 1: ISSUES AND CONCEPTS IN EDUCATIONAL PLANNING STATISTICS AND QUANTIFICATION

Unit 1: Concepts and Nature of Educational Planning Statistics and Quantitative Methods

Unit 2: Data Requirements for Statistics and Quantitative Analysis in Educational Planning

Unit 3: The Role of Statistics and Quantification in Educational Planning.

Unit 1: CONCEPTS AND NATURE OF EDUCATIONAL PLANNING STATISTICS AND QUANTITATIVE METHODS

Contents

1.0 Introduction

This unit is concerned with the basic concepts and nature of educational Planning statistics and quantitative methods. The unit focuses on the meaning of statistics and statistical procedures. It guides you through the statistical tools commonly used in quantitative analysis as well as the meaning of planning and educational planning.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the meaning of statistics and data,
- distinguish between data and statistics,
- describe the arithmetic tools of quantification in educational planning,
- explain the bases of statistical data classification,
- explain the concepts of planning and educational planning.

3.0 Main Content

3.1 Meaning of Statistics and Statistical procedure

3.1.1 What is Statistics?

Statistics can not simply be a collection of facts. If it were, there would hardly be much point in studying the subject. Neither is statistics a substitute for abstract theoretical thinking or for careful examination of exceptional cases. You may then ask: What is statistics?

Statistics may be described as the collection, presentation, analysis, and interpretation of numerical data. The facts, especially in regard to school system indices, which are dealt with must be capable of numerical expression. Statistics is not a science; it is a scientific method (Croxton and Cowden, 1955). The methods and procedures, which we shall be examining later, constitute a useful and often indispensable tool for the researcher.

In common parlance, it is generally used synonymously with the word data. Thus some people say “statistics of school students in Nigeria”. However, statistics is not the same as data. Data are the pieces of facts, figures and information that can give meaning when statistical procedures are followed. Therefore statistics is made up of various analytical and scientific tools of giving meaning to data collected.

3.1.2 The Statistical Procedures

Remember that we described statistics as the collection, presentation, analysis and interpretation of data. These constitute the statistical procedures. They are explained below:

1. Collection: Data for educational statistical analysis may be obtained from existing official or unofficial sources. They could be from published or unpublished documents. They could come from government ministries, parastatals or agencies. They could be collected from recognised associations, research bodies, journals, newspapers, magazines and so on. On the other hand, researchers and investigators may decide to collect their information, going from school to school, street to street, village to village and town to town to obtain their data. The second process could be more tedious, especially in our own environment. Although a researcher may never collect statistical data for his or her own use and may always use published sources, it is essential that he or she has a working knowledge of the processes of collection and that he or she be able to evaluate the reliability of the sources he or she proposes to use. According to (Croxton and Cowden, 1955), untrustworthy data do not constitute a satisfactory base upon which to rest a conclusion.

2. Presentation: Statistical data must be presented in suitable form, whether such data is for personal use or for the use of others. It is usual to arrange data in tables or represented by graphic devices. In educational planning, graphic presentation of data is commonly used and encouraged in addition to table presentation. This is to give good visual impression and meaning at first glance.

3. Analysis: In the process of statistical and quantitative analysis, data must be classified into useful and logical categories. The possible categories must be considered when plans are made for collecting data. Such data must be classified as they are tabulated and before they can be shown graphically. It can be said that the process of data analysis partially concurrent with collection and presentation of data.

4. Interpretation: The last process in a research or any investigation is to interpret the data analysed. From there you can draw conclusions. You can answer research questions too. The results must be interpreted in the light of the limitations of the original materials. It is important that an investigator should discover and clarify all useful and applicable meanings which is present in his data.

Self Assessment Exercise 1

1. What do you understand by the term statistics?
2. List the four statistical procedures you know?

3.2 Statistical Tools Commonly Used in Quantitative Analysis in Educational Planning

3.2.1 Ratios, Rates and Percentages

Ratios are computed to expedite comparisons. Through ratios, large numbers are reduced, but much is gained by comparing a series of figures with a rounded base of 100. The term "rate" is sometimes used to mean the amount or quantity of one variable considered in relative to one unit of a different variable. Thus, 45 km per hour is a rate of speed. On the other hand the term "ratio" is the relationship that two similar variables bear to each other. For example enrolment ratio is the ratio of pupils enrolled in the school system to the ones not enrolled. However, general use does not always observe this distinction between rate and ratio.

In educational planning analysis, ratio is often used with "stock" and rates as "flow" parameters. Stock statistics refer to the situation as it is measured on the reference date. They give the number of schools, classrooms, teachers and students on that day. On the other hand, flow statistics allow an assessment of the movement of students and teachers through the educational system. They include information on new entrance, repetition, promotion and dropout of students in the system (Nwankwo, 1981).

Percentages: A percentage is the number, amount or rate of something, a quantity, expressed as part of a total, which is one hundred (100). It is a part or share of a whole, which is usually 100. A percent is that part in every 100. If 500 students passed an examination out of 1000 students, it can be expressed as 50%, i.e. 50 out of every 100 students passed the examination.

3.2.2 Calculation and Recording

When one or more numbers are being compared to another number, the figure to which comparisons are made is known as base. A ratio is found by dividing the figure, which is being compared to the base, by the base. The figure is then expressed in terms of or in relation to the base, and ratios of all sorts are therefore sometimes referred to as relative or relatives (Croxton and Cowden, 1955).

The enrolment of primary school pupils in a state in a year, let us say 2000 was 100,000. In 2004 enrolment rose to 150,000. To therefore state the 2004 enrolment in terms of the 2000 enrolment, which is the base, you divide 150,000 by 100,000 to obtain 1.5. This implies that the 2004 enrolment was 1.5 times as great as in 2000. In most cases, ratios are most useful when expressed as percentages. To change 1.5, the ratio to one, to 0 ratio per hundred, the decimal point is moved two places to the right, the resulting figure, 150 percent is obtained.

Generally percentages are recorded to one decimal place. If the percentages are based upon large figures, and particularly if one or more than one, part of a total is quite small, it may be desirable to use more than one decimal. Occasionally only whole percentages are shown, in order that relationship may be grasped readily.

3.3 Basis of Statistical Classification

There are four important bases of classification of statistical data. They are:

i. Quantitative
ii. Qualitative
iii. Chronological
iv. Geographical

Let us take a look at each of them critically.

3.3.1 Quantitative

A quantitative classification is appropriate when items vary in respect to some measurable characteristics. Schools may be classified according to enrolment, teachers on roll, sex, etc. Students may be classified according to number of male and female. A quantitative data must be measurable.

Sometimes, qualitatively classified data may be reclassified on a quantitative basis by making slight changes. For example, the school curricula as qualitative information may be reclassified on a quantitative basis as science, vocational, social sciences, Arts.

3.3.2 Qualitative

Certain statistical data are not readily measurable. Some information are important for analysis, but they can not be measured. They include the objectives of education, philosophy of education, educational

equality, but they are necessary to guide investigator, especially in education.

3.3.3 Chronological

Chronological data, sometimes called time series show figures concerning a particular phenomenon at various specified time, for example the budgetary allocation to education over some years. The analysis of time series, involves a consideration of trend, cyclical, periodic (seasonal).

3.3.4 Geographical

The geographical distribution is essentially a type of qualitative distribution. We may want to consider how schools are distributed across a state or a country. How the universities are located across a country; how the Study Centres of the National Open University of Nigeria are distributed around the country.

Self Assessment Exercise 2

1. Distinguish between rates and ratios.
2. Can you differentiate quantitative data from qualitative data?

3.4 Meaning of Planning and Educational Planning

3.4.1 What is Planning?

Before you can apply statistical tools to effective educational planning, you should understand what planning is. Simply put, to plan is "to devise" or "design" something to be done, some action, some steps or decisions, to be carried out; "to arrange beforehand". Planning, according to Anderson and Bowman (1967) denotes nothing more than a process of preparing a set of decisions for action in the future". Dror (1963) describes planning as "the process of preparing a set of decision for action in the future directed at achieving goals by optimal means".

Thus, planning focuses on: series of decisions; the decisions are directed towards the future; the decisions are concerned with proper and most effective use of the limited resources; so as to achieve the objectives of the organisation.

Planning is also a deliberate, organised, continuous process of identifying different elements and aspects of an organism, determining their present state and interaction, projecting them in concert throughout a period of future time, and formulating and programming a set of

actions that are required to attain desired results (Branch and Robinson, 1968).

As you can see from the above meaning of planning, the essential features are process, decisions, actions, future and goals or objectives. For you to address these features, you must be able to project into the future and make forecasts to cope with the future demands. You can only do these effectively if you can handle the facts and figures of today, through relevant statistical and quantitative analysis. The special field through which this can be well handled in education is the Educational Planning.

3.4.2 What is Educational Planning?

Educational Planning, like all planning branches can be described as a process of preparing a set of decisions about the educational system in such a way that goals and purposes of education will be sufficiently realised in future with the available resources. According to Nwankwo (1981) the focus of educational planning is the application of rational and systematic analysis of the education production function with a view to suggesting what actions or measures would make the production of education more efficient and effective. This is based on the nature of goals of the society and the students.

Educational Planning according to the Implementation Committee on the Nigerian National Policy on Education (Blueprint, 1979) is a continuous process of obtaining and analysing facts and, from empirical base, of providing information to decision makers on how well the education system in accomplishing its goals in particular on how the cost effectiveness of education programmes and specific projects can be improved. You will notice from this description that the expectation or the functions of educational planning are:

- obtaining facts; and
- analysing such facts

These are to be a continuous process, while such analysis is to provide information that guide decision-makers to effectively manage education to achieve stated objectives. You can see that from the on-set, educational planning is to deal with the statistical and quantitative analysis that will guide decision making in education. Therefore, you seriously need the knowledge of the course to function as an educational planner.

Educational planning is interested in the following:

- preparing of alternative decisions,
- goals and objectives,
- programmes and services,
- human resources in the educational system,
- physical resources in the educational system,
- finance,
- government structure,
- the social context or what sources and social elements must we consider in the educational system.

You should therefore bear in mind that planning whether national, local or institutional must influence the future by taking logical, predetermined action in the present through designing alternative methods, strategies and approaches to assist organisations to accomplish its desired objectives. The functionality of educational planning is how -ever contingent on the factors of time, finance and the competencies of educational planners.

4.0 Conclusion

In this unit, you have learned a number of basic and important issues that are related to the concepts and nature of statistical and quantitative analysis in educational planning. You have learned the meaning of statistics and data. You have been able to identify the statistical and quantitative tools commonly used in educational planning. We have also highlighted the various bases for statistical data classification. The meanings of planning and educational planning were described so as to enable you appreciate the relevance of statistical and quantitative analysis knowledge to the planners.

5.0 Summary

What you have studied in this unit relates to the meaning and nature of statistics in planning education. It has served to give you some background information on planning and educational planning. The units which follow shall build on this introduction.

6.0 Tutor-Marked Assignment

Explain the statistical procedure for educational planning investigation.

7.0 References/Further Readings

Aghenta, J. A. (1993) Principles and practices of educational planning: Focus on the developing countries. Benin – City: Nigerian Society of Educational Planning.

Branch, M. and Robinson, I.M. (1968) "Goals and objectives in city comprehensive planning", Town Planning Review, 4, 38 – 62.

Croxton, F. E. and Cowden, D. J. (1955). Applied general statistics. New York: Prentice-Hall, Inc.

Dror, Y. (1963) "The planning process", in International Review of Administrative Sciences, 29(1), 46 – 58.

Implementation Committee on National Policy on Education (1999). Blueprint.

Nwankwo, J. I. (1981). Educational planning: Theory and Methods. Lahore/Karachi: IZHARSONS.

Anderson, C. A. & Bonman, M. J. (1969) "Educational Planning" in J. A. Lanwerys (ed). Education and the Economy, London: Evans brothers Ltd.

Unit 2: DATA REQUIREMENTS FOR STATISTICAL AND QUANTITATIVE ANALYSIS IN EDUCATIONAL PLANNING

Contents

1.0 Introduction

In the last unit, you learnt about the meaning, the concepts and nature of statistics and quantitative analysis in educational planning. In this unit, you will learn the types of data required for quantitative analysis in planning education and how you can readily obtain these data. You will also learn the constraints associated with data collection in developing countries like Nigeria and ways through which the situation can be improved. Since data availability is very important to educational planning, it is therefore necessary that you should know the types, relevance and the reliability of the data you will need for planning purposes. It behoves on the planner to know where certain data and information concerning planning can be readily obtained.

2.0 Objectives

At the end of this unit, you should be able to:

- identify the types of data required for planning education,
- explain the types of data required,
- highlight the sources of data collection for planning,

- explain the problems confronting data collection for the purpose of analysis for planning education,
- explain the ways data collection and generation can be improved.

3.0 Main Content

3.1 Types of Data Required

Two types of data and information are broadly classified in educational planning. They are:

i. Quantitative data; and
ii. Qualitative data.

3.1.1 Quantitative Data

Quantitative data are information on education that are documented in figures, which can be readily measured to give meaningful interpretation towards effective educational planning and problem solving. These include numerical figures or data that cover:

- The schools
- The students
- The teachers and non-teachers
- The population
- Finance
- Facilities and equipment
- School inspection
- Assets and liabilities of schools
- Available benchmarks and standards.

i. **The Schools Data**: Educational planner needs data on the number of schools for various planning purposes. Data on the type of schools can include: day or boarding, technical/vocational or general, Science or Arts etc. it could be level; such as primary school, secondary school (Junior or Senior), tertiary (Colleges of Education, Polytechnics/Monotechnics, Universities). Schools could be classified into private or public.

In addition, data on the size of school, whether small, medium or large are very important for planning purposes. Data on school location and distribution are very important too.

ii. **The Stuc ent Data**: The pupils or students are the most importan t inputs in the education system. The whole planning efforts surround them. Therefore, planner needs data on the school enrolment (i.e. number of students). Data by age, sex (male/female) and pattern of enrolment are necessary. Data on the social-economic background and the origin of birth (State and local government area) are required. Data on student enrolment by grade and level are required for stock and flow analysis. You may want to know how many students are in the primary schools this year to enable you make projection for the future year(s).

iii. **Teacher and Non-Teacher Data**: The teachers and non-teachers constitute the workforce in the school system. The effectiveness and the realization of the overall objectives of the educational system rest largely on the quality and quantity of the school personnel. The planner needs an up-to-date data on the stock and flow (movement) of the school personnel from time to time. This is to enable him or her make adequate projection for teacher and non-teacher needs in the school system. He or she needs data on the: number of teachers, number of teachers by sex, age, qualifications, experience, specialisation and so on.

iv. **Population Data**: Planning in all ramifications is done for the purpose of man and the entire society. As such the total number of people to be planned for overtime should be known. Hence, there is need for accurate population census. The census will enumerate the total number of people living within a geographical entity, which could be a country, a state, a local government area, a city, a town or a village. Th e enumeration should cover population by age, by sex, by location, tribe etc. you may need to answer questions such as:

- How many people are living in a state?
- How many of them are within an age bracket (e.g. age group)?
- How many people in such population are boys, girls, adult etc.?
- What is the fertility rate?
- If given the present population, what will be the population in a future date?

To answer these questions, you need accurate data on population.

v. **Financial Data:** Money is very crucial to the implementation of any plan, including educational plan. Without money the best intention could be frustrated, whereas a badly planned project may succeed with plenty of money. You can not plan without knowing the quality and quantity of resources at your disposal, which are a function of the amount of money available to you. As such the planner needs data and information on the sources of funds readily available through allocation and budgeting. You need data on the cost of education, especially unit cost of pupil or student per level, per year. You need data on private and social cost of education, institutional cost, current and capital cost etc.

vi. **Data on Facilities and Equipment**: Facility planning is important for effective school management. The adequacy or otherwise of school facilities and equipment could make or mar the school curriculum delivery and consequently the national goals and development. For these reasons, up-to-date and records of school facilities should be readily available for planning purposes. Data should be kept on school buildings, equipment, workshop, laboratories, classrooms, library and library books, the general store inventory, sports and hostel facilities etc. The analysis of such data will guide decision makers to identify the areas of strength and weaknesses during the implementation process of education policy programmes. It will guide the planner to make effective projection for future use.

vii. **Data on School Inspection**: School inspection ensures effective monitoring and evaluation of the school performance indices. Inspectors are to monitor and evaluate on regular and periodic bases the resources allocation and utilization to education; school management, teachers and non-teachers, facilities and equipment, and the school planning indices whether they comply with the benchmarks or existing standards. Therefore, data should be kept on the profile of those inspectors such as: data on the number of inspectors' available, data on the ratio of inspector to teachers, and ratio of inspector to school. You also need the data on the routine visits and feedbacks from visits. You equally need data and information on the facilities available for school inspection, such as vehicles. This is to enable you plan for any inadequacy that may be observed during data analysis.

viii. **Data on the Assets and Liabilities of School**: Schools, from primary to the university level have movable and

immovable assets. They also have liabilities. Data on these items should be kept. They may be required by the educational planner for certain analysis that could impact on the functionality of the school system.

ix. **Benchmarks and Standards**: There are official standards and benchmarks in the educational system to guide the quality of education at all levels. For example, the standard teacher/pupil ratio at the primary education level in Nigeria is 1:40, i.e. one teacher to forty pupils. They are standard/benchmarks set by various government agencies regulating the various aspects of education. Such agencies include: the National Universities Commission (NUC), Universal Basic Education Commission (UBEC), national Commission for Colleges of Education (NCCE), National Board for Technical Education (NBTE) etc. Educational planner requires such information to guide his/her analysis and decisions.

3.1.2 Qualitative Information

Qualitative information are the non-quantifiable or non-measurable information to be taken into consideration by the planner in the planning process. Such important information include: the vision, the mission and objectives of education. They also include information on the nation's philosophy of education. (for example, Nigeria philosophy of education is 'equal education for all'), educational policies, the content of education etc.

A planner is guided by these qualitative information; whatever is the quality and quantity of resources at his/her disposal. A planner should know whether the country he/she is planning for intends to operate a free and compulsory education or not and at what level. He/she needs information on the school curriculum and what the nation expects to derive from her investment on education. It is like an architect who is to design a plan for a building. He/she needs to be guided by the information from his/her client on the objective(s) of such building and even the location.

Self Assessment Exercise 1

Can you highlight the coverage of quantitative data required by the educational planner for planning analysis?

3.2 Sources and Suitability of Statistical and Quantitative Data for Planning

When an investigator or researcher embarks on a study, he/she may decide to either collect the data by himself/herself using questionnaire or checklist or obtain the relevant data from already existing published or unpublished documents. Hence the classification of data to primary and secondary based on the sources through which such data is collected.

3.2.1 Primary and Secondary Sources of Data

When a researcher decides to embark on data collection by himself/herself by going to the field with his/her developed instrument, which can be a questionnaire or checklist, he/she is said to be collecting data from a primary source. It is expensive and somehow cumbersome to collect reliable data from the primary sources in Nigeria. This is because of the rural nature of most of our communities. They lack access roads and most of the residents are illiterate, who may find it difficult to communicate with researchers, especially if they do not speak the same language. They may not be able to complete the questionnaires too.

In some cases, certain data may or may not have been published. They may have been originally collected by an individual, an agency, a firm, a research officer, a newspaper or magazine, a local, state, or federal government office, an association and so forth. Some publications contain only data, which were collected by the issuing organisation. Such sources are also designated as primary (Croxton and Cowden, 1955).

However, not all researchers will collect original data. Many will find it possible to make use of the existing sources for data and information. Some publications bring together data, some or all of which were originally compiled by organizations other than the one responsible for the publications. These are referred to as secondary sources.

It is preferable to make use of a primary source whenever possible, but in many times, planners rely on secondary sources. The Statistical Digest and Annual Statistical Documents of many government agencies are products of the secondary sources, however, they are very invaluable to the educational planner because they are readily available.
Primary sources of data are, however, preferred to the secondary sources because:

- the secondary sources are prone to mistakes due to errors in transcription made when the figures were copied from the primary sources;
- the primary source frequently includes definitions of terms and units used; this makes data from this source more clear and understood by users;
- the primary source often includes a copy of the schedule and a description of the procedure used in selecting the sample and in collecting the data; the reader is thus enabled to ascertain how much confidence may be reposed in the findings of the study;
- a primary source usually shows data in greater details. A secondary source often omits part of the information or combines categories. (Croxton and Cowden, 1955).

Whether from primary or secondary sources, educational planning data are readily obtainable from the following:

- Schools (records),
- Ministry of Education (State and Federal)
- Schools Board,
- Local Education Departments,
- Department of Planning and Research of Ministries and Parastatals,
- Ministry of Finance,
- Ministry of Labour and Employment,
- National Manpower Board,
- Federal Office of Statistics,
- National Population Commission,
- Educational Agencies (NUC, NCCE, NBTE, NERDC etc).

3.2.2 Suitability of Data

Investigators and planners are advised against making use of data from either a primary or a secondary source without assuring himself/herself as to the reliability, accuracy and applicability of such data. He/she must address the following questions before data use.

i. Was the schedule for data collection well designed?
ii. Was the sample representative enough, if the enumeration was based on sample?
iii. Was the collecting agency unbiased? This is because bias may enter either consciously or unconsciously.
iv. Was a selective fact introduced because of careless enumeration?
v. Were enumerators capable and well trained?

vi. Was the collection and editing carefully and conscientiously done?
vii. Was the tabulating performed with care and accurately checked?
viii. In view of the definition used, the area studied, and the methods of procedure, are the data applicable to the problem that is under investigation? (Croxton and Cowden).

Self Assessment Exercise 2

1. Differentiate between primary and secondary sources of data collection.
2. List the places you should rightly visit to collect data for education planning analysis in your state.

3.3 Problems of Data Generation and Collection for Educational Planning in Nigeria

There are several problems confronting obtaining adequate and reliable data for statistical and quantitative analysis in education in most developing countries. Nigeria is not an exception. The problems include:

1. Poor census base
2. Fraudulent compilation of most official records
3. Official secrecy attached to required data from governmental sources
4. Absence of functional data bank
5. Lack of adequate fund to obtain primary data
6. Incorrect data stored in many situation
7. Inadequacy of data storage, retrieval and processing technology
8. Low level of literacy, especially when collecting data at the primary source

1. **Poor Census Base:** Nigeria has conducted several censuses and all had ended in controversies among several groups in the country. There have been complaints of over-enumeration in some areas and under-enumeration in certain areas. Some state governments have even rejected the census figures given to their states. Since census figures serve as the planning base for any nation, it becomes difficult in Nigeria to rely on controversial figures. Up till now, the 2006 census figure is yet to be ready for public use.

2. **Fraudulent Compilation of Official Records:** Planners across the world rely heavily on information and data from official records. But when records are fraudulently compiled, it becomes unreliable.

It will interest you to learn that in a study I carried out on technical colleges on Nigeria in 1989, I collected what should be data on the same subject from the records of three official sources (the schools, the Federal Ministry of Education and National Board For Technical Education). The figures collected from these three sources were different. I had to rely on the average figures. Some of these figures are deliberately inflated to collect money from the government.

3. **The Secrecy Attached to Official Documents:** Many government important records and documents, where investigators and planners could obtain data and information are not readily available and accessible. This is because such documents are marked SECRET. There could be relief in a no distant time if the Free Information Bill is passed by the National Assembly.

4. **Absence of Data Bank:** Data banks are created in many developed countries to make data and information easily accessible and retrievable. Such data banks are not available in Nigeria. A data bank is to scientifically collect, collate and store data for the use of researchers, planners, government and various use. Data bank regularly updates and review data and their reliability.

5. **Inadequate Funding**: Many developing countries are poor. They do not have enough funds to invest on many important developmental needs. Generating primary data is very costly and demanding. Because of inadequate fund, many data are fraudulently compiled. Many researchers 'juggle' figures, many compile data in their rooms and offices to save cost.

6. **Incorrect Data Stored:** Many secondary data are not reliable because they are fraudulently obtained. Some data are collected with bias and full of errors. The error could be a result of the sampling and poor enumeration.

7. **Inadequacy of Information and Computer Technology (ICT) Use:** The world has gone technological. Data collection, retrieval, storage and processing today are technologically advanced. But it is costly to install ICT for statistical purposes. This is a big problem in Nigeria. In addition, many people, even scholars, are not ICT compliant or proficient. Many people are still computer illiterate.

8. **Low Level Literacy:** Although access to education has improved in Nigeria. However, there are still so many illiterates in the country, especially in the rural areas. Many Nigerians may not be able to respond to questionnaires meant to generate data, either

because they can not read or write or both. When they sometimes respond, they give wrong, incoherent and false responses that may not help the course of reliable data generation for planning. In many situations, the officials sent to the field to collect data are themselves ignorant of data collection processes. Many workers in the government offices and agencies that are responsible for data collection and compilation are not trained or professional.

3.4 Improving Data Generation and Collection

Since data and information are very important for planning, the problems confronting reliable data collection and retrieval must be curtailed and the existing situation must be improved. We can do this by:

1. Conducting reliable and acceptable census
2. Establishing data bank across the country
3. Developing the ICT for data and statistical purposes to ease collation, retrieval and processing
4. Training and re-training of data and statistical officials in government ministries, parastatals and agencies
5. Removing or minimizing official secret attached to governmental documents when they are needed for research and planning purposes.
6. Expanding basic education and enlightenment programmes, especially of the rural areas. Let people know the value of having reliable data and information for planning purposes.
7. Government and non-governmental organisations should fund data generating processes in the country. Government should increase funding to the special units and agencies that are specifically created for data generation and documentation in the country.

4.0 Conclusion

An understanding of the data requirements for statistical and quantitative analysis in educational planning is very important to preparing you for analytical procedure as a planner. The contents of this unit have taught you the types of data you required for analysis purposes. You have also learned the sources from which planning data can be collected. The constraints confronting reliable data in Nigeria as well as ways of improving the situation were exposed for your understanding.

5.0 Summary

To sum up this unit you have learned the types of data to be qualitative and quantitative. You have also learned that data can be collected from primary and secondary sources. We have pointed out several problems confronting statistical data in Nigeria and they include poor data bank, fraudulent compilation of records, official documents marked secret, inadequate funding and so on. You have also learned about ways of improving the data situation, which include increasing funding, development of ICT, removing or minimizing official secrecy surrounding official documents.

6.0 Tutor – Marked Assignment

1. With examples, explain the types of data that are relevant to quantitative analysis in educational planning.
2. Highlight five constraints of planning data in Nigeria.

7.0 References/Further Readings

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Unit 3: **THE ROLE OF STATISTICS AND QUANTIFICATION IN EDUCATIONAL PLANNING**

Contents

1.0 Introduction

In this unit, you will learn the usefulness and functions of statistics and statistical data in the management of education in general and educational planning in particular. Statistics as a veritable tool that deals with the collection, collation, analysis, and interpretation of data is a useful tool for research and planning. In this unit, you will learn the basic role of statistics, the general role and the specific role to education planning. You will also learn the problems confronting statistics use, while we will discuss the procedure through which statistical data can be obtained for the purpose of educational planning.

2.0 Objectives

At the end of this unit, you should be able to:

- outline the various role of statistics and statistical data to the planning of education,
- explain the basic, general and specific uses of statistics to education planning,
- highlight the problems and limitations of the use of statistics in educational planning.
- explain statistical data collection process in educational planning.

3.0 Main Content

3.1 Role of Statistics in Educational Planning

3.1.1 Basic Functions of Statistics

The importance of statistics and statistical data in any area of knowledge, including planning is enormous. An investigator can not effectively plan and carry out investigation without the knowledge of statistics. Basically, statistics has two functions. They are:

DESCRIPTION and **INDUCTION**: The descriptive function of statistics deals with the summarizing of information in such a way as to make it more usable and meaningful. Sometimes, we have so much data that we cannot adequately absorb all the information. The information must be brought to a point at which the planner or investigator can see what is in it. Measures, such as percentages, mean (averages), ratios, especially in educational planning may be used to reduce the data to manageable and meaningful level.

An equally important function of statistics is that of induction or drawing inference about the properties of a population on the basis of known sample results. Statistical inference, as the process is named, involves a rather complex reasoning, which constitutes a veritable tool in the development of any scientific discipline.

In Educational planning statistics and quantitative analysis, you will rely much on the descriptive aspect, because percentages, averages and ratios are commonly used as tools of analysis. You will be exposed to them in details in the subsequent units.

3.1.2 General Role of Statistics in Planning

According to Croxton and Cowden (1955), without an adequate understanding of statistics, an investigator in the social sciences and education may frequently be like the blind man groping in a dark closet looking for a black cat that is not there. The various methods of statistics are useful in the ever-widening range of human activities and in any field of thought in which numerical data are used. In educational planning, data analysis is heavily relied on for planning purpose. The following are the general role of statistics:

1. Data and statistical analysis of diverse nature are used by government and agencies in decision making and policy formulation. Government can establish a school in an area if data

analysis shows that there are enough children to attend the school and enough resources to manage the school. In this era of Information Technology, there is hardly a phase of human endeavour which does not find statistical devices occasionally useful.

2. Statistics facilitates the calculation of summary measures and basic indicators are used in educational planning. They include: Sex ratio, wastage ratio, teacher-pupil ratio etc.

3. Statistics enables investigators and managers describe and analyse the functioning of any system, such as the educational system. The collection and analysis of relevant data will assist the manager to know if his or her organisation is performing its role or not.

4. Data and Statistical analysis encourage effective overall assessment of the implementation of policies of government or organisation. Data analysis will show clearly if policy implementation is succeeding or not. Data analysis will reveal the need for policy review or policy reversal.

5. Data and statistical analysis enable assessment and evaluation of resource implications of development plans. It could be the education development plan. Data analysis will reveal the developmental needs of any country. How complex the needs may be will largely have implication on resource requirements.

6. Data and statistical analysis on regular bases is crucial because of the increasing demand for efficient resource allocation and utilization in the face of dwindling resources available to government, organisations and even individual across the globe.

7. The place of statistics and statistical analysis can not be compromised today when planning approach is shifting from static planning to dynamic planning. Today, various statistical planning models, such as Simulation, Lotus Modelling, Modular approach etc are used to predict future occurrences and how to tackle them. Modern managers therefore need to update themselves statistically.

3.1.3 Specific Role of Statistics in Educational Planning Analysis

Data and information on the educational system are required to make educational policies and plans. Educational planners require data and

information, and also sound knowledge of statistical and quantitative analysis to guide his decisions. Educational planner may not be able to make accurate decisions on resource allocation and utilization if he lacks adequate skills and knowledge in statistics and data analysis that are relevant to the field of educational planning. Therefore, statistics and quantitative analysis will assist the educational planner to effectively do the following:

1. Diagnosis of Educational Management Problems
2. Projection/Estimation of Resource Input
3. Prediction (Forecasting)
4. Target Setting
5. Evaluation of Education programmes.

Let us discuss them in details.

1. **Diagnosis of Educational Management Problems**

Data and statistical analysis are used by planners to easily discover and locate the problem areas and deficient system, sub-system, institution, school in the educational system. For example, data concerning financing of the primary education may help to expose the level of under funding or otherwise through unit cost analysis. This is an analysis that reveals what is spent on the average on one student. This is against taking decision by using the quantity or the size of money spent on the entire school system, which may be deceitful. Statistical analysis may reveal understaffing of the school facility situation etc. In fact, statistics facilitates situation analysis of the educational system. Diagnostic analysis also facilitates effective cure and remedying measures of any deficiency observed.

2. Projection/Estimation of Resource Inputs

The major function of educational planning is to make projection and prepare estimate on future needs. A planner should be able to decide accurately how many schools or colleges will be required in a country in a future date, based on the data on the existing ones. He should be able to determine how many school buildings may have to be built or replaced and the likely cost in the future. He can not effectively do this without adequate knowledge and skills in relevant statistical tools and analysis. To draw estimate of future financial requirement and budgeting, a planner must be proficient in statistics, especially for projection.

3. **Forecasting (Prediction)**

This is similar to projection, however, with a slight difference. While projection can be described as an estimation of the future resource input in form of figure and amount, forecasting is a statement about what will happen in future, based on information available at present. Forecasting, is predicting, while projection is estimation. Prediction is not always correct, while projection has higher level of accuracy. You can predict that Nigerian university graduates will not be able to compete at the International level in the next ten years if there is no change in the quality of the teaching facilities in the universities as they are today. Whatever the case, a scientific forecast requires statistical and data analysis knowledge. Therefore, the role of statistics in the forecasting ability of educational planner cannot be overemphasised.

4. **Target Setting**

To set target, you need certain goal or objective or target to accomplish. You also need to plan to guide the achievement of such goal. The availability of resources determines to a large extent the type of target you set. Data analysis encourages target setting. For example, a government may set target as to when primary education will be free and compulsory in a country or when illiteracy will be totally wiped out. For target to be achieved, data analysis concerning resource availability, allocation and utilization must be continually done.

5. **Evaluation of Education Programmes**

Quality assurance through regular programme evaluation is one of the duties of educational management. Programme evaluation in the education programme is a process of determining the value, worth and quality of such programme. In economics of education, the common tools for evaluation are: cost-benefit analysis, cost effectiveness analysis, planning programming and budgeting system (PPBS) etc. All these tools are quantitative in nature. Therefore, the educational planner should be vast in the knowledge of their use. This is to enable him or her use quantitative tools to evaluate the various inputs and large resources always allocated to education. He must be knowledgeable in cost statistics and analysis.

Self Assessment Exercises 1

1. Highlight the general role of statistics to planning.
2. Explain why educational planner requires the knowledge of statistics and quantitative analysis?

3.2 Problems and Limitations of the Use of Statistics in Educational Planning

We have just discussed the various role and uses of statistics to planner, policy maker, government and researchers. These uses and role, not-withstanding, statistics as a tool of analysis has some limitations, especially to educational planning. The limitations include the following:

1. If wrongly used, statistical analysis can lead to the establishment of wrong and potentially misleading conclusions, which could create more problem or even lead to crises, even more than the one such analysis intends to solve.
2. All problems, especially in education may not be quantifiable in term of figures, because education deals with people from various background and interest. For example, educational planners are yet to agree statistically on the actual cost of education. The actual private cost of education is not known, because it varies from person to person and household to household. Even the cost by government is difficult to analyse, because various governmental agencies and parastatals spend on education. The problem of demographic analysis is worrisome. Educational planners depend on the official school- going age for planning, whereas hardly do parents respect the official age in sending these children to school.
3. Since statistics deals with aggregate of facts and attaches no importance to individual items, it makes it difficult to actually trace individual problem through statistical analysis. Education activities are carried out mainly by individuals. It could be individual student or pupil, teacher, principal, school, etc.
4. Conclusions arising from statistics and quantitative analysis are not usually definitive and firm. This is because findings from statistical analysis are normally based on approximation and deductions.
5. The presence of bias on the part of a planner or researcher may discredit the entire findings and conclusions arising from it.
6. Omission of important factor (variable) in the process of statistical procedure may render a whole investigation useless.
7. Insufficient data result in a high degree of uncertainty in respecting any conclusion which may be made from them. A very small sample may lead us to a correct conclusion, but we can not place a high degree of assurance in our conclusion (Croxton and Cowden, 1955).
8. Unrepresentative data could pose a big-threat. We may base our conclusions on data which are numerically sufficient, but which are not representative enough. It has been severally discovered

that a small sample may be representative, while a large sample may not be.

9. Conclusion also drawn from statistical data may sometimes be invalid due to the presence of a concealed classification which is often overlooked. For example, the classification of urban and rural settlement in Nigeria can contaminate research findings. In some states, any local government headquarters is considered urban, whether urbanised or not. Whereas some settlement are big, even bigger, but not so classified.
10. Sometimes, failure to define units of study properly may affect the findings and conclusions.
11. Sometimes, misleading "Totals" could be used for statistical analysis. This is sometimes done ignorantly. Often we hear that about certain million of children are out of school. Ask how such million is arrived at, you will be told it is from mere estimate.

3.3 Collecting Statistical Data

An investigator can collect the data directly from the field by himself or through the assistant investigator(s), who are appointed by him/her. He or she can also collect the needed data from already existing available published or unpublished documents from various sources. We have earlier discussed the sources available to educational planner and researchers.

Statistical data are usually obtained through questionnaire and checklist. Interview can also be used to obtain information. In collecting data for statistical investigation, the following procedure can be followed:

- Planning of the study
- Design the questions and prepare the instrument
- Selection of the sample, if the examination is not to be a total coverage
- Use the instrument to collect data and information
- Edit the instrument
- Organise and collate the data
- Analyse the data
- Prepare tables and charts
- Analyse the findings

Self Assessment Exercise 2

1. State five problems of statistics use in education.
2. List the procedure to follow in statistical investigation.

4.0 Conclusion

In this unit, you have learned the role of statistics and quantitative analysis in decision making. The roles have been discussed under basic role, general role and the specific role of statistics to educational planning. You have equally been exposed to the problems and limitations that are usually encountered in using statistics for analysis despite its use. Since statistical investigation requires data, you have learned the procedure can be followed for such analysis.

5.0 Summary

This unit has taught you the role and collection of statistical data in educational planning. The role identified descriptive and inductive functions. We also identified the general role of statistics to planning. These include the uses of statistics in decision making and policy planning by government and individual; measure of indicators and performance evaluation of resource inputs. Statistics also assists educational planner in the areas of making accurate projection, forecast (prediction), target-setting, evaluation of programme and diagnosis. Problems and limitations of statistics, especially in educational management as well as statistical procedure were learned.

6.0 Tutor-Marked Assignment

1. Explain the problems confronting the use of statistics in planning analysis.
2. Highlight the role of statistics and quantitative analysis to educational planning.

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Module 2: **PARAMETERS FOR DEMOGRAPHIC AND STUDENT FLOW ANALYSIS**

Unit 1: Demographic Analysis and Educational Planning
Unit 2: Population Growth and School Enrolment Projection and Forecast
Unit 3: School Age Determination from Un-clarified and Incomplete Data
Unit 4: Enrolment Ratios Analysis
Unit 5: Indicators of Educational Planning
Unit 6: Intra-System Student Flow Analysis
Unit 7: Efficiency and Cohort Flow Analysis
Unit 8: Standard Progression Analysis and Wastage Reduction

Unit 1: Demographic Analysis and Educational Planning

Contents

1.0 Introduction

Demography is the scientific study of certain characteristics of human population. These include the size, growth, structure, distribution and occupation. Demographic study is therefore important to education; especially educational planning. This is because all quantitative analysis of educational planning depend on the data and information of people

living in a geographical area, such as a country, state, local government area, community and so on. Therefore, all planners, including you in training need the understanding of various concepts of demography. In this unit, you will learn the sources of demographic data, the structure of population in terms of its sex and age. You will also learn the impact of population structure on teacher requirements, education expenditure and school enrolment. You will equally learn about population distribution and the location of educational institutions.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the importance of demography to educational planning,
- identify the sources through which demographic data and information can be obtained,
- explain the meaning of population structure,
- explain the effect of population structure on school enrolment, teacher requirements and educational expenditure,
- describe the impact of geographical distribution of population on school location planning.

3.0 Main Contents

3.1 Demography and Educational Planning

Education is a human activity, which deals primarily with the transmission of a group's value to its citizens from generation to another. Education is therefore a people centred activity. Demography as the scientific study of population and its characteristics is very relevant to educational planning. This is because the population characteristics, which are: size of population, population growth overtime, the structure in term of sex and age distribution, and geographical distribution to be studied are all relevant to educational planning. In fact they serve as the bases for educational planning.

To assess the needs and demand for education, the educational planner must have a good understanding of the population size, structure and its dynamics for him to effectively plan. He or she must know the number of school going age population before he or she can plan adequately for number of schools, teachers and other resources for the education of such children. Demographically, the future demand for education is affected by the increase in the population of school age group. The future demand of education is also influenced by the education of the parents; hence the knowledge of the age structure of the population is important to educational planning.

3.2 Sources of Demographic/Population Data and Information

Demographic data and information are required by the educational planner to determine the behaviour and dynamics of the population of a country. This is to enable him understand the population figures he or she expects to work with at a present time as well as in the future date. He or she also requires the data and information to plan for education, especially in the areas of projection and forecasting of future education needs of the citizenry and the resource requirements of the educational system itself. Demographic data and information can be obtained from the following sources:

1. Census
2. Partial Enumeration
3. Sample Surveys
4. Vital Registration

The National Population Commission and the Federal Office of Statistics are the government agencies where population data and information can be readily obtained. Let us now discuss these sources in detail.

1. **Census**

Census is described as the total process of collecting, compiling and publishing of the demographic, economic and social data at a specified time concerning all the persons living in a country or a specified territory. In other words, census involves the complete enumeration of all the inhabitants of a defined geographical area. In Nigeria, census is conducted periodically. It used to be in every ten years. Census usually reveals the population size, age and sex structure, distribution and density, as well as occupation distribution.

2. **Partial enumeration**

Partial enumeration is carried out for a specific purpose. For example, an enumeration may be conducted to identify the school age population for a level of education in an area. It may be conducted to identify the need for vocational education by adult learners in an area.

3. **Sample Survey**

Sample survey is a method through which a representative area is selected for a later generalization. This is sometimes necessary because of the expensive nature of carrying out a complete census. However, the sample area may not always be a true representation of the geographical area. Group survey can also be used to cross-check the census figures.

4. **Vital Registration**

Vital registration deals with the records of population related events in a country. The events are:

- Birth
- Death
- Migration (Emigration and Immigration)
- Marriages

In many developed countries, registering of vital events is compulsory. This is not the case in the developing countries like Nigeria. Vital registration should be continuous for its information to be useful to planners.

From the information collected from the vital events, the population of a country can be easily updated and its dynamics understood. If you have the records of the vital events, you can derive the population by using this equation:

$P_2 = P_1 + B - D + I - E$ at T_2, where:

P_2 = Updated Population
P_1 = Current Population
B = Births
D = Deaths
I = Immigration
E = Emigration
T_2 = Following year

Example

Estimate the population for a country X at the end of 2005, if:

Census Population at the end of 2004	=	P_1 = 500,000
Live births in 2005	=	B = 30,000
Deaths in 2005	=	D = 10,000
Immigrants in 2005	=	I = 20,000
Emigrants in 2005	=	E = 22,000

∴ The population for country X at the end of 2005, making use of the above equation will be:

$$\begin{array}{rcl} & (P_1) \quad (B) \quad (D) \quad (I) \quad (E) \\ P_{2005} & = & 500{,}000 + 30{,}000 - 10{,}000 + 20{,}000 - 22{,}000 \\ & = & \underline{518{,}000} \end{array}$$

This implies that 2005 population of country B will be 518,000. This will be the data to work with by planners.

Self Assessment Exercise 1

1. What is the connection between education and demography?
2. Why is an educational planner in need of the knowledge of demography?
3. Explain the vital events necessary for demographic data.

3.3 Population Structure and Education Planning

Population structure deals with the study about the composition of the population based on certain pre-defined factors. The educational planner may be interested in the population by age and sex. He may be interested in the population by distribution, by economic sectors and occupation so as to enable him plan for the manpower requirements. He may also be interested in the geographical distribution of the population so as to be guided properly in school location planning as well as school plant planning. The simplest way of studying the population structure is through the construction of an AGE PYRAMID. Figure 1 shows the Age Pyramid of the 1963 population of Nigeria. Population age structure gives a summary of the demographic past of a country and also governs to a certain extent the future trend of population (Akangbou, 1982).

A close study of a population structure can reveal the past events, which may have affected the population of a country. The census population provides the information needed to construct a population structure. The structure of any population portends certain implications for educational planning. These are in the areas of future enrolment, teacher requirements and financial demand. These shall be discussed in detail.

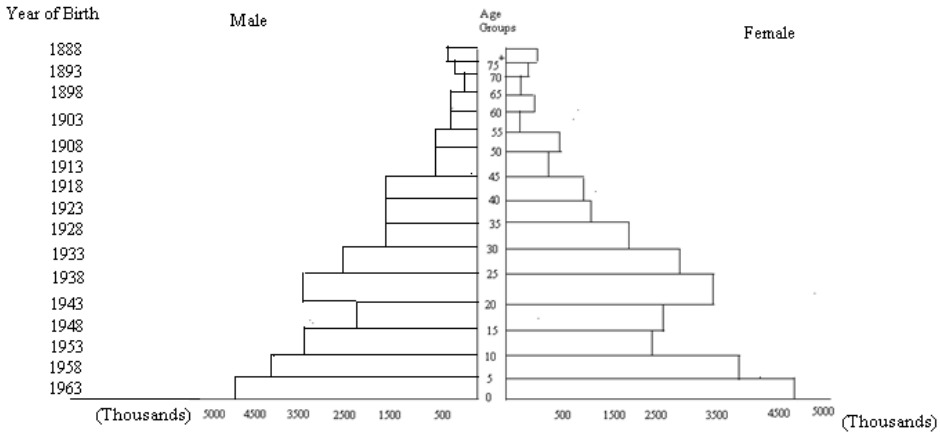

Figure 1: Population of Nigeria by Age and Sex (Structure), 1963

Source: Federal Office of Statistics (1973) Annual Abstract of Statistics, Lagos.: FOS

3.3.1 Population Structure and Enrolment

Population structure, in particular the age structure will enable us to estimate and forecast effectively the size of the school age population. It enables us to accurately measure the school enrolment rates.

The sex structure is also important. Sometimes it is necessary to calculate the school enrolment by sex to determine the proportion of male to female in the school system in comparison to their population. The sex and age structure pyramid will practically assist the planner to easily sort the age and sex factors in the planning of education.

3.3.2 Population Structure and Teaching Staff Requirements

The age pyramid in figure 1 shows a continuous increase in the births overtime. The pyramid shows that 0 – 5 age group children in 1963 were about 4.5 million male and 4.5 million female, totalling 9 million. In years before 1963, the population of this group of children was far lower. Increased population has far reaching implications on educational inputs, especially the teacher that will teach in the schools. This is because the teachers will be recruited from the generation of people born before those that will be in the school system. If you study figure 1 properly, the pyramid shows that the population from the groups the teachers will come from is thin. This sometimes could explain the shortage of teachers in those days.

In addition, an increase in birth, depending on the school going age will result in an increase in the school enrolment. This therefore calls for planning for more teachers and how they will be trained. For example, the 1963 age structure revealed that about 9 million children should

have started school between 1964 and 1969. If the teacher-pupil ratio by then was 1 to 30, the following number of teachers would have been recruited.

$$\frac{9{,}000{,}000\ Children}{30\ Teaches} = 300{,}000\ Teachers$$

The population structure shows that based on the teacher-pupil ratio of 1 to 30, about 300,000 teachers should have been recruited. How would the country have got this number in those days if primary education had been made compulsory?

3.3.3 Population Structure and Educational Financing

Education expenditure is proportionate to enrolment. Enrolment is also dependent on the school age population. Financing of education is, however, a levy on the production of the economically active age of the population. That is, those who are working. In Nigeria, the school age population was from 6 – 17 years; while the work force population was from 18 – 60 years of age. Not all of them may be working. An estimate of the relative load of educational expenditure on the active population is therefore obtained by establishing the proportion of the 6 – 17 years old population to those of 18 – 60 years of age.

A population is said to be young when the number of young people in proportion to the total population is relatively high. When the proportion is low, the population is said to be old or aged. The population structure pyramid can easily show whether a population is young or old.

Moreover, the age structure of the teachers in the school system; especially by seniority enable the planner to make accurate forecast of the financial effects of changes in the pay scale. The average salary and consequently the total cost are higher when majority of teachers are comparatively old persons.

3.4 Population Distribution and School Location Planning

3.4.1 Population Distribution

The population of a country can be either densely distributed or sparsely distributed. Population distribution is concerned with the spatial location of persons across the country. There are many factors that influence the settlement pattern of a country. People settle in a place for many reasons. It could be for security, employment, business and so on. The Nigerian population is mainly rural and scattered. However, in

recent time, there has been an increase in rural-urban movement, thereby increasing the urbar population, while the rural population thins down. In fact, some rural communities are becoming depopulated because of the rural-urban migration. Population is not static but dynamic, because people always move from one place to the other to settle in search of daily living. It becomes a challenge for educational planning, especially in the area of planning for the school location and plant planning. Let us study the following diagrams showing different population distribution.

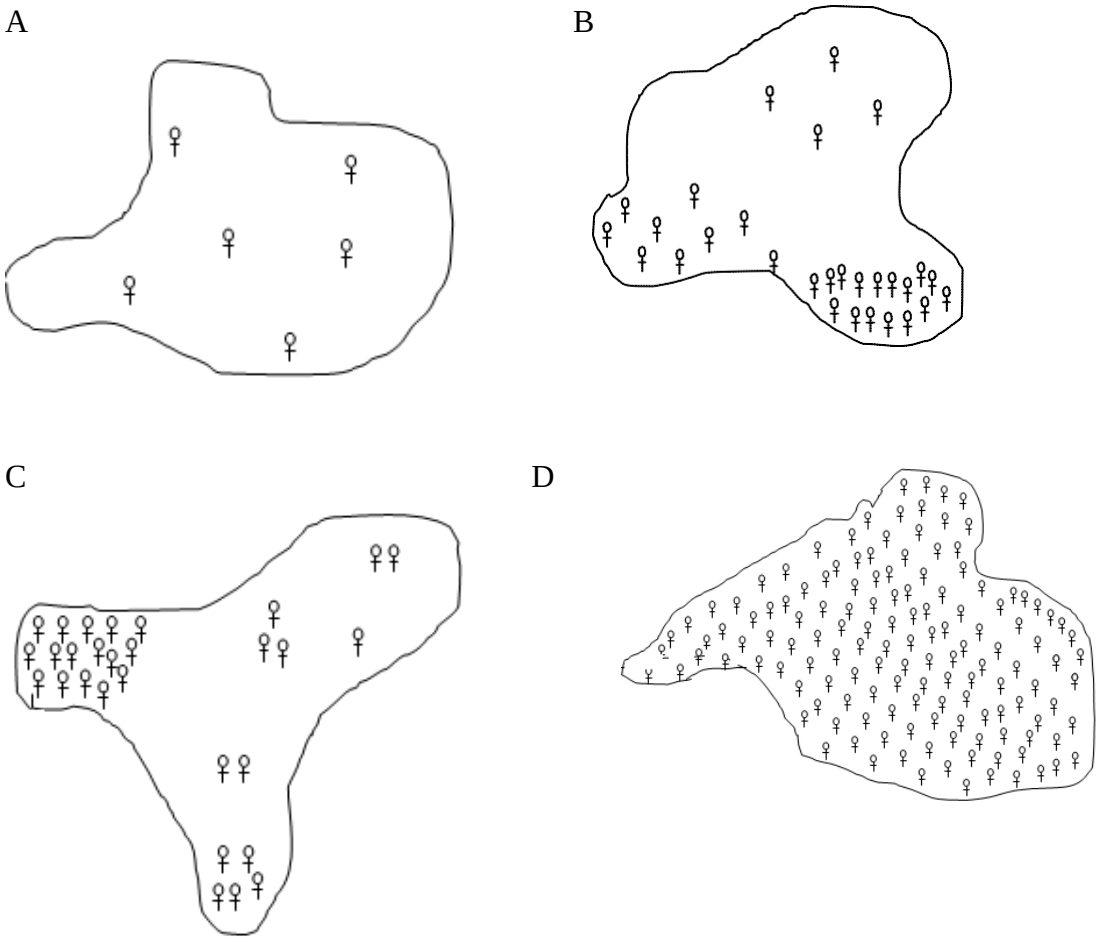

Figure 2: Population Distribution in Four Communities

The four communities present different population distribution pattern. The challenge for you as a planner is that all communities with humans deserve education and access to school. Sometimes, the population density in an area could be so low. As such it may not be cost efficient to establish even a primary school. But the question is: What happens to the children in such a situation. A big challenge! This takes us to the population distribution and school location planning.

3.4.2 Planning School Location

Two factors are very crucial and must be seriously considered in planning the location of educational institutions. They are:

- The population size, and
- The catchments to be served by the institution.

In Nigeria, these factors are often ignored in establishing school. Political leaders usually use political consideration and sentiment in locating educational institutions, especially higher-institutions. State Governors have in many cases site universities and colleges in their towns and villages, even when all planning indices show the contrary.

1. The Population Size

There must be a certain minimum number of primary or secondary going age populations, living within an area to justify the establishment of a school: The problem of ascertaining whether minimum number of school going age does not arise in densely populated areas where there is always sufficient population. The problem lies mainly in the sparsely populated area or in dispersed settlements. It will be easier to locate a school in community 'D' than community 'A' in figure 2.

2. The Catchments Area

Catchments area in educational planning refers to a geographical area an institution should serve. It is important that the area to be served by an institution should not be too large especially at the primary and secondary education levels, so that pupils or students can easily reach the school from their homes. The acceptable limits of the catchments area largely depend on the following:

- Level of education
- Age of children
- Means of transportation
- The terrain and climate of the environment
- Security devices available
- Facilities offered by school (e.g. Lunch, Hostel)

A higher institution can be established any where. It is expected that the children for higher education are big and more mature. As such they could access any institution with confidence. Primary schools should be closer to children home because of insecurity and mobility. The means of transportation available can also determine the catchments coverage.

Unfortunately schools are scattered in rural area where the means of transportation is poor. Children are seen walking over several kilometres everyday before getting to school. Most secondary schools do not run the boarding system anymore, while boarding system is never a part of the primary education. The terrain of an area must be considered before locating a school. It is not feasible to locate a school in a marshy area, or a place close to the river, especially for young children.

The central location model is prescribed for the location of school in a sparsely populated area. The model suggests that where population or settlements are dispersed to the extent that each can not sustain a school with enough population, a school should be built in a central place for such community of small settlements. Such school is to be located in a central place that will guarantee easy access to all members of such community, without any disadvantage. Figure 3 is an example of a central location of a school in a dispersed community.

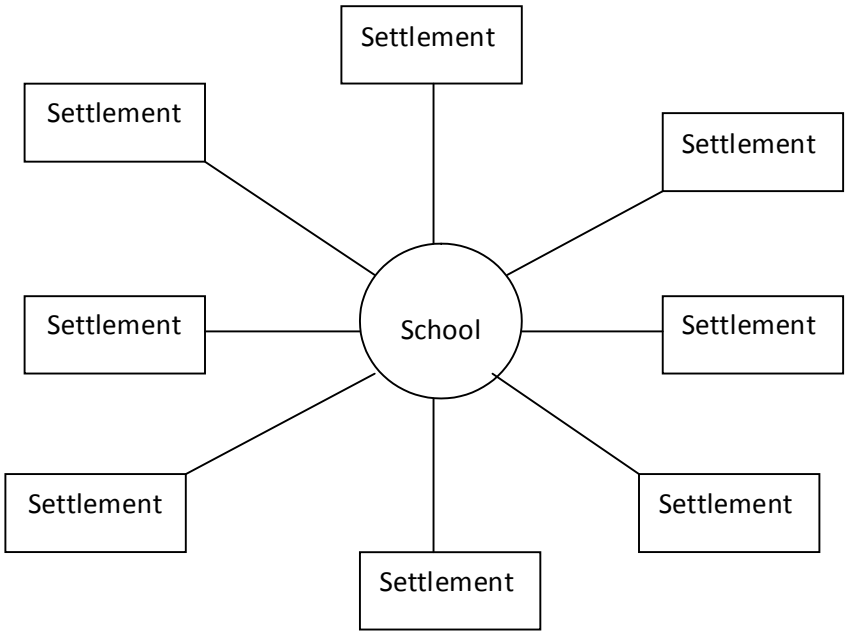

Figure 3: A Model Showing a Centrally Located School in Dispersed Settlements Community

In selecting sites for educational institution, Akangbou (1982) advised planners to always ask the following questions:

- Should areas where enrolment rates are particularly low be favoured at the risk of obtaining small numbers of pupils/students

or should more institutions be provided where population density is high and justifies such institutions?

- Should the total number of students/pupils be increased to maximum?
- Should equal opportunities be provided for all boys and girls regardless of where they live?

Whatever be your answer, as a planner the following will objectively guide you:

1. The policy of education in the country.
2. The cost of education and the economy.
3. The desire of the citizens.
4. The ideology and manifestoes of government in power.

Self Assessment Exercise 2

Explain the population structure of a country?

4.0 Conclusion

Demography is very important to educational planning, because it is the scientific study of human population. It is the human population that forms the basis of planning, because all quantitative analysis in educational planning depend largely on the data and information of a country's population. The population characteristics of size, the growth of the population, the sex and age structure are all critical to the planning of all aspects of any nation, especially education. An educational planner should know how and where to obtain demographic data and information for planning. It is the collected data and information that guide him to plan for the future enrolment, teacher requirements, the facility requirements and financing needs of the educational system. The understanding of the geographical distribution of population will also guide the planner in school location and plant planning.

5.0 Summary

In this unit, you have learned that demography is the scientific study of human population. The sources of population data and information were identified to come through the census, vital registration, sample survey and partial enumeration. You have learned that population structure affects the school enrolment, teachers requirements and educational financing. You equally studied the spatial distribution of population and location of educational institutions.

6.0 Tutor Marked Assignment

1. Why should an educational planner study demography?
2. How can demographic data and information be obtained for planning purposes in education?

7.0 References/Further Reading

Akangbou, S. D. (1982) Qualitative and quantitative aspects of educational planning. A set of Modules on Educational Planning. Prepared for BREDA, Dakar, Senegal. UNESCO.

Chau, T. N. (1969) Demographic aspects of educational planning. Fundamentals of Educational Planning. No. 9. Pans, UNESCO – IIEP.

Unit 2: POPULATION GROWTH AND SCHOOL ENROLMENT PROJECTION AND FORECAST

Contents

1.0 Introduction

The main essence of demographic study by educational planners is to enable him/her predict accurately the future resource inputs and possible outputs in the educational system. He or she therefore should understand the growth behaviour of such population from time to time. Population growth is very important because it affects the school age population and the pattern of future enrolment in the school system. It is the population that will enable the educational planner to correctly forecast future enrolment. In this unit, you will learn the population growth and projection.

2.0 Objectives

At the end of this study, you should be able to:

- explain the natural growth of population;
- identify the population projection methods;
- explain the methods of population projection;
- project future population based on available data.

3.0 Main Content

3.1 Population Growth and Birth Projection

The growth of any population is mainly determined by the variables of Fertility (Births) and Mortality (Deaths). International migration is also a factor, but not as significant as births and deaths and it can not be adequately predicted. Because it varies from country to country, as such it is not often considered when population growth and projection are determined.

3.1.1 Natural Growth Rate of Population

The differential between birth and deaths is referred to as natural growth of population. As people die daily so also new babies arrive daily. To calculate the growth of a population, the difference between the crude birth rate and the crude death rate will be done.

The crude death rate is measured by this formula:

$$CD_t = \frac{D_t}{P_t} X1000, \text{ where}$$

CD_t = Crude Death Rate in year t

P_t = Average population in year t (Average Annual population is either the population as at first day of July or at the beginning or the end of the year)

D_t = Total Deaths in year t

Example: If population is 1,000,000 in year t
Deaths = 20,000 in year t

$$\text{Crude Death Rate} = \frac{20{,}000}{1{,}000{,}000} X1000$$

$$= 20\ {}^{o}/_{oo} \text{ (20 death per 1000).}$$

Crude Birth Rate is measured by using this formula

$$\text{Crude Birth Rate } (CB_t) = \frac{B_t}{P_t} X1000, \text{ where}$$

B_t = Live births in year t

P_t = Average population in year t

Example

If population = 1,000,000
Birth = 55,000

$$\therefore CB_r = \frac{55{,}000}{1{,}000{,}000} X100$$

= 55 $^{o}/_{oo}$ (55 births per 1000)

∴ Natural Growth Rate = Crude Birth Rate – Crude Death Rate
= 55 $^{o}/_{oo}$ – 20 $^{o}/_{oo}$
= 30 $^{o}/_{oo}$ Natural Growth Rate.

We can convert this to percentage for your understanding.

$$\text{Natural Growth Rate} = \frac{30}{100} X100$$

= 3%

3.1.2 Birth Projection

Birth projection is a process by which the number of births to be born in a future date is estimated. To do this, you need data on the Projective Fertility Rates of the country. Such data are kept by the Population Office or Federal Office of Statistics. It is assumed that Projective fertility Rate varies from period to period, especially for different female cohorts (groups). You also need data on the population of female cohorts (groups) in two dates to show attrition to each group as a result of death or International emigration. Table 1 will throw more light.

Note: A female cohort is consisted of female numbers of a population born in the same period. For example, female children born between 2000 – 2004 can be said to belong to the same cohort. The classification of people into birth cohort is officially done in many countries.

Table 1: Population Projection of female Cohorts (Group)

Years of Birth of Female Cohorts	Population as at 1/7/2003	Population as at 1/7/2007	Projective Fertility Rate 0[redacted]00
1960 – 1964	700,000	680,000	800
1965 – 1969	800,000	720,000	750
1970 – 1974	890,000	810,000	900
1975 – 1979	880,000	800,000	980
1980 – 1984	950,000	900,000	900
1985 – 1990	900,000	870,000	980

What the table is saying for example is that the population of the female born from 1960 – 1964 was 700,000 as at 1/7/2003. But the population was reduced to 680,000 as at 1/7/2007 due to factors of death or international emigration.

You can find the average of these females as:

$$\frac{700{,}000 + 680{,}000}{2}$$

$$= \quad 690{,}000$$

The next stage is to multiply this figure by the projective fertility rate for the cohort, which is 800%0 to give us the projected number of births expected from this cohort during this period, i.e. between 2003 and 2007.

$$= \quad \frac{690{,}000\,X\,800}{1000}$$

$$= \quad 552{,}000$$

This implies that 552,000 is the number of births expected from the female cohort of 1960 – 1964, between 2003 and 2007. You can break this figure to male and female, based on the existing male-female population ratio in the country. You may have a ratio 100:110, i.e. for every 100 male there are 110 female and you will obtain:

Male	=	262,857 births
Female	=	289,143 births

Since some of these children may not survive till 1/7/2007, you can obtain the actual 0 – 4 age group by the corresponding survival rate, which is available in the country from the relevant agency.

For example, if the survival rate of the 0 – 4 age group is 80%, the actual figure that will be useful to the educational planner for school enrolment forecast will be:

$$552{,}000\,X\frac{80}{100}$$

$$= \quad \underline{441{,}600}$$

Self Assessment Exercise 1

Project the births for the other female cohorts in Table 1

3.2 Population Growth and Projection or Forecast

In the absence of data on the registration of vital events, population at a current date or future date can be projected if the growth rate is known. What matters are the population figures of two recent censuses. For example, the two recent censuses in Nigeria are the ones of 2006 and 1991.

3.2.1 Population Growth Rate based on Arithmetic Progression

The annual rate of change of a population is in Arithmetic progression. That is, there is a constant amount of increase per unit of time. The Rate of change of population is measured with this expression.

$$r = \frac{\frac{P_t - P_o}{P_o}}{n} X 100 \text{, where}$$

r	=	(% Annual Rate of change growth over the period between P_t and P_o)
P_t	=	Population in the last of the two censuses (the latest census figures). E.g. 2006 will give Nigerian latest census.
P_o	=	Population of the initial census (i.e. the census before the latest one). E.g. 1991 census was Nigerian P_o here.
n	=	Number of years between the two census dates.

Example

If 1991 population = 78,000,000, and
2006 population = 148,000,000, with
n = 15 years (Between 1991 and 2006)

$$\therefore \text{Rate of Change} = \frac{\frac{P_{2006} - P_{1991}}{P_{1991}}}{15} X 100$$

$$= \frac{\frac{148{,}000{,}000 - 78{,}000{,}000}{78{,}000{,}000}}{15} X 100$$

Annual Rate of Change = 8.97%

This implies that the population was growing at 8.97% annually. This can be used to project future population.

3.2.2 Population Growth Rate based on Geometric Progression

Conventionally, population does not grow arithmetically as explained above; but geometrically, that is at a compound rate; because any additional increase in the population generates a further increase. A child born today may in the next thirty years be contributing children to the population. Because of this, the following formula has been developed to obtain the average annual rate of growth. It is expressed as:

$$r = anti\log\left(\frac{LogP_t - LogP_o}{n}\right) - 1, \text{ where}$$

r = Average Annual Rate of Growth of Population.
P_t = Population in the last of two recent census.
P_o = Population in the initial of the two recent census.
n = Number of years between the two dates.

Example

P_t = 1963 Census = 55,670 (in thousand)
P_o = 1953 Census = 30,402 (in thousand)
n = 10 years
Log = Logarithm (You can use the Four-figure Table or Calculator)

$$\therefore \quad r = Anti\log\left(\frac{Log\,55{,}670 - \log 30{,}402}{10}\right) - 1$$

Take the Log of 55,670 = 4.74562
30,402 = 4.48310
n = 1963 – 1953 = 10

Substitute these values in the formula,

$$\therefore \quad r = Anti\log\left(\frac{4.74562 - 4.48310}{10}\right) - 1$$

= Antilog(0.002627) – 1

Then take the antilog of 0.002627 before subtracting 1

= 1.06236
$\therefore$ r = 1.06236 – 1
= 0.06236
= 0.062 or 6.2%

Since the population growth rate is known, you can use it to project a future population on the assumption that the rate obtained will remain constant.

Example

If the 1963 population was = 55,670, you may want to project population for 1973.

Let us use this data:
(P_o) P_{1963} = 55,670
(P_t) P_{1973} = To be projected
n = number of years between 1963 and 1973 = 10
r = Already known = 0.062 or 6.2%

The following equation is used:

P_t = Antilog(Log P_o)+n(Log1+r)

Substituting with the above data,

= Antilog(Log55,670)+10(Log1+r)
= Antilog(Log55,670)+10(Log1.062)

Find the log of 55,670 = 4.745
1.062 = 0.026

= Antilog(4.745+10(0.026)
= Antilog[4.745+(10 x 0.026)]
= Antilog (4.745 + 0.26)
= Antilog (5.005)
P_t = 101,158
:. 1973 = 101,158(000)

This implies that based on the projection from 1963 data and on the assumption that the population rate of 6.2% or 0.062 will remain constant, the 1973 population is projected to be 101,158(000) The educational planner will rely on the projected population figure to embark on other projections.

Self Assessment Exercise 2

What is the difference between the annual growth of population based on the arithmetic and geometric progression assumption of population growth?

4.0 Conclusion

Population growth is critical to school enrolment projection because it affects the school going age population and future enrolment pattern in the school system. As such it is very important that educational planner understands the calculation procedures of various population growth that will enable you to understand the projection method. The projected population will inform the planner on the resource plan he or she will have to get prepared for the projected enrolment derived from the projected population.

5.0 Summary

In this unit, you have learnt the place of population growth and projection in school age population forecast. You have studied birth

projection method, which will enable you project future births by women as well as the natural growth rate of population. You have equally learned the types of population growth rates, whereby annual growth rate of population can be obtained by assuming arithmetic and geometric progression of population. You have also learned how to project future population using the existing growth rate, which is assumed to be constant overtime.

6.0 Tutor- Marked Assignment

1. Find the population growth rate if
   P_t = 950,000
   P_o = 720,000
   n = 7 yrs

   Find r. Use the conventionally acceptable method.

7.0 References/Further Readings

Aghenta, J. A. (1993) Principles and practices of educational planning: Focus on the Developing countries. Benin City: NSEP.

Akangbou, S. D. (1982) Qualitative and quantitative aspects of educational planning. A set of modules on Educational Planning. Prepared for BREDA, Dakar, Senegal, UNESCO.

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Unit 3: SCHOOL AGE DETERMINATION FROM UN-CLARIFIED AND INCOMPLETE DATA

Contents

1.0 Introduction

Census figures constitute the major data and information for the planning activities in all the sectors of a country. Education planning therefore relies mainly on population data for the future projection and forecast in the education system. However, such population figures are not always reliable and adequately compiled to be directly useful to the planner, especially in the developing countries like Nigeria. The population of the school age children are the most important to the planner, but hardly can you find such data separated in the population office. Therefore, it behoves the planner to study the methods through which he or she could smooth the structure of census population to obtain the school age population. In this unit, you will learn about the age structure smoothing method, age group splitting and school age population derivation methods. It is this knowledge that will assist you in the quantitative analysis.

2.0 Objectives

At the end of this unit, you should be able to:

- smooth the population age structure
- split the 10 year and 5 year age groups of population
- explain the use of Sprague multipliers for age splitting purpose
- explain how school age population can be obtained from an unknown age distribution.

3.0 Main Content

3.1 Method of Smoothing the Age Structure of a Population

The main concern of an educational planner is to obtain the school age population that will require educational services in a country in a future date. However, the census figures to be relied upon must be reliable, adequate and presented accurately. Any planning based on inaccurate census figures can not be reliable. This is the problem with many developing countries, such as Nigeria. Therefore, a planner must be very careful and diligent in making use of such figures for decision making. Therefore irregularities should be removed or corrected. Age structure smoothing is a veritable way of removing population figure irregularities.

Certain irregularities are caused by errors due to false statement of age in the age structure of the census population. Such errors could occur as a result of:

- Those who do not know their age and make inaccurate statements during census and
- Those who know their age but give false information.

These errors can be smoothed out. This can be done by linking each group under consideration with two groups, which precede the group under consideration and the two groups which follow the group being considered.

The United Nations (UN) developed a method for age adjustment. The method is represented by the following formula:

$$S_o = \frac{1}{16}\left(S_{-2} + 4S_{-1} + 10S_o + 4S_1 - S_2\right), \text{ where}$$

S_o = Number in the Age Group under Consideration

S_1 and S_2 = Number in the Two(2) Age Groups Following S_o

S_{-1}, S_{-2} = Number in the Two (2) Age Groups Preceding S_o

Note: S_{-1} and S_{-2} do not indicate that you are subtracting 1 or 2 from S. They are mere symbols.

The essence of this formula is to erase irregularities caused by understatement or overstatement of age in census population. You may discover that the age being considered has only one age group preceding or following it, in such situation, you will make use of the only group.

For example, if you have the following age groups and you are to smooth out the age group 10 – 14, the following procedure shall be followed:

Age Group	Population ('000)
0 – 4	200,000
5 – 9	175,000
10 – 14	180,000 *
15 – 19	150,000
20 – 24	180,000
25 – 24	160,000

If we apply the above formula, we will obtain * Age Group to be smoothed out = 10 – 14.

$$S_o = \frac{1}{16}(0-4+4(5-9)+10(10-14)+4(15-19)-20-24)$$

This is to say that 0 – 4 and 5 – 9 age group precede S_o, which is 10 – 14 (age group being considered), 14 – 15 and 20 – 24 age group follow S_o, the age group being considered.

The census population of S_o = 180,000. What age group smoothing does is to give you a fairly more reliable figure for the group. To remove the errors of enumeration as identified above from 'S_o', we calculate as follow:

Substituting the population for the age groups, you have

$$S_o = \frac{1}{16}(200{,}000 + 4(175{,}000) + 10(180{,}000) + 4(150{,}000) - 180{,}000)$$

$$= \frac{1}{16}(200{,}000 + 700{,}000 + 1{,}800{,}000 + 600{,}000 - 180{,}000)$$

$$= \frac{1}{16}(3{,}120{,}000)$$

Or

$$= 0.0625 \times 3{,}120{,}000$$

$$= 195{,}000$$

Since we do not have fraction of human being, you should approximate when ever you have a fractional figure.

∴ 'S_o' i.e. 10 – 14 age group accurate figure will be 195,000 instead of the stated 180,000 in the population census. It is the 195,000 figure that will guide the planner in his or her work and not the 180,000.

3.2 Age Splitting Method

After smoothing the age group structure you will discover that the age group still put together people of different ages. A group in our example above is in 5 years. Age group 10 – 14 has in it 10 years, 11 years, 13 years and 14 years of age children. You may only need the figure for the 10 years age only for decision making.

In many situations, age groups may be compiled even in 10 years age groups. In Nigeria the school age are 6 – 11 fir primary education and 12 – 17 for secondary education. There are two groups that are very important to the educational planner. Unfortunately, population age groupings do not follow the school age grouping, hence the educational planner must break the population groups to suit his or her use. Population figures are usually in 10 and 5 years age groups. This section will deal with the splitting of the 10 year age group to two or 5 year age groups and 5 year age group into single years.

3.2.1 The 10 – year Age Group Splitting Method

As discussed above, you can split the 10 year age group into two 5 – year age groups. The following formula is used:

$$f_a = \frac{1}{2}f_o + \frac{1}{8}[f_{-1} - f_{+2}]$$, where

f_a = Number of the First 5 – year age group of the 10-year age group to be split into two.

f_o = Number of the 10-year age group to be split

f_{-1} = Number of the 10-year age group preceding the age group under consideration

f_{+1} = Number of the 10-year age group that follows the age group under consideration

Note: f_{-1}, f_{+1} do not mean that 1 is to be added or subtracted to f. No! f_{-1} and f_{+1} are mere symbols.

To obtain the figure for the second 5-year age group is by simply subtracting the obtained figure of the first 5-year age group from the figure of the 10-year age group being considered. It is obtained by using this formula:

$f_b = f_0 - f_a$ = Number of the second half, i.e. 5-year age group of the 10-year age group under consideration.

However, this method is inapplicable to the first 10-year age group in a population, that is the 0 – 9 age group because it has no group preceding it. The age group 0 – 5 has been recorded to comprise approximately 55% of the group 0 – 9 age group in developing countries. (United Nations).

Illustration

Age Group	Population ('000)
0 – 9	300,000
10 – 19	275,000
20 – 29	200,000
30 – 39	180,000
40 – 49	145,000

Note that the data is in 10-year age groups.

To divide the 10 – 19 into two 5-year age groups, that is 10 – 14 and 15 – 19, we shall apply the above formula as:

$f_a = 10-14$ (the first 5 – year age-group)

f_o = 10 – 19 (age group to be split)

f_{-1} = 0 – 9 (the 10 – year age group preceding the age group to be split)

f_{+1} = 20 – 29 (the 10 – year age group that follow the age group to be split)

$\therefore \quad f_a = \frac{1}{2}\left(f_{10-19} + \frac{1}{8}\left(f_{0-9} - f_{20-29}\right)\right.$

$= \quad \frac{1}{2}\left[275,000 + \frac{1}{8}\right.(300,000 - 200,000\left.\right]$

$= \quad \frac{1}{2}\left[275,000 + \frac{1}{8}\right.(100,000\left.\right]$

$= \quad \frac{1}{2}(275,000 + 12,500)$

$= \quad \frac{1}{2}(287,500)$

$f_a \quad = \quad 143,750$

This implies that the first 5 – year age group, that is 10 – 14 age group of ' f_o ' will be 143,750. To obtain the second 5 – year age group, that is 15 -19, that is ' f_b ', you will subtract ' f_a ' from ' f_o ', that is

$f_b \quad = \quad f_o - f_a$, where

$f_b \quad = \quad 15 - 19$

$f_o \quad = \quad 275,000$

$f_a \quad = \quad 143,750$

$\therefore \quad f_b \quad = \quad 275,000 - 143,750$

$= \quad 131,250$

Our calculation has revealed that out of the population figure of 275,000 for age group 10 – 19, we now have

10 – 14 = 143,750

15 – 19 = 131,250

However, the 5 – year age group is not too detailed for the use of educational planner, since he or she will prefer to work with single age figures. Hence, there is need to split the 5 – year age group into single ages.

Self Assessment Exercise 1

1. Why do you need to smooth out age structure of population?
2. Explain the procedure of splitting 10 year age group population figure into two 5-year age groups.

3.2.2 The 5 – year Age Group Splitting Method

You have learnt to divide the 10 – year age group into two 5 –year age groups. Now you are to learn how to split the 5 –year age group into single year ages. This is very important because you need the single ages to plan for primary and secondary education enrolment. For example you may be asked to plan for the resource needs of the 6 years age in a population for a future date. To do this, you need to apply a table of coefficients devised by Sprague and it is popularly called SPRAGUE'S MULTIPLIERS.

Sprague's method of interpolation is based on the number in the 5 – year age group to be considered; the two preceding 5 – year age groups, and the two 5 – year age groups following the group to be considered.

Sprague's table of coefficients is presented in Table 1. The table contains three panels. They are:

i. **First Panel**: It is for the age group 0 – 4, shown under First table as: f_a, f_b, f_c, f_d, f_e

ii. **Second Panel**: It is for the age group 5 – 9, also shown under Second Table as: f_a, f_b, f_c, f_d, f_e

iii. **Intermediate Panel**: It is for the successive age groups, except the last two terminal age groups, where splitting is not so useful. The table also shows f_{-2}, f_{-1}, f_o, f_{+1}, f_{+2}, f_{+3}, where

f_o	=	Number in the age group to be split
f_{+1}, f_{+2}, f_{+3}	=	Number in the following age groups
f_{-1}, f_{-2}	=	Number in the preceding age groups
f_a, f_b, f_c, f_d, f_e	=	Number in the first to fifth single years in the age group.

For example

0 – 4 age group has 0, 1, 2, 4 single years
5 – 9 age group has 5, 6, 7, 8, 9 single years
10 – 14 age group has 10, 11, 12, 13, 14 single years
15 – 19 age groups has 15, 16, 17, 18, 19 single years

This has been simplified in Table 2 to make your calculation easy. The number of children in each single age can be determined by multiplying the number in the corresponding 5 – year age group with the coefficients on the table indicated against a single year age for which the number is to be determined. You may do this for the primary and secondary school going single ages.

Note: Where there are no two preceding or following groups, make use of the only available preceding or following group.

Illustration

Let us assume we have the following population figures according to age groups.

Age Group	Population ($'^{000}$)
0 – 4	13,000
5 – 9	11,000
10 – 14	9,000
15 – 19	8,000
20 – 24	7,000
25 – 29	6,000
30 – 34	5,000
35 – above	4,000
Total	**63,000**

Let us determine the number of 6 year olds and 12 years olds from the total population of 63,000. The 6 and 12 years olds are ready for primary and secondary education respectively and the educational planner must plan for them. He or she needs the rough estimate of their numbers to be effective in his or her projection.

Procedure

i. To calculate the 6 years, we are going to make use of the tables 1 and 2 for the applicable coefficients. Make use of the notations.

6 years old, Trace all the coefficients that are corresponding to 6 years.

That is:

6 years old = +0.0080 x 13,000(f_{-1}) 5 – 9 age group has only one preceding group, as such use the only one. That is why we refer to the only one as f_{-1}.
+0.2320 x 11,000 (f_o). This is because 6 years falls within the 5 – 9 age group, which now becomes the age-group under consideration.
-0.0480 x 9,000 (f_{+1}), the first age group following the age group under consideration (f_o). f_{+1} is 10 – 14 age group
+0.0080 x 8,000 (f_{+2}), the second age group following the age group under consideration (f_o). f_{+2} is 15 – 19 age group.

The true picture of our calculation will be:

For 6 years old	=	+0.0080 x 13,000	(0 – 4)
		+0.2320 x 11,000	(5 – 9)
		-0.0480 x 9,000	(10 – 14)
		+0.0080 x 8,000	(15 – 19)
	=	104 + 2,552 – 432 + 64	
	=	2,288	

This result has revealed that out of the total population of 63,000, or 11,000 for the 5 – 9 age groups in the data we are using, 2,288 are 6 years old children. The implication of this to planner is to plan ahead for the furniture they will use, the teachers that will teach them and other inputs that will be necessary for their education.

Let us say the teacher-pupil ratio for primary education is 1 to 40. That is 1 teacher to teach 40 pupils. It will be easy for a planner to take decision. He or she will divide 2,288 by 40 to obtain the required teachers. That is

$$\frac{2{,}288}{40}$$

= 57.2

= About 57 teachers

He can do this for the other resources, such as classrooms required if he or she knows the Average class size. The required desks and chairs can be determined. Even the cost can be derived if he knows the unit costs of these inputs. We shall discuss this in subsequent units.

The coefficient for the 11 years old = 0.0016 for (0 – 4), which is f_{-2}, then in the first group preceding (f_o), which is 10 – 14. The 11 years old falls within this group.

+0.0144 for (5 – 9), which is f_{-1}, that is the second preceding age group to (f_o).

+0.2224 for (10 – 14), which is (f_o), the age group under consideration. The 11 years old falls within this group.

-0.0416 for (15 – 19), which is f_{+1}, which is the first age group following the (f_o).

+0.0016 for (20 – 24), which is f_{+2}, which is the second age group following the (f_o).

Interpolating these coefficients to the population data earlier used for the 6 years old example, we will obtain the following:

11 year old = -0.0016 x 13,000 (0 – 4) → f_{-2}
+0.0144 x 11,000 (5 – 9) → f_{-3}
+0.2224 x 9,000 (10 – 14) → (f_o)
-0.0416 x 8,000 (15 – 19) → f_{+1}
+0.0016 x 7,000 (20 – 24) → f_{+2}

= -20.8 + 158.4 + 2,001.6 – 332.8 + 11.2

= 1,817.8

≅ 1,818

The population figure for the 11 years old from the total population of 63,000 we are using is 1,818. That is from the age group 10 – 14 figure of 9,000, 1,818 of them are 11 years old. This figure will also guide the educational planner in planning for the children educational needs in JSS I.

Table 1: Sprague's Multipliers

	f_{-2}	f_{-1}	f_o	f_{+1}	f_{+2}	f_{+3}
First table						
f_a			+ 0.3616	- 0.2768	+ 0.1488	- 0.0336
f_b			+ 0.2640	- 0.0960	+ 0.0400	- 0.0080
f_c			+ 0.1840	+ 0.0400	- 0.0320	+ 0.0080
f_d			+ 0.1200	- 0.1360	- 0.0720	+ 0.0160
f_e			+ 0.0704	+ 0.1968	- 0.0848	+ 0.0176
Second table						
f_a		+ 0.0336	+ 0.2272	- 0.0752	+ 0.0144	
f_b		+ 0.0080	+ 0.2320	- 0.0480	+ 0.0080	
f_c		- 0.0080	+ 0.2160	- 0.0080	+ 0.0000	
f_d		- 0.0160	+ 0.1840	+ 0.0400	- 0.0080	
f_e		- 0.0176	+ 0.1408	+ 0.0912	- 0.0144	
Intermediate table						
f_a	- 0.0128	+ 0.0848	+ 0.1504	- 0.0240	+ 0.0016	
f_b	- 0.0016	+ 0.0144	+ 0.2224	- 0.0416	+ 0.0064	
f_c	+ 0.0064	- 0.0336	+ 0.2544	- 0.0336	+ 0.0064	
f_d	+ 0.0064	- 0.0416	+ 0.2224	+ 0.0144	- 0.0016	
f_e	+ 0.0016	- 0.0240	+ 0.1504	+ 0.0848	- 0.0128	

Source: Chau, Ta Ngoe. Demographic Aspects of Educational Planning, Paris, IIEP, 1960 (FEP No. 9)

Table 2: (Simplified Form of Table 1) Sprague's Multipliers (Coefficients)

	f_o Age-groups					
Age	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29
5 yrs.	+ 0.0336	+ 0.2272	- 0.0752	+ 0.0144	-	-
6 yrs.	+ 0.0080	+ 0.2320	- 0.0480	+ 0.0080	-	-
7 yrs.	- 0.0080	+ 0.2160	- 0.0080	+ 0.0000	-	-
8 yrs.	- 0.0160	+ 0.1840	+ 0.0400	- 0.0080	-	-
9 yrs.	- 0.0176	+ 0.1408	+ 0.0912	- 0.0144	-	-
10 yrs.	- 0.0128	+ 0.0848	+ 0.1504	- 0.0240	+ 0.0016	-
11 yrs.	- 0.0016	+ 0.0144	+ 0.2224	- 0.0416	+ 0.0064	-
12 yrs.	+ 0.0064	- 0.0336	+ 0.2544	- 0.0336	+ 0.0064	-
13 yrs.	+ 0.0064	- 0.0416	+ 0.2224	+ 0.0144	- 0.0016	-
14 yrs.	+ 0.0016	- 0.0240	+ 0.1504	+ 0.0848	- 0.0128	-
15 yrs.	-	- 0.0128	+ 0.0848	+ 0.1504	- 0.0240	+ 0.0016
16 yrs.	-	- 0.0016	+ 0.0144	+ 0.2224	- 0.0416	+ 0.0064
17 yrs.	-	+ 0.0064	- 0.0336	+ 0.2544	- 0.0336	+ 0.0064
18 yrs.	-	+ 0.0064	- 0.0416	+ 0.2224	+ 0.0144	- 0.0016
19 yrs.	-	+ 0.0016	- 0.0240	+ 0.1504	+ 0.0848	- 0.0128

3.3 Method of Obtaining the School Age Population in an unknown Age Distribution

We can obtain the school age population who may be seeking for admission into the school system when the age distribution of the projected population is unknown. This can be done in two ways. They are:

1. Imposition of the age structure of the projected population developed by the United Nations.
2. Imposing the age structure of the population of a country with similar background. Such background could include demography, social economic, political and cultural variables.

The United Nations in the 1980's through the World Bank country Economic Report projected the Nigerian population by assuming that the existing percentage distribution of population according to age groups will remain constant over a period of time.

The 1980 estimated population was used. The percentage distribution of the estimated population was calculated as follows:

Table 3: Percentage Distribution of Projected Population

Age Groups	Estimated Population ('000)	Percentage Distribution
0 – 4	13,828	19.0
5 – 9	10,688	14.7
10 – 14	8,703	12.0
15 – 19	7,456	10.2
20 – 24	6,213	8.5
25 – 29	5,230	2.2
30 – 34	4,475	6.1
35 – 39	3,823	5.3
40 – 44	3,204	4.4
45 – 49	2,587	3.6
50 – 54	2,056	2.8
55 – 59	1,610	2.2
60 – above	2,910	4.0
Total	**72,783**	

Source: World Bank, Country Economic Report, Nigeria Option for Long – Term Development. P.102,Table 2.

This method assumes that the percentage distribution of the age groups as contained in Table 3 will continue to apply to Nigerian population, all

things being equal. Therefore, we can assume that the percentages will apply to 2006 population of about 148,000,000 as follows:

Population = 148,000,000

Age Group	% Distribution to be Applied	Population ('000)
0 – 4	19.0	28,100
5 – 9	14.7	21,758
10 – 14	12.0	17,760
15 – 19	10.2	15,096
20 – 24	8.5	12,580
25 – 29	7.2	10,656
30 – 34	6.1	9,028
35 – 39	5.3	7,844
40 – 44	4.4	6,512
45 – 49	3.6	5,328
50 – 54	2.8	4,144
55 – 59	2.2	3,256
60 – above	4.0	5,920
Total		**148,000**

For example 19% of 148,000,000 = 28,120,000 (0 – 4)
14.7% of 148,000,000 = 17,760,000 (5 – 9)

Because the distribution is in age groups, the educational planner will have to use the age splitting method learnt above to divide the relevant age groups into single years of age. The planner requires population in single years for projection purposes.

The second method, which is an international comparison, is not scientific enough to be recommended for the use of serious nations. This is because there are no two countries with exact developmental characteristics. Each country has its own peculiarities.

Self Assessment Exercise 2

1. Explain the usage of the Sprague's Multipliers or Table of Coefficients.
2. Discuss the ways by which you can obtain the school age population from an unknown age distribution.

4.0 Conclusion

Population figures constitute the background for quantitative analysis in educational planning. However, it is hard to obtain a readily usable population data because of irregularities in compilation of the census

data. Similarly, population figures are merely presented in age groups, either in 5 – year or 10 – year. This makes them not to be directly usable. As such, educational planner must break the groups to usable single year ages. Irregularities in population can be removed through a method of age structure smoothing, while age group figures can be split to single year ages. An educational planner must be well equipped with these methods to enable him or her to be adequate in the process of planning.

5.0 Summary

In this unit, you have learned the procedure of smoothing the age structure of population to remove irregularities occasioned by poor census enumerations. You also studied how to split 10-year age group population into two 5 – year age groups as well as the process of dividing the 5 – year age group into single years, which will enable the educational planner to make projection with ease. You equally learned the methods of obtaining the school age population when the age distribution is unknown.

6.0 Tutor - Marked Assignment

Age Group	Population
0 – 4	100,000
5 – 9	90,000
10 – 14	80,000
15 – 19	70,000
20 – 24	60,000
25 – 29	50,000.

Calculate the 7 years old figure from the above data. Make use of the Sprague's Table of Coefficients.

7.0 References/Further Readings

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Unit 4: ENROLMENT RATIOS ANALYSIS

Contents

1.0 Introduction

In this unit, you will learn about the different enrolment ratios used in quantitative analysis and how to use them. Enrolment ratio is a very common measurement and a commonly used indicator for assessing a country's coverage of enrolment at any level of education. You will learn the various enrolment ratios used for planning purposes. They include level enrolment, which can be gross or net as well as age specific enrolment ratio.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the various enrolment ratios
- understand the computation procedure of the enrolment ratios
- apply the ratios in solving educational problems

3.0 Main Content

3.1 Meaning and Types

Enrolment ratio is a common indicator, used for assessing a nation's coverage of enrolment at a particular level of education or age group. It is calculated by expressing the enrolment as a percentage of the total population of the corresponding age group. It is generally expressed as:

$\frac{E^t}{P_t} = \frac{Enrolment}{Population} X100$, where 't' means time.

Enrolment ratio will enable you do a comparative analysis of enrolment status of different countries, state, local governments and even zones. It provides a tool with which to measure a country's or any geographical area's achievement in regards to her citizens education. It measures whether children of school going age are in school or not; and helps to determine the non-schooling gap existing in a country. Enrolment ratio is also used to make projection concerning future enrolment.

In Nigeria, the following age groups and corresponding grades/levels are recognised for analytical purposes. They are:

Education Level	Age Group (Population)
Primary (1 – 6)	6 – 11 years
Post Primary (JSS1-3, SSS 1-3)	12 – 18 years

* They will be used for our calculation as we go on.

As useful as enrolment ratio is in measurement, it is faced with some problems. They include:

- The actual ages of pupils or students may vary due to early or late enrolment
- The actual ages of pupils may also vary due to repetition or interrupted school attendance
- Difficulty in actual determination of the ages of many children because of the illiterate background they come from.

To address these problems therefore, different types of enrolment ratio have been developed to improve analysis. They are:

a. Overall enrolment ratio
b. Level enrolment ratio
c. Age specific enrolment ratio

We shall discuss them in detail and with illustrations.

3.2 Overall or General or Crude Enrolment Ratio

Overall enrolment ratio is also referred to as "Crude" or "general" enrolment ratio. This is because it generalised enrolment. It puts all enrolments across the levels of education together. It considers all pupils and students in all the levels (primary, secondary, tertiary) as

single entity. This method is considered deficient and inadequate for detailed study and analysis of enrolment development and projection. No wonder the appellation given to it "crude" or "general". The lumping together of students/pupils at all levels will make level enrolment differentiation and identification almost impossible.

Definition

Overall enrolment ratio is the relatedness of the total enrolment in the educational system to the total population corresponding to the age groups for all the levels of education. It is represented as follows:

$$\text{Overall Enrolment Ratio} = \frac{E^t}{P_a^t} X100$$

The formula is defined as:

E^t = Total enrolment at all levels (Primary, Secondary and Higher levels), which can be taken to be:

$E_p^t + E_s^t + E_h^t$, where:

E_p^t = Primary school enrolment
E_s^t = Secondary school enrolment
E_h^t = Higher education enrolment

P_a^t = Total population of the corresponding school age in year t
= P_{ap}^t = 6 – 11 age population (for Primary)
P_{as}^t = 12 – 17 age population (for Secondary)
P_{ah}^t = 18 – 22 age population (for Higher Education)

Illustration

Level of Education in Year 2006 (At All Levels)	Total Enrolment in 2006
Primary Level Secondary Level Higher Education level	300,000 230,000 150,000
Total	680,000

Level of Education and to Age Groups in Year 2006	Total Population Figures Corresponding to the Level/Age Group
Primary Level (6 – 11 years) Secondary Level (12 – 17 years) Higher Education (18 – 22 years)	500,000 400,000 300,000
Total	1,300,000

*Note that we are looking at the year 2006 for both enrolment and the population.

With the above figures or data, we can now calculate the overall enrolment ratio as follows:

$$\text{Overall Enrolment Ratio} = \frac{300,000 + 230,000 + 150,000}{500,000 + 400,000 + 300,000} X 100$$

$$= \frac{580,000}{300,000} X 100$$

$$= 52.3\%$$

The ratio is 52.3%. This implies that in the system we have just looked at, only 52.3% of her citizens that should be in the school at all levels are in the school. By implication 47.7% are not in school. The problem here is that it is difficult to separate according to levels, since the enrolment is merged together for this type of ratio calculation. Hence, there is need to use more meaningful methods.

Self Assessment Exercise 1

Calculate the overall enrolment ratio, making use of the following data:

- Enrolment by level, year 2002.

Levels	Enrolment (Year 2006)
Primary	250,000
Secondary	200,000
Higher	110,000
Total	**560,000**

Level of Education/Age groups	Corresponding Population
Primary (6 – 11)	400,000
Secondary (12 – 17)	320,000
Higher (18 – 22)	230,000
Total	**950,000**

3.3 Level Enrolment Ratio

Level enrolment ratio is considered to be a better measure of enrolment than the overall enrolment ratio. It is also called "level specific" enrolment ratio, because it addresses only one level at a time. It is calculated for each level of education. Patwari (1981) identified two types. They are:

a. Gross level enrolment ratio, and
b. Net level enrolment ratio.

We shall study them in detail very soon.

3.3.1 Gross Level Enrolment Ratio

Gross level enrolment ratio is obtained by relating the total enrolment at a particular level of education to the population of the age group, which under the available regulation should be enrolled at such level. Under gross enrolment, all the students or pupils that enrolled at such a level are considered, irrespective of their age. That is, the under- age and the over-age children at such level are considered. But only the population of the official school going age is considered. Gross level enrolment ratio is expressed as:

Gross Level Enrolment Ratio = $\frac{E_l^t}{P_a^t} X 100$, where

E_l^t = Enrolment at a level in year 't'. Where 'l' can be expressed as $\left(E_p^t, E_s^t, E_H^t\right)$

Where E_p^t = Enrolment at primary level in year t

E_s^t = Enrolment at secondary level in year t

E_h^t = Enrolment at higher level in year t

Year 't' = could be any academic year.

P_a^t = Population of age group 'a' which could correspond to any age group of any level in year 't'. Year 't' could be any academic year while 'a' could be any age group, e.g. 6 – 11, 12 – 17 etc.

Illustrations

Let us calculate the Gross Level enrolment ratio at a primary level in year 2000

If P_a^t or Population aged 6 – 11 in 2000 = 100,000 in Kayiwa State; and enrolment at the primary level in the same year was 92,000. Calculate the gross level enrolment ratio.

$\therefore$ Gross Level Enrolment Ratio $= \frac{92,000}{100,000} X 100$

$= 92\%$

It implies that the gross enrolment rate at the primary education level in year 2000 was 92%. This however, can not tell us enough about how many of the 6 – 11 years old children were in school, since the gross enrolment included those who are less than 6 years and above 11 years but still in primary schools.

Illustration 2

If P_a^t or population aged 12 – 18 in year 2001 = 80,000 in a state; and enrolment at secondary level (because the population aged 12 – 18 corresponds to secondary level) was 61,000 for the same year, calculate the gross level enrolment ratio.

Gross Level Enrolment Ratio $= \frac{61,000}{80,000} X 100$

$= \underline{76.3\%}$

Because of the noticed ambiguity, in the gross level enrolment ratio, a better alternative has been developed in the Net level enrolment ratio, which you will learn next.

3.3.2 Net Level Enrolment Ratio

Net enrolment deals with the actual pupils or students that belong to the same age group that should be at a level of education by official regulation. That is, the 'over-age' and the 'under-age' children in the level are excluded when you are calculating the Net Level Enrolment Ratio. However, it is difficult to obtain data on the exact age distribution of pupils or students in many developing countries such as Nigeria.

By definition, net level enrolment ratio is the relationship between the actual enrolment of pupils or students who by official age regulation should be at that level to the population corresponding to the level's age group. For example at the primary school level, children of 6 – 11 are supposed to be enrolled. Under this method, they are only recognised unlike the gross level enrolment ratio method. Net Level Enrolment ratio is expressed as:

Net Level Enrolment Ratio = $\frac{E_a^t}{P_a^t} X100$, which is defined as:

E_{ap}^t = Enrolment in age group 'a' at the primary (p) level in year 't'

P_a^t = Population of age group 'a' that corresponds to the actual age group to be considered in a level in year 't'.

Year 't' = could be any academic year

Illustration 1

If total enrolment for the primary level was 500,000 in year 2005. That is, if

E_{ap}^t = 500,000 (i.e. Enrolment in year 't' (2005) at the primary level, 'P.;

The actual 6 – 11 children enrolled at the primary level in year 2005 (i.e. E_{ap}^t) = 230,000; and population of the age group, 6 – 11 that correspond to primary level was = 700,000 (i.e. P_a^t = 700,000). Therefore

Net Level Enrolment Ratio = $\frac{230.000}{700.000} X100$, and not $\frac{500.000}{700.000}$

= 32.3%

Note: The first figure of 500,000 constitutes the Gross enrolment for the primary level. This figure included those who are below and above the official school age for the level, but are there. Only 230,000 of this figure are supposed to be at the primary level if we follow the age regulation that children from 6 – 11 should be in primary school. This is the concern of the Net Level Enrolment Ratio.

Illustration 2

Consider the following enrolment and population data in a state's school system.

Primary level	=	200,000
Secondary level	=	150,000
Higher level	=	100,000, and

Population for:	Primary (6 – 11)	=	500,000
	Secondary (12 – 17)	=	270,000
	Higher (18 – 22)	=	200,000

Then calculate the Net level Enrolment Ratio for secondary level.

Net Level Enrolment Ratio = $\frac{150,000}{270,000} X100$

= 55.6%

Self Assessment Exercise 2

1. Distinguish between gross level and net level enrolment ratio
2. With the following data, calculate the gross and net enrolment ratios.

Enrolment in Primary Level in Year 2003	Corresponding Age Group Population in 2003
10,000	1 – 5
25,000	6 – 11
3,000	12 – 17
Total = 38,000	

Age Group Population, 2003	Age Group
50,000	1 – 5
65,000	6 – 11
45,000	12 – 17
Total = 160,000	

3.4 Age Specific Enrolment Ratio

This is explained as the relationship between the enrolment of an age group across all levels of education in a given year to the population of the age group. In other words, members of one age group can be enrolled in levels of education other than the one his /her age group is

supposed to be under the official regulation. For instance, 12 – 17 years old children are supposed to be in secondary schools under normal situation. But we may find that some of them may be in primary school, some may even be in the higher institutions. All of them in the same age going, irrespective of the level they may be are put together when calculating the Age specific enrolment ratio. The concern is where can we trace the members in the group within the educational system?

Age specific enrolment ratio is expressed as:

Age Specific Enrolment Ratio = $\frac{E_a^t}{P_a^t}$ X 100, which is defined as:

E_a^t = $E_{a^p}^t + E_{a^s}^t + E_{a^h}^t$, where 'a' = p, or s, or h

p = primary level (enrolment of the age group in primary)
s = secondary level (enrolment of the age group in secondary)
h = higher level (enrolment of the age going in higher)

Illustration 1:

Let us consider the following data to calculate age specific enrolment ratio.

- Age Group under consideration = 12 – 17 years
- Population of the age group 12 – 17 = 100,000
- Enrolment of the age group 12 – 17 in the school system
  12 – 17 age group → in primary school = 15,000
  12 – 17 age group → in secondary school = 40,000
  12 – 17 age group → in higher institution = 5,000

Age specific Enrolment Ratio = $\frac{15,000+40,000+5,000}{100,000} X\ 100$

= $\frac{60,000}{100,000}$ X 100

= 60%

Illustration 2

Can we look at another example? Let us use the following data to calculate the age specific enrolment ratio.

$E_a^t(p,s,h)$	=	6 – 12 age group in primary	=	500,000
		6 – 12 age group in secondary	=	100,000
		6 – 12 age group in higher level	=	50
		Total 6 – 12 age group in schools at all levels	=	**600,050**

P_a^t = 6 – 12 age group population = 900,000

Age Specific Enrolment Ratio = $\frac{600,050}{900,000} X\ 100$

= 66.7%

Age specific enrolment ratio may be calculated, using single age years or using the age group as we have just done. But the calculation depends very much on the availability of data on enrolment and age group population (Nwankwo, 1981).

4.0 Conclusion

In this unit, you have learned that enrolment in the school system can be measured through various methods. You have learned the types of enrolment, each with its deficiencies. You have learned that population data as well as pupils' and students' enrolment across the educational levels are important for you to calculate enrolment ratios.

5.0 Summary

Enrolment ratio is an indicator commonly used for assessing the coverage of enrolment at a particular level or the levels in the educational system. Three major types have been identified and studied in this unit. They are the overall enrolment ratio, otherwise known as "crude" or "general" enrolment ratios. We also have the level enrolment ratio, under which you learned the gross level enrolment ratio and net level enrolment ratio. You also learned the computation procedure of the age specific enrolment ratio as we did to others.

6.0 Tutor Marked Assignment

Carefully study the data presented on table 1. Use them to calculate overall enrolment ratio, gross level enrolment ratio, net level enrolment ratio and age specific enrolment ratio.

Table 1: Age Distribution of Population and Pupil/Student Enrolment in Dadawa District in Year 2002

Age (Years)	Class						JSS			SSS			Population
	1	2	3	4	5	6	1	2	3	1	2	3	
5^+	11												110
6^+	50	6											120
7^+	9	52	6										115
8^+	4	9	40	3									100
9^+	1	5	10	39	2	2							108
10^+		3	8	9	25	2	1						100
11^+			3	4	8	23	4						90
12^+			1	2	1	4	21	3					80
13^+				1	1	2	4	25					75
14^+						1	1	1					82
Total	75	95	68	58	36	34	31	29					

Note: Limit yourself to the 6 – 11 age group only.

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Unit 5: INDICATORS OF EDUCATIONAL PLANNING

Contents

1.0 Introduction

In planning education, certain indicators are commonly adopted in assessing and analysing the stock and sometimes the flow position of the educational system. In this unit, you will learn about these indicators, their computation methods and use.

2.0 Objectives

At the end of this unit, you should be able to:

- identify the various indicators for measuring planning parameters,
- explain the use of the identified indicators,
- understand the computation process of the indicators,
- apply them to real life analysis

3.0 Main Content

3.1 Progression or Grade Ratio

A 'grade' is the same as 'class' or 'form'. Thus, we may have class 1, 2, 3, etc or Form 1, 2, 3,. We may also have Grade 1, 2, 3. They mean the same thing. Progression is a term used to indicate the movement of pupils/students from grade to grade within the school system. Hence, progression or grade ratio is a measure of the relationship between pupils/students enrolled in a particular grade, in an academic year and the number enrolled in a previous grade, in a preceding academic year. In fact, it is the enrolment in two successive grades (classes) and in two successive academic years.

For example the primary 2 pupils in 2004 were enrolled as primary 1 pupils' in 2003. To know the progression of these pupils, you will relate the enrolment of the class of 2004 to the enrolment of the class of 2003.

The method is commonly used in the developing countries because of inadequate data and information about promotion and repetition rates. But this method is readily available where data on simple grade-wise enrolment as normally compiled in our schools are available. It is a method that can be useful in calculating wastage ratio and consequently the determination of internal efficiency of the school system. The major shortcoming however, is that it does not recognise repetition and repeaters that are met in a grade.

Grade or progression ratio is expressed as:

$K_g^t = \frac{E_{g+1}^{t+1}}{E_g^t} X\ 100$, which is expressed as:

K_g^t	=	Progression Ratio in year 't' and grade 'g'
t	=	time (which could be year or academic session)
g	=	grade (or class or form)
E_g^t	=	Enrolment in class or grade 'g' in year 't' (i.e. enrolment in the previous year for the grade under consideration)
E_{g+1}^{t+1}	=	Enrolment in grade/class g+1 (i.e. the previous grade plus another academic year. You can say the next class) in year t+1 (The year + additional year). If primary {g) 2 is the E_g^t in 2001 (t), then primary 3 will be the g+1 in t+1, which is 2003.

Illustration

If enrolment in grade (g) 3 in 2002 was 175,000 and enrolment in grade 4(g+1) in 2003 were 157,000, then the progression of pupils between the two grades can be determined by calculating the grade/progression ratio as follows:

$$\frac{157,000}{175,000} X\ 100$$

= 89.7%

The value at unity of the progression ratio should be a maximum of 100%. This is, however, when repetition and dropout will equal zero. In the developing countries like Nigeria, this rate can sometimes be more or less than unity. This is because enrolment in a given grade at any level in a given academic year may exceed the enrolment in the next grade in the following year. This is possible as a result of repeaters that may be in such grade. This method does not have a way of eliminating the repeaters, which is one of its weaknesses.

You may need to collect a grade- wise data like the one in Table 2 before you can embark on a progression ratio analysis.

Table 2: Enrolment in a Junior Secondary School by Grade, 2000-2003

Year	Grades or Classes			
	JSS 1	JSS 2	JSS 3	Total
2000	170,000	130,000	100,000	400,000
2001	180,000	140,000	111,000	431,000
2002	185,000	150,000	121,000	456,000
2003	190,000	165,000	160,000	515,000

You may want to calculate the progression rate of the JSS 1 students of year 2001, which is year 't'. You should know that JSS 1 is the 'g', JSS 2 will be the 'g+1'.

∴ JSS 1 in 2001 enrolment = 180,000. This set is to proceed to JSS. the following year, 't+1'

JSS 2 in 2002 enrolment = 150,000 in JSS 2 in 2002 made progress from JSS 1 of 2001.

∴ the Progression ratio = $\frac{150,000}{190,000}$ X 100

= 83.3%

You may also calculate the progression rate of the JSS 2 in 2002 to JSS 3 in 2003 as:

JSS 2 = 150,000 (2002),
JSS 3 = 160,000 (2003)

$$\frac{160,000}{150,000} X\ 100$$

$$= \quad \underline{106.6\%}$$

The 106.6% obtained suggests that certain student repeaters were met in JSS 3 in 2003, which the method has no way of checking.

3.2 Literacy Rate

A literate is taken to be a person who is able to read and write with a level of understanding. An illiterate is the opposite. Therefore, literacy rate is measured as the proportion of the population that can read and write with a degree of understanding at a particular point in time in a geo-political entity, such as a country, state, local government area.

In 1970, UNESCO put Nigeria's literacy rate at 24%, but the country has improved tremendously since then. Literacy rate is measured in two ways:

(a) Crude Literacy Rate
(b) Age Specific Literacy Rate

a. **Crude Literacy Rate**: This considers everybody in a country as a population during calculation. It is expressed as:

$$L_r^t = \frac{L^t}{P^t} X\ 100\text{, where}$$

L_r^t = Literacy rate in year 't'
L^t = Number of literates in a population in year 't'
P^t = Total population of an area in year 't'

Illustration

If literate persons in a country = 150,000 and
Total population of the area = 755,000

$$\therefore L_r^t = \frac{150,000}{755,000} X\ 100$$

$$= \quad \underline{19.9\%}$$

This implies that only 19,9% of the population are literate, while 79.1% are illiterate.

b. **Age Specific Literate Rate**: Because of the inadequacy of the crude literacy rate method in doing international comparison, the age specific method is considered to be more effective. The method makes use of the age group in calculating and age 15 and above is preferred. Age specific literacy rate is expressed as:

$$\text{Age Specific Literate Rate} = \frac{L_a^t}{P_a^t} \text{ X } 100, \text{ where}$$

L_a^t = The literates in an age group 'a' in year 't'
P_a^t = Population of age group 'a' in year t

Illustration

If P_a^t (15– 19 age group in year 1995) = 35,000, and

L_a^t (Literates in the age group 15 – 19) = 22,000, then

$$\text{Age Specific Literate Rate} = \frac{22,000}{35,000} X\ 100$$

$$= \underline{62.85\%}$$

This implies that 62.85% of the 35,000 people that fall within the age bracket 15 – 19 are literate.

3.3 Non-Schooling Rate

A non-schooling gap is that gap that exists between those who are in school and those that are supposed to be there, but due to one way or the other, they are out of the school system. The non-schooling gap is wider in poor countries of the world and also among the poor people of any country. In many cases, parents may not be able to afford the cost of schooling; hence they keep their children at home to follow them to the farm or to learn their art and trade. It is measured by subtracting the figure of those who are in the school system in an age group from the population of such age group. It can be expressed as:

$$\text{Non – Schooling Ratio} = \frac{P_a^t - E_a^t}{P_a^t} X\ 100$$

$$\text{Non – Schooling Ratio} = \frac{\textit{Age Group Population} - \textit{Age Group Enrolment } (E_a^t)}{\textit{Age Group Population } (P_a^t)} X\ 100$$

Illustration

Age Group Population (6 – 11) = 100,000
School Enrolment of Age Group (6 – 11) = 70,000

Non-Schooling Gap = 30,000

Non-Schooling Ratio = $\frac{30,000}{100,000} X\ 100$

= 30%

3.4 Sex Ratio

Sex disparity constitutes a topical issue in the education process of children all over the world. We often hear of sex imbalance, sex inequality, sex bias etc in providing education opportunities for citizens. It is common in the enrolment, admission process and even in employment process.

Sex ratio indicates the development of female education or enrolment in comparison to the male. It measures the proportion of female to male enrolment in the school system. It can be expressed as:

Sex Ratio = $\frac{M}{F} X\ 100$, where
M = Male enrolment in a level of education
F = Female enrolment in a level of education

Illustration

If Enrolment of male students in the primary level of a state is 499,000
And Female is 345,000,
∴ the SR(Sex Ratio) = $\frac{499,000}{345,000} X\ 100$

= 145

This implies that for every 100 girls in the state's primary school, there are 145 boys. The disparity is much.

Self Assessment Exercise 1

1. Explain the Following indicators: progression ratio, sex ratio and non-schooling rate.
2. Calculate the progression rate from JSS 1 in 2002 to JSS 2 in 2003. Use the data on Table 2.

3.5 Teacher-Pupil/Student Ratio

Teacher-pupil ratio is one of the most useful and commonly used planning indicators in education. It is used for making projection about teaching manpower requirements of schools, facility planning and enrolment forecast. It is also useful in budget estimation preparation and financial planning of the school system. Simply, it measures the number of pupils or students that are taught by a teacher at a particular time. It is expressed as:

$$\text{Teacher-Pupil Ratio} = \frac{\textit{Total Enrolment of a level in a year}}{\textit{Total number of teachers in that level in that year}}$$

You do not need to take to percentage. It is just like finding and average.

Illustration

If total enrolment in secondary level = 100,000, and
Total number of teachers at the level = 1000, then

$$\text{TPR/TSR(Teacher Pupil/Student Ratio)} = \frac{100{,}000}{1000}$$

$$= \underline{100}$$

This gives a TSR of 1 to 100, which can be expressed as 1:100. This implies that one teacher is to handle 100 students on the average.

3.6 Average Class Size

Average class size is measured by the average enrolment in a class at any level of the school system. A class size can be small, moderate or large depending on the general size of the overall enrolment. It is calculated by dividing the total enrolment by the total number of the functional classroom available in the school system. It can be expressed as:

Average Class Size (ACS) =

$$\frac{\textit{Total Enrolment at a level of Education in a year}}{\textit{Total Number of Usable Classrooms at a level of Education in a year}}$$

Illustration

If Total Enrolment at the primary level = 1,000,000 and
Total Usable classroom at the = 50,000, then

$$ACS = \frac{1,000,000}{50,000}$$

$$= \underline{20}$$

This implies that on the average a classroom is to house only 20 pupils, thus we say that average class size is 20.

3.7 Average School Size

The idea of an average school size is similar to the average class size. While the latter talks of classrooms, the former addresses the schools. Average school size relates to the students carrying capacity of a school on the average. It is an average measure of the number of students a school should accommodate. It is calculated by dividing the total enrolment in a level of education at a particular time by the total number of functional schools at that time. The school size is a function of many factors. They include the usable classrooms available, other facilities, available teachers etc. In many situations, benchmarks and standards are set to address what should be an average school size. It can be expressed as:

$$\text{Average School Size (ASS)} = \frac{\textit{Total Enrolment at a Level in a Year}}{\textit{Number of Functional Schools in that Year}}$$

Illustration

If total enrolment at a level in a year = 500,000, and total number of functional schools at that level in that year = 10,000, then

$$ASS = \frac{500,000}{10,000}$$

$$= \underline{500}$$

This implies that on the average the school size is 500. But all schools can not have the same enrolment. Hence the classification of schools as explained earlier by government; based on the facilities and equipment as well as the manpower available in the schools.

3.8 Entry Rate or Admission Rate

Entry or admission rate is a measurement of the movement of students or pupils or applicants into the educational system, usually the first grade of a level. At the primary level, new pupils move to the first grade (primary one) from the age group recognised, usually 6 years. At

the secondary and tertiary levels, successful school leavers move to the first grade. They may come through entrance examinations.

In situations where all new entrants in grade one start school at the same age, the number of new entrants will be determined by the number of children of admission age. This will be related to the proportion of this age group that will come forth for registration if education is not compulsory at such level.

If all children start school at the age of i years, the entry rate, let's say primary education, it can then be expressed as:

$$E_i^t \frac{e_i^t}{P_i^t} X\ 100, \text{ where}$$

E_i^t = Entry Rate of new entrants of i years old in year t

e_i^t = Proportion or number of i years old entering into the grade 1 in year t

P_i^t = Population, of i years(s), usually 6 years for primary education in year t.

Illustration

If the number of new entrants into grade 1 of the primary level in year 1999 = 50,000, and the population of legal entrance age to primary 1 in 1999 (usually 6 years), = 75,000, then

$$\text{Entry Rate} = \frac{50.000}{75.000} X\ 100$$

$$= \underline{66.7\%}$$

This implies that entry rate was 66.7%, that is, out of 75,000 6 year old children, 66.79 percent of them entered primary one in 1999. Under the UBE, all the 75,000 are expected to enter primary one. If otherwise, the system is said to be mal-performing.

Admission on entry into the higher level is usually based on a more complete process. An applicant applies; he/she is short -listed through entrance examination or other methods. Not all that passed such entrance are admitted in most cases. Therefore, the admission rate is measured as crude or level specific rate.

(a) **Crude Admission Rate**

Crude measurement relates the number of applications to the number of the successful applicants. It can be expressed as:

$$\text{Crude Admission Rate (CAR)} = \frac{\text{Number of Successful Applicants}}{\text{Total number of Applicants}} X\ 100$$

Illustration

If total number of applications = 4,000, and total
Number of successful applicants = 3,000, then

$$\text{CAR} = \frac{3,000}{4,000} X\ 100$$

$$= \underline{75\%}$$

(b) **Level Specific Admission Rate**

Level specific admission rate relates the number of candidates admitted to the first grade of a higher level of education to the enrolment of the final grade in the lower level before the one being applied to. In other words, if we are to calculate the admission rate to the Senior Secondary School, we would relate total enrolment at the JSS 3 to the number admitted to SSS I and not only those that applied. This will enable planner decide whether the transition process from one level to the other is progressing or not. It can be expressed as:

$$\text{LSAR} = \frac{\text{Number Admitted to grade 1 of a higher level in a particular year}}{\text{Total Enrolment of the last grade of a lower level in the same year}} X\ 100$$

Illustration

If the number of candidates admitted to a Senior Secondary School (SSSI) in a year in a state = 10,000, and the total enrolment at the terminal class in the state's Junior Secondary School (JSS 3) in the year is 40,000, then

$$\text{LSAR} = \frac{10,000}{40,000} X\ 100$$

$$= \underline{25\%}$$

Because the higher levels of education are constrained from admitting all that seek admision into them. The calculation of RECEPTION RATE becomes important.

3.9 Reception Rate

It is an indication of the capacity of the educational system to absorb new entrants. The ability of the school system to receive new intakes is determined largely by the resources at its disposal. The staff size, facilities and equipment and funds that are available in the school are very important to determine its reception rate or what is now referred to as Carrying Capacity. Reception Rate can be expressed as:

$$\text{Reception Rate (RT)} = \frac{\text{Number of applicants the school or level can admit in a year}}{\text{Total number of applicants for the year}} X\ 100$$

Illustration

If the total application to a level for admission in a year = 70,000, and total number of applicants that the level could admit and cope with = 23,000 out of 60,000 that passed entrance, then the level's Reception Rate is:

$$Rt = \frac{23{,}000}{70{,}000} X\ 100$$

$$= 32.8\%$$

Self Assessment Exercise 2

1. Explain the teacher-pupil ratio, literacy rate and sex ratio
2. Differentiate entry rate from reception rate.

3.10 Transition Rate

Students move from one level of education, usually from a lower level to a higher level in the school system. The pattern of this movement is called transition history. Transition history is measured by a quantitative tool called Transition rate. Transition rate is calculated to measure the proportion of students or pupils that continue from last grade of a lower level to the first grade of the next higher level. It can be expressed as:

$T_t^i \frac{NE_{t+1}^{i+1}}{E_t^i} X\ 100$, where

T_t^i = Transition rate

NE_{t+1}^{i+1} = New entrants in grade i+1 (first grade of next higher level) in year t

E_t^i = Enrolment in grade i in year t (Final grade in the lower level)

Illustration

If enrolment in primary six in 2000 = 97,000, and enrolment in JSS 1 in 2001 = 95,000, then

Transition Rate = $\frac{95,000}{97,000} X\ 100$

= 97.9%

Transition rate is a very important tool for formulating educational policies, especially on students' admission and duration of course. The transition rate should be occasionally regulated by government to control the available facilities as well as the labour market.

3.11 Retention Rate

Retention rate is used to measure the degree of persistence of students in the school system. It is the rate of return of students to the school system at the beginning of a new academic session in pursuance of their course. It is believed that student retention rate is actually a measure of the school system's ability to retain its students. It has been postulated severally that when the conditions for teaching-learning is very favourable in a school that students will want to persist, while the apposite is the case. However, this may not be true as there are many factors that are external to the school system that may not encourage student persistence instincts.

Retention rate is related to withdrawal rate and attrition rate. It can be expressed as:

$$\text{Retention } Rate = \frac{\text{Number of Students that Withdraw Before the completion of their Course}}{\text{Total Enrolment at the level or Grade under Consideration}} X\ 100$$

Illustration

If the total enrolment at a grade or level of education in a particular year = 100,000, out of which 5,000 leave at any point without completing their programme for a reason or the other, then

$$Retention\ Rate = \frac{5{,}000}{100{,}000} X\ 100$$

$$= \underline{5\%}$$

3.12 Attrition Rate

Attrition rate is the degree at which the input into a system wears or thins down. In other words, it is the rate of 'cut down' of the input into the education system. It is commonly used to measure the degree at which students or staff leave the system, especially when they have not yet completed their course or academic programme or when the staff leave for one reason or the other before the end of his/her career. It is used to measure the ability of students to persist in their study and staff persistence on their job. Bean (1982) identified academic variables, student intent, goals, expectation, external and internal environmental factors as conditions that determine attrition rate among students.

Student attrition rate is measured by relating the number of students that leave a level of education before the completion of their academic programmes in a particular year to the total enrolment at that particular level in the same year. It can be done programme by programmes, school by school, state by state etc. Attrition rate can also be computed for staff. We can determine attrition rate of teachers in a level of education by relating the number of teachers that leave the school system in a particular year to the stock of teachers (number on roll for that year.)

It can be expressed as:

$$\text{Attrition Rate (Students)} = \frac{\begin{array}{c}Number\ of\ students\ that\ depart\\ before\ completing\ programme\\ at\ a\ level\ in\ a\ year\end{array}}{\begin{array}{c}Total\ Enrolment\ at\ the\ level\\ in\ the\ same\ year\end{array}} X\ 100$$

Illustration 1

If the number of students that leave a system without completing their programmes = 7,000, and the total enrolment at the level of education in that year = 25,000 then:

$$\text{Attrition Rate} = \frac{7{,}000}{25{,}000} X\ 100$$

$$= \quad \underline{28\%}$$

Illustration 2

If the number of teachers that leave the teaching service of a state at the end of a session in a particular level of education = 2,000 out of a stock of 15,000, then

$$\text{Attrition Rate (Teachers)} = \frac{2{,}000}{15{,}000} X\ 100$$

$$= \quad \underline{13.3\%}$$

4.0 Conclusion

From your study of this unit, you have learned several planning indicators that are used in quantitative analysis in educational planning. Some of them can be used to measure the school progress, facility and resources utilisation. Some of them are used to measure both stock and flow statistics in the educational system.

5.0 Summary

This unit has exposed for your understanding the various indicators for assessing the stock and flow dimensions of the educational parametres. You have learned about the various ratios and rates planners used for the day to day decision making in the educational system. They include the progression ratio, sex ratio, literacy rate and teacher-pupil ratio. You have also learned the calculation procedure of the average class and school size, the transition rate, attrition rate and retention rate, which are all used to assess the degree of students and sometimes staff persistence in school and on the job respectively.

6.0 Tutor - Marked Assignment

1. Distinguish average school size from average class size. Use examples where necessary.
2. Explain with figures the following: Sex Ratio, Teacher – Pupil Ratio and Transition Rate.

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Unit 6: **INTRA-SYSTEM STUDENT FLOW ANALYSIS**

Content

1.0 Introduction

After admission of students or pupils into the school system, how they move through the system is very important to all stakeholders in the school business because of resources required to see the students through educational level. Analysis of students flow through system is also essential in determining the internal efficiency at the school system. In this unit, you will learn about the indicators used in computing the intra flow analysis. You will particularly learn how to calculate the promotion rate, the repetition rate and the dropout rate.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the concept of intra student flow,
- list the indicators for measuring intra student flow,
- explain the procedure of using the indicators,
- make use of the indicators for intra flow analysis.

3.0 Main Content

3.1 Overview of Student Flow Through the School System

Several parameters are used for analysing the flow of students through the school system. Stakeholders in the educational system, the parents, the teachers, the government and the students themselves are interested in what becomes of the pupils and students after they have been admitted into the school system in the course of their study.

At the end of an academic session or at the beginning of a new session, it is interesting to find out the direction of students' flow (movement) within the school system. It is likely that one of the three events should have occurred.

(i) Students could have been promoted to the next higher grade or class.

(ii) Students could have been asked to repeat the same grade or class in the following year.

(iii) Students could for one reason or the other could have dropped out of the school system. The reasons could be death, financial hindrance, academic inadequacy or transfer to the school as a result of parents' relocation. The reason of transfer is still a contentious issue because scholars are of the view that if a student transfers to another school, such student is still within the school system and should not be seen as a dropout.

The three pattern of movement is usually diagrammatically represented as we have in figure 1.

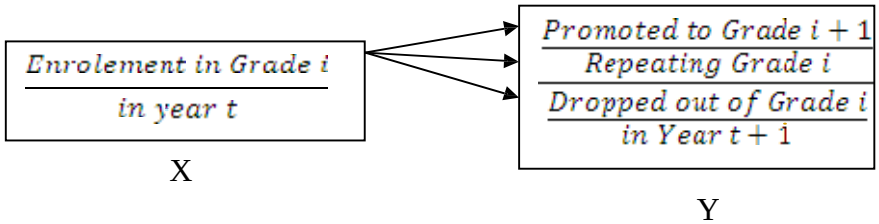

Figure 1: Student Flow from Grade i in year t to grade i + 1 in Year t + 1

Under normal situation, the enrolment in the box X in year t is supposed to fit into one of the three panels in year t + 1, that is, in the following year. All students who can not be accounted for in the promotion and repetition panels are taken to have dropped out.

Promotion, Repetition and Dropout are represented with the following graphical notations. You should note them well because you need them when building a cohort flow chart.

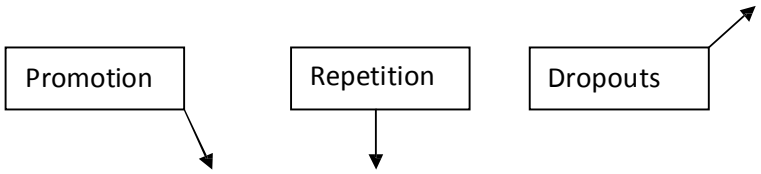

Figure 2: Notations Indicating Promotion, Repetition and Dropouts

The direction to which the arrow points is very important during cohort flow analysis. Thus, the promotion arrow points diagonally to the right; repetition arrow points vertically downward; and the repetition arrow points diagonally upward to the right.

Illustration

If the enrolment in grade one of a secondary school in year t (e.g. 2001) was 3000. At the beginning of the following year (t + 1 = 2002), it was found that 2500 of them were in grade two (grade i + 1); 400 of them were still in grade 1 (grade i) in year 2002 (year t + 1); and the rest of them (100) could not be accounted for among those promoted and repeaters. They are assumed to have dropped out. You can present this schematically as we have in figure 3.

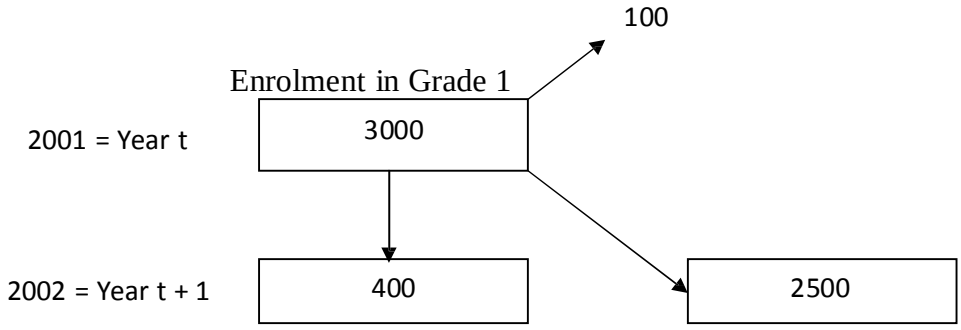

Figure 3: Schematic Presentation of Student Flow

Figure 3 has shown promotion figure of 2500 in year t + 1, repetition figure of 400 in year t + 1, and figure of 100 as dropout because they can not be accounted for again in year t + 1. The dropout figure represents the difference between those who are still in the system and those who are no more in the system.

These three parameters are used to measure the intra flow rates of students in the school system in an attempt to determine the system's internal efficiency. They are :

(a) The Promotion Rate,
(b) The Repetition Rate, and
(c) The Dropout Rate.

Let us study the procedure of using them in detail.

3.2 The Promotion Rate

The promotion rate can be defined as the relationship between the number of students promoted to the next higher grade from among the students who were in a grade in a previous session and the total enrolment of the same group of students in the previous session. Simply put, it is the number of students promoted divided by the total number of students in the same grade in the previous year. It is expressed as:

$$P_t = \frac{P_{t+1}^{i+1}}{E_t^i}, \text{ where}$$

P_t = Promotion Rate

P_{t+1}^{i+1} = Number of students promoted to grade i + 1 in year t + 1 (i = grade, t = year)

E_t^i = Enrolment in grade i in year t, where i = (could be grade 1, 2, 3, …. n) i.e. any class.

Illustration

Enrolment of primary 1 (grade 1) pupils in year t (1999) = 112,932. Number of pupils promoted to primary 2 (grade 2) in year t + 1 (2000) = 109,205.

$$Promotion\ Rate\ (P_t) = \frac{109,205}{112,932}$$

$$= 0.97$$

You may convert it to percentage. This rate, 0.97 can then become 97%. The minimum promotion rate obtainable is 0.0 or 0% and maximum of 1.0 or 100%. The planner should expect that during

statistical analysis, a promotion rate of between 0.0 and 1.0 (0% and 100%) can be obtained. If a figure that is outside this range is obtained, then there is either a problem with the data used or the calculation procedure.

It is also observed that students sometimes encounter problems in calculating the promotion rate as they follow data on enrolment or the cohort (group) they are studying up the higher grades. That is, following students flow from say primary 1 to 6. This occurs when the figure of those promoted from a previous year is added to the repeaters they met in such a grade. You should therefore always subtract the repeaters from the grade enrolment and the remaining student figure as those promoted. For example, let us calculate the promotion rate in table 1.

Table 1: Enrolment in JSS in 1999/2000 and 2000/2001 with Repeaters

Year		Grade		
		1	2	3
1999/2000	E.	9990	9550	8550
2000/2001	E. R.	10500 105	9950 85	9000 82

Key: E = Enrolment, R = Repeaters

You should note that Enrolment in Grade 1, 2, 3 in 1999/2000 were 9990, 9550, 8550 respectively. For the following year – 2000/2001, the Enrolment for Grade 1 was 10,500 (105 of them were repeaters); Grade 2, Enrolment was 9950 (85 repeaters); and Grade 3 Enrolment was 9000 (82 repeaters).

Illustration

Find the promotion rate from grade 1 in 1999/2000 to grade 2 in 2000/2001. Also find the promotion rate from grade 2 in 1999/2000 to grade 3 in 2000/2001. The calculation will be as follows:

(a) Grade 1 in 1999/2000 to Grade 2 in 2000/2001

$$Promotion\ Rate\ (P_t) = \frac{9950 - 85\ (repeters\ of\ Grade\ 2\ in\ 2000/2001}{9990}$$

$$= \frac{9865}{9990}$$

$$= 0.987 \text{ or } 98.7\%$$

Note: Repeaters did not belong to the cohort (group) being considered. Their mates were in grade 3 in 2000/2001.

(b) Promotion Rate (Pt) = $\frac{9000 - 82 \text{ (repeaters in grade 3 in 2001/2002}}{9550}$

= $\frac{8918}{9550}$ *or* 93.5%

= 0.934 0r 93.4%

Self Assessment Exercise 1

1. Identify the three parameters for intra flow analysis.
2. Use your own figure to dramatise the promotion rate.

3.3 The Repetition Rate

Repetition is defined as the number of students repeating a given grade (class) in a following year. It is measured by the number of students who repeat a given grade in year t + 1 divided by the total number of students (total enrolment) in that grade in the previous year. It is expressed as:

$Repetition\ Rate(R_t) - \frac{R_{t+1}^i}{E_t^i}$, where

R_{t+1}^i = Number of repeaters in grade i in year t + 1 (i.e. following year)

E_t^i = Total number of students in grade i in year t, where i = 1, 2, 3, 4, …n

Repetition rate is expressed as a decimal, but may be converted to percentage. Like the promotion rate, it is usually between 0.0 and 1.0 or 0% to 100%. If any obtained value does not fall within this range, it means the data is either faulty or there is error of calculation.

Illustration

Use Table 1 above to find the repetition rates in grades 1, 2, and 3.

1. Grade = 1 = R_t = $\frac{105}{9990}$

= 0.01% or 1%

Note: From Table 1, 105 originally belonged to the 9990 in 1999/2000 in grade 1, but repeated in 2000/2001 and again became part of the 10,500 students. This is the case with all repeaters. Some of them may repeat more than once and become members of many student groups.

ii. $Grade\ 2 = R_t = \frac{85}{9550}$

= 0.009 0r 0.89% or 9%

iii. $Grade\ 3 = R_t = \frac{82}{9.000}$

= 0.009 or 0.89 = 0.9%

3.4 The Dropout Rate

Dropout rate is a measure of the degree of student withdrawal from the school at any point before the completion of his or her schooling. It is defined as the number of students that dropped out of a given grade in year t, divided by the total number of students in that grade in year t. This is expressed as:

$Dropout\ Rate\ (D_t) = \frac{D_t^i}{E_t^i}$, where

D_t^i = The number of students that dropped out of grade i in year t

E_t^i = Total number of students in grade i in year t.

Dropout figure can be simply determined by subtracting the number of those promoted plus repeaters from the total number of students enrolled

in a grade in year t. That is: Total Enrolment in a grade – (Promotion figure + Repetition figure) = Dropout figure.

This implies that the summation of promotion rate (P_t) and repetition rate subtracted from unity, which is 1 or 100% will give us the dropout.

Illustration

If the total number of students in grade 1 in a state primary school in year t (1998) was 450,000 and out of this 415,000 students were promoted to the next grade in the following year, while 22,000 of them repeated the same grade. The drop-outs will therefore be 450,000 – (45,000 + 22,000).

= 450,000 – 437,000

= 13,000

The drop-out rate will therefore be calculated as:

$$D_t^i = \frac{13,000}{450,000}$$

= 0.0288 or 2.9%

Drop-out rate may also be calculated, using this expression

$D_t^i = 1 - (P_t^i + R_t^i)$, where

D_t^i = Drop-out rate in grade i in year t

P_t^i = Promotion rate in grade i in year t

R_t^i = Repetition rate in grade i in year

To use the above expression, you must first obtain the promotion rate and repetition rate.

Illustration

Making use of the above data, we can calculate as follows:

Promotion rate (P_t) = $\frac{415,000}{450,000}$ = 0.92 or 92%

Repetition rate (R_t) = $\frac{22,000}{450,000}$ = 0.049 or 4.9%

∴ Drop-out Rate (D_t) = 1 – (0.92 + 0.049 or 92% + 4.9%)
= 1 – 0.969
= <u>0.031</u>

Or 100 – 96.1
= <u>3.1%</u>

From our analysis, it is clear that these three rates, i.e. promotion, repetition and drop-out will add up to 1 if using decimal and 100% if using percentage. These rates help in showing the probability of any individual selected at random in a given grade of his either being promoted or repeating or dropping out of the grade at the end of a year. These indicators are to the educational planners the useful instruments for the analysis of student flow from grade to grade within the school system. They are also the veritable indicators for cohort flow analysis, a model designed to measure the wastage rate of the school system. They provide information for the re-construction of the educational history of a given cohort of students. They also serve as tools for projection of enrolment pattern in a future date.

Self Assessment Exercise 2

Explain the repetition ratio and dropout rates as indicators of intra system student flow analysis.

4.0 Conclusion

In this unit, you have studied the three parameters of student intra system flow analysis, together with the indicators for measuring them. An understanding of the calculation of promotion rate, repetition rate and dropout rate is very crucial in preparing you as a planner on how to use the cohort flow analysis to determine the wastage level of the school system as well as in enrolment projection. You will learn more about this in the subsequent units.

5.0 Summary

This unit has introduced you to the general overview of the student flow through the school system. You have learnt that students can either be promoted or repeating or dropping out of the school during their course of study. These three parameters can be analysed with the indicators of promotion rate, repetition rate and dropout rate. With various illustrations, you have learned how these indicators are calculated.

6.0 Tutor-Marked Assignment

Use the below data to calculate promotion rate from grade 1 in 1995/96 to grade 2 in 1996/97; repetition rate in grade 3 in 1995/96 and drop-out rate in grade 2 at the end of 1995/96.

Year		Grades			
		1	2	3	4
1995/96	E.	10,000	9,800	9,200	8,990
1996/97	E. R.	100,000 300	9,300 400	8,900 250	7,500 200

7.0 References/Further Readings

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Unit 7: EFFICIENCY AND WASTAGE ANALYSIS TECHNIQUE

Contents

1.0 Introduction

Efficiency is an economic concept, now popular in educational planning. It is used to analyse production process and productivity, especially the transformation process. The transformation of educational impact into outputs, the degree of transformation as well as the wastage in the process are central to resource allocation, utilization and evaluation by educational planner. In this unit, you are going to learn the types of efficiency in education, measurement of efficiency as well as wastage determination in the educational system.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the concept of efficiency
- distinguish between external and internal efficiency
- highlight the inputs and outputs in the educational system
- construct a cohort flow chart
- use the constructed flow chart for wastage ratio analysis
- determine the efficiency level of the educational system through wastage ratio interpretation

3.0 Main Content

3.1 Concept of Efficiency

3.1.1 An Overview

The concept of efficiency originated as an economics concept, as it is believed that all human activities, including education start by goal definition or stating the expected output from input on investment. Efficiency is explained in term of the optimal relation between INPUTS and OUTPUTS in an organisation.

An organisation is said to be efficient, if such organisation is able to utilise a given quantity of input (resources) to obtain a maximum quantity of outputs. Hence, its relevance to educational planning. The concept is used for the analysis of production, which in economic parlance is a process of transformation through which good or services are transformed (changed or processed) to finished products. It is central to the theory of production. Education, as a productive activity makes use of various inputs, which are processed to produce outputs like all other human activities.

3.1.2 Types of Efficiency in Education

Efficiency in education has two dimensions. They are:

- the flow of the students through the system with a minimum wastage; and
- the quality of learning achieved in the system at given levels of periods (Nwankwo, 1981)

Wastage in the intra student flow is manifested quantitatively through dropout and repetition in the school system. On the other hand, quality of learning is measured by the inputs (resources) and outputs (graduates) of the school system. Educational planner and even government and other stakeholders are interested in the efficient use of resources in education. It is assumed that inefficient utilisation of resources (the human, materials and funds) provided to education leads to inefficiency in the flow of students, and consequently amounting to wastage. The rate of wastage assists in the determination of internal efficiency. The quality of learning could be contentious and controversial to measure, as it is very difficult to measure.

Based on the above explanation efficiency can be categorised into:

(i) External efficiency, and
(ii) Internal efficiency

(i) External Efficiency

External efficiency of the educational system relates the education acquired to the world of work. It is the extent to which the educational system meets the broad social, economic, cultural, political and the totality of the goals set by the nation or a state. It is expected that the national objectives can only be achieved through efficient educational system. It is the educational system that produces the manpower needed to achieve stated goals. The knowledge and skills needed are imparted by the school system.

However, external efficiency is usually difficult to quantify. This is because it takes a long time to produce the manpower needed to achieve the national goal, as such it takes a very long time to assess external efficiency. For example, to determine the efficiency of education in achieving the national objective of 'egalitarianism' as we have in the National Policy on Education will take time.

(ii) Internal Efficiency

Internal efficiency is the extent to which the resources that are available to educational system are optimally utilised to achieve the immediate objectives of the school system. The immediate objectives of the school system are centred on seeing students through the school system with minimal wastage that usually come through repetition and dropout. That is, the flow of students through the system with minimum wastage ensures high internal efficiency. The internally efficient system is the one, which produces outputs (graduates) without wasting student – year, arising from repetition and dropout. However, an internally efficient school system may not be externally efficient. For example, a system may graduate students without wastage, yet its products (outputs or graduates) may not be able to perform to expectation of the society. They may not be able to meaningfully contribute to the achievement of the national goals, because of their low quality. Internal efficiency can be measured.

Self Assessment Exercise 1

Explain the differences between the concepts of internal and external efficiency

3.2 Inputs and Outputs of Educational System

You will have noticed that we mentioned inputs and outputs when we discussed the concept of efficiency. This is because we can not quantify (measure) efficiency without relating inputs to outputs. It is believed that "sweet soup is the product of good money". Money here is the input, while 'sweet soup' constitutes the output. Therefore, we should identify the inputs and outputs in the educational system, especially when we embark on wastage calculation and determination of internal efficiency.

(a) **Inputs**

The resources used up in the process of producing finished students (graduates) are enormous. They include: teachers and non-teachers that are very vital in the processing or transformation process of the other resources; the students; physical resources (buildings, library, furniture, textbooks etc.). All these inputs cost money. Teachers and non-teachers must be paid and physical facilities procured. Because they all cost money, they can then be expressed as expenditure per student/per year. That is, when you put all the cost together and divide by the total enrolment, you will obtain cost or expenditure per student, per year. Therefore, the basic unit of calculation of input in education, especially when internal efficiency is being determined through wastage calculation is **STUDENT - YEAR**. It is believed that each student uses up certain expenditure in a school year. If a student fails to get promotion at the end of school year or if he or she drops out in that year, it is assumed that the expenditure on him/her has been wasted.

Resource wastage in education is a major concern of all stakeholders, especially government. Government spends so much on education with little immediate return; unlike other productive ventures.

(b) **Output**

Simply put, the output of any productive system is its finished products. Unlike other productive system, education system's raw materials are the students who go through the process of transformation, which are the teaching and learning, using various inputs. The finished products in the school system are its graduates. Therefore, the graduates or successful completers constitute the school system's outputs.

3.3 Concept of Wastage in Education

Wastage in education can not be divorced from the concept of efficiency. Educational wastage connotes inefficient utilization of

education inputs (resources). It is related to repetition, dropout, attrition, withdrawal, even unemployment and underemployment and so on. The measurement of wastage in the system is very important in determining the degree of internal efficiency. The indicator for measuring the education wastage is called the wastage ratio. It is defined as:

$$\text{Wastage Ratio (WR)} = \frac{Actual\ Input-Output\ Ratio}{Ideal\ Input-Output\ Ratio}$$

You will learn in detail the procedure of calculating the wastage ratio very soon.

The discussion on educational wastage must touch on every aspect of the education production function framework. This includes: the input, the process (transformation) and the output. There are several causes of educational wastage in our country. They include:

- the nature, ability and capacity of students;
- the nature of school;
- the nature of the educational system;
- the resources available to education;
- the socio-physical environment; and
- the labour market (Nwankwo, 1981)

3.4 Cohort Flow Analysis and Internal Efficiency

To measure internal efficiency, two methods are readily available. They are:

i. Cohort Analysis Method, and
ii. Standard Progression Method.

Because of the technicality it involves, the two can not be studied in this unit. You will learn the cohort analysis method in this unit, while you will learn the standard progression method in the next unit.

The cohort analysis is used to measure the internal efficiency in education. A cohort in a school system refers to a group or set of students that arrived into the grade one of the school system in the same year. Therefore, the cohort analysis simply tells the history of a particular group of students in a level of education from their entry point to the time the last of them leaves that level of the school system. For example, all students admitted to the JSS 1 in 2009 in Edo State belong to the same cohort. The cohort flow studies them through the JSS level until the last of them will leave the JSS.

The cohort flow anaysis shows the extent the educational system is able to use its raw maerials (students or pupils) in the production of graduates. If the system is able to see the students through the system within the shortest possible period/duration, such system is said to be internally efficient. In other words, a system is said to be internally efficient if the wastage rate is low. The cohort flow analysis starts with the construction of Cohort Flow Chart.

3.4.1 The Cohort Flow Analysis

The following steps are to be followed to construct a chart.

1. In some cases these ratios are officially determined by the government.
2. Calculate the theoretical proportion of an entry cohort survival for each successive year.
3. It is advisable that analysis should be done by using 1000 as figure to be used for the flow chart construction to ease computation and make presentation less cumbersome. Note that irrespective of the action base enrolment of the cohort you are using, the application of the promotion, repetition, and drop-out rates to the value of 1000 will not change your result.
4. Let us consider the rates in Table 1 for our use in constructing the cohort flow chart.

Table 1: Promotion Rates, Repetition Rates and Drop-out Rates

Rates	Grade (Class)					
	1	2	3	4	5	6
Promotion Rate (P_r)	0.8 (80%)	0.90 (90%)	0.86 (86%)	0.84 (84%)	0.81 (81%)	0.80 (80%)
Repetition Rate (R_r)	0.11 (11%)	0.9 (9%)	0.06 (6%)	0.07 (7%)	0.08 (8%)	0.8 (8%)
Dropout Rate (D_r)	0.09 (9%)	0.01(1%)	0.08 (8%)	0.09 (9%)	0.11 (11%)	0.12 (12%)

5. On the basis of the rates presented in table 1, a full history of the cohort can be given in a cohort flow chart (diagram).

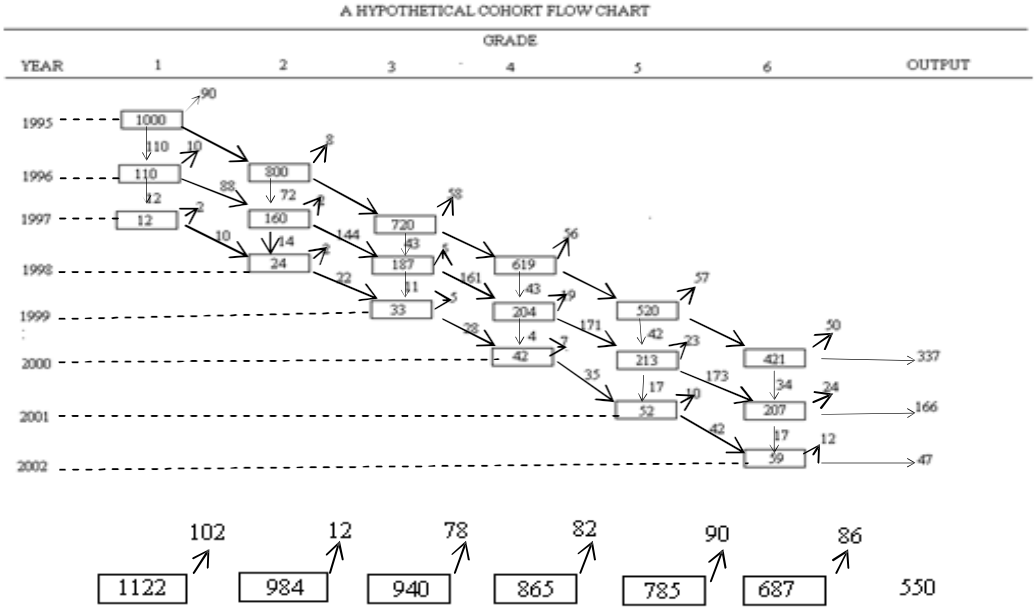
   Note that the rates are obtained from the school enrolment data. Thereafter, you will apply them to the figure of 1000 for easy computation. This will not in any way affect the result. It is only to make your computation easier with small figure.

6. The construction of the cohort flow chart is based on the following assumptions:

- that a student is only allowed to repeat any grade (class) twice in the school cycle, except otherwise ordered by the government policy,
- no new entrant is allowed to join the cohort being studied at any point (grade) through the school cycle, that is, in the subsequent years,
- the same flow rates (promotion, repetition and dropout rates) for each grade apply both to those who get to a grade directly through regular promotion and to those who are delayed through one or more repetitions.

Let us construct a cohort flow chart now, using the rates on table 1. You should study properly the unit 3 of module 2, especially the diagrams to guide you in the construction of the chart.

Note: You must be very careful in preparing the flow chart because any error on the flow chart will give you false wastage ratio and wrong interpretation of the internal efficiency.



Source: Adapted from Patwari, A. S. (1981) Application of Statistical Techniques to Educational Management Problems in Nigeria. Monograph. Department of Educational Management, University of Ibadan, Ibadan. p. 114

The cohort flow chart is for the group of students that entered primary one in 1995. The repeaters they met in primary one are not part of the

cohort being studied. Those ones belonged to another cohort, possibly the 1994 primary one set. The flow of the 1995 set ended in 2002 when the last of them left the system.

After the completion of the cohort flow chart, the data on it will be used to calculate the wastage ratio of the school system in the process of seeing the cohort of 1995 primary one students through the system.

3.4.2 The Wastage Ratio

Making use of the analysis done on the cohort flow chart, the wastage ratio is computed.

Under conditions of maximum efficiency, a successful completer of any level of education must not spend more than the official number of years presented for such level. For example for primary level in Nigeria, it is 6 years, Junior Secondary School is 3 years, Senior Secondary School is 3 years. For primary education, a wastage ratio of one (1) indicates maximum internal efficiency, while a wastage ratio of 1.1 to 2.0 shows inefficiency. For maximum efficiency, the input-output ratio will be 1 graduate (out-put) produced with 6 units of inputs (student – years). For primary education therefore, the

$$\text{Input – Output Ratio} = \frac{6}{1} = 6$$

It is difficult to achieve this level by any country, where all students that enter a class in a year will all graduate without any repetition or dropout. Even, if there is no repetition, there is possibility of dropout the duration of course. Thus, we can follow this procedure to calculate the wastage ratio.

Steps

(1) Calculate the actual Input – Output ratio.

(i) Sum up the Dropout figure from the chart

= 102 + 12 + 78 + 82 + 90 + 86 (i.e. for grades 1, 2, 3, 4, 5, 6) = 450

(ii) Sum up the Output = 337 (those who graduate without any repetition) + 116 (those who graduated with only one repetition) + 47 (those who repeated twice before graduation) = 550.

(iii) Sum up the Input = Number of pupil – years (Student – years) used by the cohort (group).

Grade 1 = 1000 + 110 + 12 = 1122 pupil – years.
Grade 2 = 800 + 160 + 24 = 984 pupil – years.
Grade 3 = 720 + 187 + 33 = 940 pupil – years.
Grade 4 = 619 + 204 + 42 = 865 pupil – years.
Grade 5 = 520 + 213 + 52 = 784 pupil – years.
Grade 6 = 521 + 210 + 59 = 687 pupil – years.
Total = 5383 pupil – years.

(iv) Calculate the Actual Input – Output ratio

$$= \frac{Actual\ Input}{Actual\ Output} = \frac{5383\ (pupil-years)}{550\ (successful\ fompleters/Graductes}$$

$$= 9.79$$

This implies that it cost a pupil from this cohort 9.79 years on the average to go through a primary education instead of 6 years.

(2) Compute the Ideal Input – Output Ratio.

$$\frac{Ideal\ Input}{Ideal\ Output} = \frac{6\ (Normal\ Pupil-years\ for\ Primary\ Education}{1\ (A\ unit\ of\ pupil)}$$

i.e. Ideally one (1) pupil will use 6 pupil-years for primary education.

(3) Calculate Wastage Ratio

$$\text{Wastage Ratio} = \frac{Actual\ Input-Output\ Ratio}{Ideal\ Input-Output\ Ratio}$$

From the above data derived from the cohort flow analysis, the wastage ratio is therefore:

$$\text{Wastage Ratio} = \frac{9.79}{6.0}$$

$$= 1.63$$

3.4.3 Wastage Ratio and Internal Efficiency

The value of wastage ratio is used to determine the level of internal efficiency. The perfect efficiency will give a wastage ratio value of 1.0. There is no wastage ratio value less than 1.0. If you obtain any value less than 1.0, you must have committed a serious error in your analysis. Any value that is higher than 1.0 indicates a degree of inefficiency. A perfect value of 1.0 has not been achieved by any nation as earlier explained. What countries aim at is to achieve wastage ratio values that are close to perfect (1.0). The nearer the wastage value obtained to 1.0, the lower the level of inefficiency.

Therefore, to interpret the wastage ratio value of 1.63 obtained above is simple. The case just illustrated is one of very high inefficiency because the ratio is 0.63 above the perfect value of 1.0. This is to say that about 0.63 or 63% additional inputs were used to see 1 pupil on the average through the primary school.

Self Assessment Exercise 2

Highlight the inputs of the educational system. In what ways are the inputs different from outputs?

4.0 Conclusion

From our study in this unit, it can be concluded that efficiency in education is a measure of the level of performance of the inputs through transformation process to produce outputs. The quality and ability to manipulate the inputs will determine the level of efficiency. External efficiency is not measurable, while the internal efficiency is measurable and the cohort analysis method can be used. It is a technical method through which the wastage ratio is determined and consequently the internal efficiency. Your knowledge of this method would assist you in determining the internal efficiency of any level of education, even of a single school.

5.0 Summary

This unit has provided you a framework of efficiency measurement in educational planning. The unit has taught you the concept of efficiency, where you identified the external and internal efficiency. You have also learned to inputs and outputs of the educational system. The concept of wastage in education was learned and you also studied the construction of the cohort flow chart, which is the model used to analyse the cohort flow. You have also learned that the cohort flow analysis provides the

data for the computation of the wastage ratio, which enables you to interpret the level of internal efficiency of the school system.

6.0 Tutor-Marked Assignment

Which of the two countries is more internally efficient, making use of the following data?

Country X

Total Output	=	705
Total Input	=	2950
Level of Education	=	Junior Secondary School (JSS)
Duration of JSS	=	3 years

Country Y

Total Output	=	980
Total Input	=	3200
Level of Education	=	Junior Secondary School (JSS)
Duration of JSS	=	3 years.

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Unit 8: STANDARD PROGRESSION ANALYSIS AND WASTAGE REDUCTION

Contents

1.0 Introduction

As you learnt in unit 4, efficiency as a concept originated from the field of economics and it is useful in explaining the performance of the production process of all human activities. It is applicable to educational planning because it relates resources to the expected outcomes. In unit 4, you have learnt the two types of efficiency, where you learnt that it is only the internal efficiency that is measurable. You also learnt that two methods are readily available to measure internal efficiency. They are the cohort flow method and the standard progression method. The cohort analysis was studied in unit 4. In this unit, you will learn about the standard progression analysis. You will also learn how to cost wastage in education and how wastage can be reduced in the educational system.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the standard progression method
- use the standard progression method to determine the wastage ratio of the school system

- interpret the wastage ratio value to determine the level of internal efficiency of a school system
- explain the procedure of costing wastage in education
- highlight the various wastage reduction practices

3.0 Main Content

3.1 Standard Progression Method of Wastage Calculation

3.1.1 Meaning of Progression

In many developing countries, it is difficult to obtain reliable and detailed data and information about the indices of wastage, especially on repetition rate, promotion rate and dropout rate. Because of this, it is difficult to use the cohort flow analysis effectively in analysing wastage. However, it is easy to obtain a grade-wise enrolment in many of these countries, including Nigeria. As a result of this, the standard progression method becomes a rightful tool to use.

In any school system, students progress from one grade to the other within a level of education, usually to a higher grade (class). The rate at which this progression is achieved can be measured, using the progression ratio. The progression ratios for all the grades and over some years are put together and the average found to give the "Standard Progression Ratio". The progression ratio as you learnt in unit 2 is the relationship between the total numbers of students enrolled in particular grade (class) at a particular year and the total number of pupils or students enrolled in the previous (lower) grade in the preceding (previous) year. For example, students in grade (class) 3 in year 2002 would have definitely progressed from the grade (class) 2 in year 2001.

The progression rate is expressed as:

$$K_g^t = \frac{E_{g+1}^{t+1} X 100}{E_g^t}, \text{ where}$$

K_g^t = Progression ratio

t = time (which is usually an academic year)

g = grade (class)

E_{g+1}^{t+1} = Enrolment in a grade in following year, i.e. year t plus another 1 year. E.g. Year 2000 can be 't', when you add 1 (i.e. another year), t + 1 = 2001.

Also g represent grade or class; g + 1 indicates a next higher grade or class. E.g. if grade 1 in 2000 is

g in year t. Then grade (g + 1) will be grade 2 and in year t + 1 = 2001.

E_g^t = Enrolment in grade (class) g in year t. That is, the base year under consideration. It could be any grade. For example if you are relating the grade 4 enrolment in 2004 to the enrolment in grade 3 in year 2003.

g = can be grade (class) 1, 2, 3, 4, …. 4, depending on the number of grades in any level. You can revise the details of progression, ratio in unit 2.

3.1.2 Using Standard Progression method to Calculate Wastage Ratio

You should follow the following five steps to calculate the wastage ratio, using the standard progression ratio. They are:

1. Collect the grade-wise enrolment data.
2. Use the obtained enrolment data to obtain the Progression Ratios for the system.
3. Calculate the Standard Progression Ratios from the progression ratios.
4. Obtain the Ideal and Actual Input ratios.
5. Calculate the Wastage Ratio.

1. The first stage is to collect a grade-wise enrolment. You can obtain this directly from schools or from relevant government agencies or ministry.

<u>Illustration</u>

Table 1: Grade-wise Enrolment of a State's Primary School by Grade (Class) Between 2000 – 2006

Year	GRADE (CLASS)						Total
	1	2	3	4	5	6	
2000	19796	11291	11131	9995	98349	86793	62699
2001	11832	11363	11178	11106	9859	86791	64017
2002	11885	11421	11234	11041	9881	9688	64150
2003	11901	11500	11294	11087	9907	8715	64404
2004	12067	11609	11406	11183	9979	8772	65016
2005	12180	11768	11519	11291	9107	8860	64725
2006	12325	11844	11641	11368	9116	8934	65228

It is from this enrolment as contained in table 1 that will enable you to calculate the progression ratios.

The Arrows (→) indicate the progression from the lower grade to a higher grade in the following year.

2. Computation of Progression Ratios from Table 1.
   The progression ratio formula as explained in 3.1.1 will enable you to compute the ratios.

Examples:

i. The progression rate from grade 1 in year 2000 to grade 2 in 2001

$$= \frac{11363}{11796} X\ 100$$

$$= \quad 96.3\%$$

ii. Progression rate from grade 2 in 2001 to grade 3 in 2002

$$= \frac{11234}{11363} X\ 100$$

$$= \quad 98.9\%$$

iii. Progression rate from grade 4 in 2003 to grade 5 in 2004

$$= \frac{9979}{11087} X\ 100$$

$$= \quad 90.0\%$$

iv. Progression rate from grade 5 in 2005 to grade 6 in 2006

$$= \frac{8934}{9107} X\ 100$$

$$= \quad 98.1$$

v. Progression rate from grade 4 in 2000 to grade 5 in 2001

$$= \frac{9859}{9955} \text{ X } 100$$

$$= \quad 98.6$$

These examp les arto guide you to complete a progression ratio table as we have in Table 2The arrow (→) marks on table 1 are to guide you to identify the directions of progress from grade to grade.

Table 2: Progression Ratios Between Grades as Computed from Table 1

Year 1	From Grade 1 to Grade 2 2	From Grade 2 to Grade 3 3	From Grade 3 to Grade 4 4	From Grade 4 to Grade 5 5	From Grade 5 to Grade 6 6
2000 – 2001	96.3	98.9	99.7	98.6	88.2
2001 – 2002	96.5	98.9	98.7	88.9	88.1
2002 – 2003	96.7	98.8	98.6	89.7	88.1
2003 – 2004	97.5	99.1	99.0	90.0	88.5
2004 – 2005	97.5	99.2	98.9	81.4	88.7
2005 – 2006	97.2	98.9	98.6	80.7	98.1
Average	96.95	98.96	98.91	88.21	89.95

3. Calculating the Standard Progression Ratio.
   The standard progression ratio is derived by finding the average progression ratios grade by grade. From table 2 above, you can find the average progression ratios as presented in table 3.

Table 3: Standard Progression Ratio

Between Grades	1 – 2	2 – 3	3 – 4	4 – 5	5 – 6
Standard Progression Ratio	96.95 (0.9695)	98.96 (0.9896)	98.91 (0.9891)	88.21 (0.8821)	89.95 (0.8995)

In the same way you applied the promotion rate, the repetition rate and dropout rate to a figure of 1,000 for easy computation during your study of the cohort analysis in unit 4, you will also apply the standard progression ratios obtained in Table 3 to a figure of 1,000 to obtain the Actual inputs, which are the student – years as explained in unit 4. It is to make computation easy. Whatever the figure to which you apply the standard progression ratios, you will still obtain the same result.

4. Obtain the Ideal and Actual Inputs.
   Applying the standard progression ratios to 1,000 will give us the following standard progression figures, which will serve as the Actual Input. The actual input is thus expressed as the student – years, while each year is considered as the school year.

Procedure

't_o' represents the first school year (base year),

Students in 't_o'	=	1000			=	Grade 1 (Entry year)
$t_o + 1$	=	1000 x 96.95	=	966	=	Grade 2
$t_o + 2$	=	966 x 98.96	=	956	=	Grade 3
$t_o + 3$	=	956 x 98.91	=	946	=	Grade 4
$t_o + 4$	=	946 x 88.21	=	834	=	Grade 5
$t_o + 5$	=	834 x 89.95	=	751	=	Grade 6
		Total	=	5,453		

5,453 is the Actual Input in term of student-years.

It is assumed that all the students in Grade 6 graduated from the system, making 751 the Total Output (graduates). The output is assumed, except otherwise given or stated.

Note: The rates as they appear in the computation are in %. Always remember to convert them to decimal figures when you are using calculator for computation to avoid serious error in your analysis.

* The figure of 1,000 as used in the computation is the grade 1 input. Remember to add to the other grades.

The ideal Input for the level we are using is 6. That is, 6 years is ideally spent for primary education. In other words, 6 years to train 1 pupil under ideal condition.

5. Calculation of Wastage Ratio

The standard progression will come out as follow:

School Year	Student – Year
t_o	1000
$t_o + 1$	966
$t_o + 2$	956
$t_o + 3$	946
$t_o + 4$	834
$t_o + 5$	751
Total	5453 (Actual Input)
Output (Graduate) 751 (Actual Output)	

The factor for graduating students or the

Actual Input – Output Ratio = $\frac{5453}{751} = 7.26$

Ideal Input – Output Ratio = $\frac{6}{1} = 6$

$\therefore$ Wastage Ratio = $\frac{Actual\ Input-Output\ Ratio}{Ideal\ Input-Output\ Ratio}$

= $\frac{7.26}{6} = 1.21$

3.1.3 Wastage Ratio and Interpretation of Internal Efficiency

As discussed in unit 4, the ratio for perfect efficiency is 1. Any value above 1 indicates inefficiency. However, the size of deviation from 1 will explain the size of inefficiency. Wastage ratio can not be less than value of 1, if less, then there must have been an error in calculation. If you compare the wastage ratio of 1.21 obtained in this unit with the value of 1.63 obtained in unit 4 when we used the cohort analysis method, you will find that the value of 1.20 shows a better internal efficiency. We can therefore conclude that though there is a degree of inefficiency in the system we have just considered; the internal efficiency is moderate. This is because there is no system with perfect internal efficiency.

Self Assessment Exercise 1

1. Distinguish between the standard progression ratio and the progression ratio.

2. Interpret the internal efficiency of educational systems with the following wastage ratios:

   A = 1.07
   B = 1.37
   C = 1.11
   D = 1.83

3.2 Costing Wastage in Education

Government and educational planner are always interested in optimising this cost of education. The efficient use of the funds allocated to education is critical to the achievement of education objectives. Educational wastage will obviously affect the cost per graduate per level of education. When a student repeats a class, he or she will also repeat the resources he or she had once utilised. This will cost additional money to both the public and the household. The same thing when a student drops out of the school system, it is assumed that all what had been spent on him or her become wasted. Though there are arguments

that the knowledge a dropped out child gains when he or she was in school can not be taken away from him or her. And that such knowledge will continue to be useful to him or her.

The cost of education in our discussion will be taken as the monetary equivalent of the educational services and supplies received by the students. Therefore, the higher the wastage, the higher will be the total cost per unit of graduate in any educational system.

The concept of wastage has been defined by the wastage ratios of the observed (actual) and the expected (ideal) situations. Technically speaking, the wastage ratio is the differentials between the real inputs used and the ones that would be required in an ideal situation. The transition of the actual to the ideal level is highly costly. It is this additional cost that plays a vital role in the calculation of the differential cost of education (Nwankwo, 1981).

However, the conventional approach to costing wastage does not take into account the additional expenditure required to move from the actual situation to the ideal situation.

The following illustration will explain to you better the process of calculating the cost of wastage. Follow these steps:

Step 1: Obtain the data of the students that successfully completed the school cycle. That is graduates or outputs.

Step 2: Obtain the number of student – years spent per unit of output (graduate) i.e. actual Input – Output. Let us say we have = 7.0 years.

Step 3: Number of student – years per unit of output under ideal situation = 6 years (for primary education)

Step 4: Let us say the average annual unit cost, i.e. cost per student – year = ₦2000.00

Step 5: Determine the cost per unit of output (graduate) under the actual situation = 7.0 x ₦2000.00
= ₦14,000.00

Step 6: Determine the cost per graduate under maximum efficiency, i.e. ideal situation
= 6 x ₦2000.00 = ₦12,000.00

Step 7: Detemine the cost of wastage per unit of output (graduate)

= Actual Situation Cost – Ideal Situation Cost
= ₦14,000.00 – ₦12,000.00
= ₦2000.00

This implies that on each graduate from this system, the sum of ₦2000.00 constitutes the extra cost of his or her primary education as a result of wastage.

Step 8: Determine the total cost of wastage in the system being illustrated

= Total Output x unit cost of wastage
= ₦200,000.00 x ₦2000.00
= ₦400,000,000

You can see the huge cost of wastage and imagine what the cost of wastage will be in Nigeria if we can take time to calculate it. Hence there is serious need for any nation to do everything to reduce wastage since it can not be totally eliminated.

3.3 Wastage Reduction in Education

Measures required to reduce educational wastage should be holistically taken. That is, all aspects of the educational system and all interests in the system should be critically examined to identify where each has failed in the responsibility of running an efficient educational system. All the social and economic aspects of the nation must be examined. The school system as an entity must also be critically examined.

The social and economic focus should address the responsibility of the government, non-government and parents in regard to education. The part to be played by each group in producing efficient education must be well defined. The policies on education and the laws controlling education practices should be reviewed to guarantee efficiency in the system.

Concerning the school system itself, there is a need to review the management practices, especially school inspection and instructional supervision. As they are today, they can not ensure school efficiency. The school curricula, teachers' quantity, quality and motivation to work must be seriously addressed if inefficiency in our schools is to be reduced. School facilities and equipment must be upgraded, replaced and modernised. The situation of the schools at all levels in Nigeria is

appalling. The system of evaluation of instructions in the schools may need a review. The continuous assessment is not well implemented. Many teachers abuse the idea of continuous assessment.

The school performance indicators and benchmarks should be well observed. Indicators like the teacher-pupil ratio, average class size etc should be strictly observed.

Parents should cooperate with the school to bring efficiency. They should assist the schools in the areas of facility production and provide their children and wards with the necessary learning materials to enable them learn effectively. They should pay the necessary fees on time to save children from being embarrassed out of the school system. Parents should be enlightened not to withdraw their children from school.

It has been discovered that many teachers do not teach at all or teach poorly some subjects at the primary school level, because they do not understand the subjects. A teacher is assigned to a class at this level and he or she is expected to teach the children most of the subjects. Most time, he or she skips the teaching of Mathematics, English Language, and Science. This problem constitutes wastage at the primary school level. To address this, specialised teachers should be recruited to teach these subjects.

Training and re-training of teachers should be encouraged. In addition, the quality of teachers being trained from the teacher training institutions should be reviewed. The quality of intakes should be reviewed. In many universities, applicants without interest in teaching profession should not be admitted.

Self Assessment Exercise 2

1. Explain the procedure for the costing of educational wastage.
2. Suggest other ways you think can facilitate the reduction of wastage in education.

4.0 Conclusion

The standard progression method is a veritable tool for measuring internal efficiency, especially in situations where data on promotion, repetition and dropout are not readily available. It makes use of the simple grade-wise enrolment. With the student progression ratios, it is easy to compute the wastage ratio, which is used to interpret the internal efficiency. It is also important to know the cost of wastage and how to carry it out. Because the cost of wastage is usually large, it becomes

necessary to understand the various ways through which it could be reduced.

5.0 Summary

This unit has taken you through the procedure of using the standard progression method to measure wastage ratio and consequently the internal efficiency of the school system. You learnt the need to collect a grade-wise enrolment to enable you calculate the progression ratios. You equally learnt how to obtain the standard progression ratios, which will enable you to understand how the inputs and the outputs are obtained. You learned how the wastage ratio is determined and its interpretation. You also learned how to cost education wastage as well as how education wastage can be reduced.

6.0 Tutor-Marked Assignment

1. Calculate the wastage ratio, if you have the following standard progression data for primary education level.

School Year	Student – Years
t_o	1000
t_o + 1	920
t_o + 2	880
t_o + 3	800
t_o + 4	720
t_o + 5	650
Total Input =	

Total Output = 640

2. Use your result in (1) to interpret the internal efficiency.

7.0 References/Further Readings

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Module 3: METHODOLOGIES OF STUDENT ENROLMENT, TEACHER/MANPOWER AND COST ANALYSIS

Unit 1: Student Enrolment Analysis and Forecast
Unit 2: Teacher/Manpower Analysis and Projection
Unit 3: Education Cost and Financial Analysis

Unit 1: STUDENT ENROLMENT ANALYSIS AND FORECAST

Contents

1.0 Introduction

Student enrolment is the major factor in the educational system. The quantity and quality of other inputs in the system are dependent on the student enrolment. For this reason, it is necessary that the future enrolment is constantly projected so as to plan ahead for the required resources, especially facilities, funds and personnel. In this unit, you will learn the methods of enrolment projection and facility planning for the projected enrolment.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the methods of student enrolment forecast
- make projection of enrolment with the methods studied
- plan for the facility requirements of the projected enrolment

3.0 Main Content

3.1 Student Enrolment Forecast/Projection

Student enrolment forecast or projection could be regarded as the main focus of the quantitative analysis in educational planning. This is because the projected enrolment enables the planner to take decision on the future resources needs of the educational system. The number of teachers to recruit, facilities and equipment to put in place as well as the general cost of education for the future use of the educational system. This can be efficiently predicted if the future enrolment is well projected. Two methods of enrolment projection will be discussed. They are:

1. Extrapolation of Past Trend Methods, and
2. Student Flow Method

3.2 Extrapolation of Past Trend Method

Enrolment projection based on the extrapolation of the past is very useful, especially when detailed data and information are not available. It is based on the past enrolment trend, at least in the past two dates. For example if you have enrolment data in 1991 and 2000, you can easily find the growth rate of enrolment between the two past dates. The obtained growth rate can be extrapolated to obtain the future enrolment. Enrolment Growth Rate can be determined by the following formula:

$$r = Antilog\left(\frac{Log\ {}^{E_n}/_{E_o}}{n}\right) - 1, \text{ while}$$

Future Enrolment is obtained with the following formula:

$$E_{n_t} = E_o(1 + r_o)^n, \text{ where for both formula}$$

r = Enrolment Growth Rate

E_n = Enrolment in the more recent of the two dates e.g. 2000 is recent than 1991

E_o = Enrolment in the initial year of the two dates e.g. 1991 is the initial year between 1991 and 2000.

n = Number of years between the two dates.

E_{n_t} = The projected Enrolment in year t. A year to be decided by the planner.

Illustration

We can project student enrolment on the following data:

2003 = 50,000 = E_o
2006 = 70,000 = E_n
∴ n = 3 = Number of years between 2002 and 2006
r = ? = Growth Rate to be determined
2012_t = E_{n_t} ? = Enrolment for year 2012 to be projected.

The data gave us enrolment for 2003 and 2006. We can determine the growth rate between the two dates. It is the obtained rate (r) that will help us to extrapolate the 2012 enrolment.

Let us substitute the data in the formula

$$= Antilog\left(\frac{Log\left(\frac{70,000}{50,000}\right)}{3}\right) - 1$$

$$= Antilog\left(\frac{Log\ 1.4}{3}\right) - 1$$

$$= Antilog(0.0487) - 1$$

$$= 1.1187 - 1$$

$$r = 0.1187 \simeq 0.12 \text{ or } 12\%$$

∴ The enrolment growth rate between 2003 and 2006 is about 0.12 or 12%. Holding r to be constant, we can forecast the 2012 enrolment as follow. Using the above data,

2012 enrolment is projected as follows:

First, we will use the 2006 as the initial year E_o
∴ E_o = 2006 Enrolment = 70,000
E_n = E_{n_t} (the projected enrolment)
= ? (not yet known)
n = 6 years = Number of years between 2012 and 2006
r = 0.12 or 12% = Already calculated
t = Year 2012
Substituting the data available for the formula for enrolment projection as follows:

$$E_{n_t} = E_o(1+r)^n$$

Enrolment fro 2012 = 2006 Enrolment (1 + calculated growth rate)^n

$$= 70{,}000\ (1 + 0.12)^6$$
$$= 70{,}000\ (1.12)^6$$
$$= 70{,}000 \times 1.97$$
$$= 137{,}900$$

This implies that at the growth rate of 0.12 (12%) yearly, the 2006 enrolment of 70,000 is projected to be 137,900 in year 2012. The projected figure will assist the planner to forecast other school inputs accordingly. You can apply this to as many as possible future dates.

In using this method, you should know that all the factors influencing the past enrolment trend will persist and will also remain constant. However, this method does not project the grade-wise enrolment. That is, enrolment is not shown by class.

Self Assessment Exercise 1

With the following data, project student enrolment for the year 2011. Enrolment in 2006 = 120,000; 2008 = 140,000. Use the extrapolation of the past trend method.

3.3 Projection Based on Student Flow Method

Enrolment projection based on student flow is considered to be more usable and up-to-date method of projection. It makes use of the student flow parameters of promotion, repetition and dropout. In using this method, the planner must study the factors that influence the intra-system flow of students. Some of the factors according to Nwankwo (1981) include:

- population of admission age;
- admission rate to the first grade, i.e. class 1;
- repetition rate at different grades;
- promotion rate at different grades; and
- dropout rate at different grades.

These are the factors that dictate the intra-system student flow at all levels of education. To use this projection method, you should consider admission, dropout and repetition rates as policy variables. That is, government can regulate them to suit the thinking of the party in power. The party may want to increase enrolment by ordering free and

compulsory education as well as removing repetition through automatic promotion.

To project future enrolment with this method, you will require the following data:

- projected population of the age group corresponding to admission age;
- enrolment class by class (grade-wise) in the year preceding the base year; and
- enrolment and number of repeaters from the previous year by class within the base year.

Your understanding of unit 6 will greatly assist you in the understanding of this method. Let us use Table 1 to guide our discussion.

Table 1: Information Required for Student – Flow Enrolment Projection

Year	Estimated Population of Primary School Going Age	Admission Rate (%)	GRADE					
			1	2	3	4	5	6
2007	150,000	66.6	E: 100,000	95,000	90,000	88,000	82,000	80,000
2008	160,000	68.75	E: 120,000 R: 10,000	92,000 9,000	90,000 8,000	87,000 7,500	85,000 7,000	79,000 6,000
2009	170,000	68.75	128,875	108,340				
2010	180,000	68.75	145,638	117,252				
2011	190,000	68.75	154,064	132,020				
2012	200,000	68.75	52,706	140,415				

E = Enrolment, R = Repeaters.

Admission rate is calculated from the past trend and held constant.

Steps to Follow

1. It is assumed that Grade 1 students came from the Estimated population of school going age. You can obtain this by projecting the school going age population, using the methods you learnt in units 2 and 3 of this module.

2. It is assumed that Grade 1 students came from the school age population. Thus, you will find the admission rate for the existing years. In doing this, remember to subtract the repeaters since they do not belong to that school age population.

   Example

   We can find the admission rate for 2007 and 2008 as follows:

   2007 = $\frac{100,000}{150,000} X\ 100$

   = 66.6% (This may not be the true rate because we do not know the repeaters among the 100,000)

   2008 = $\frac{120,000-10,000}{160,000} X\ 100 = 68.75\%$

3. Calculate the Promotion, Repetition and Drop-out rates for all the classes, i.e. between 2007 and 2008. This is because you already have the data for the two years.

   Remember, you have learnt how to calculate these rates in unit 6 of this module. This is the time for you to apply the knowledge and skills.

Example: From Table 1

i. The number of promoted students from grade 1 in 2007 to grade 2 in 2008 = 92,000 minus the 9,000 repeaters they met in grade 2 in 2008.

   = 92,000 – 9,000 = 83,000

   ∴ Promotion rate = $\frac{83,000}{100,000} X\ 100 = 83\%$

ii. Repetition Rate will be calculated for 2007 grade 1 students. The number of students that repeated grade 1 in 2008 were also in

grade 1 in 2007. Therefore the number of repeaters for grade 1 in 2007 = 10,000.

$$\therefore \text{ Promotion rate } = \frac{10{,}000}{100{,}000} \; X \; 100 \; = \; 10\%$$

iii. Dropout rate can be easily estimated by the following equation:

$$D_t = 100 - (P_t + R_t)$$

$$= 100 - (83\% + 10\%)$$

$$= 100 - 93 = 7\%$$

$\therefore$ = Promotion Rate = 83%
Repetition Rate = 10%
Dropout Rate = 7%

In this way you will calculate the rates for the grades for the flow of student between 2007 and 2008.

4. Having completed the calculation of the promotion, repetition and dropout rates, you will assume that these rates will remain constant over the years. Thus, you will apply them to the projected school age population. The calculated admission rate will similarly be held constant and be applied to the future years.

Example

We can apply the rates, i.e. admission, promotion, repetition to make projection for 2009 to 2012 in the grades. Dropout may not be useful so much in this exercise.

Therefore, let us apply the obtained rates as calculated above to the first and second grades of the years in table 1 as follows:

Project the admission figures to grade 1 based on the 68.75% admission rate =

(0.6875)68.75% X 170,000 for grade 1 in 2009 = 116,875
(0.6875)68.75% X 180,000 for grade 1 in 2010 = 123,750
(0.6875)68.75% X 190,000 for grade 1 in 2011 = 130,625
(0.6875)68.75% X 200,000 for grade 1 in 2012 = 137,500

i. Let us project enrolment for the grade 1 of 2009 in Table 1.

= New Entrants + Repeaters from the same grade (Grade 1)
In the preceding year (2008)

= 116,875 + (120,000 X 0.10)

{Note: 120,000 is the enrolment for Grade 1 in 2008.
0.10 0r 10% is the repetition rate.}

= 116,875 + 12,000

= 128,875

∴ Projected enrolment for grade 1 in 2009 will be 128,875

ii. Projected enrolment for grade 1 in 2010

= 123,750 + (128,875 X 0.10)
= 132,750 + 12,888
= 145,638

iii. Projected enrolment for grade 1 in 2011

= 130,625 + (145,638 X 0.10)
= 130,625 + 14,564 = 145,189

iv. Projected enrolment for grade 1 in 2012

= 137,500 + (152,064 X 0.10)
= 137,500 + 15,206
= 152,706

Having completed projection into grade 1, you will now move to project the grade 2 enrolment.

v. Project Enrolment to Grade 2

a. Projected enrolment for grade 2 in 2009. To obtain this, you should study this equation.

= Promotees from grade 1 + repeaters from previous years
= (120,000 X 0.83 (83%) + $\left(92{,}000\ X\ \frac{9000}{95{,}000}\ X\ 100\right)$

The repetition rate for grade 2, which will be applied to all grade years $= \frac{9000}{95{,}000}\ X\ 100\ =\ 0.095\ (9.5\%)$

∴ Projected enrolment for grade 2 in 2009

= (120,000 X 0.83) + (92,000 X 0.095)
= 99,600 + 8,740
= 108,340

b. Projected enrolment for grade 2 in 2010

= (128,875 X 0.83) + (108,340 X 0.095)
= 106,966 + 10,292
= 117,258

c. Projected enrolment for grade 2 in 2011

= (145,638 X 0.83) + (117,258 X 0.095)
= 120,880 + 11,140
= 132,020

d. Projected enrolment for grade 2 in 2012

= (154,064 X 0.83) X (132,020 X 0.095)
= 127,873 + 12,542
= 140,415

This is the approach you will adopt for all the other grades to obtain the projected enrolment by grade as shown in table 1. This is what makes the method superior to the extrapolation of the past trend method. It projects enrolment class by class.

3.4 Projected Enrolment and Facility Planning

Student enrolment has serious implications for resources inputs especially educational facilities. The projected enrolment, which is likely to be on the increase would require additional classrooms, additional furniture and other teaching – learning facilities. According to Aghenta (1993), the size of these facilities depends upon the student enrolment, while the type is dependent on the nature of the institutions as well as their management.

There are benchmarks (approved standard) for student-facility use in the Ministries of Education and some relevant agencies to guide the planning of school facilities. However, the core data necessary for each planning is the student enrolment. The following are some of the quantitative methods for school facility planning.

(i) Classroom/Laboratories/Workshops

The number of students projected, the number of periods per week during which the classroom/laboratory/workshop are to be used, the number of periods they are used will largely dictate their size and quantity. According to Aghenta, we can use the following formula:

$$S_h = \frac{h_s X S}{h_r X R}$$, where

S_h = average number of students taking each period
h_s = average number of periods per week per student
h_r = average number of periods that each room is used per week
S = number of students
R = number of classrooms, laboratories, workshop etc.

However, the average class size in a period in a week varies across levels of education, because of the way their lessons are organised and the time duration for such lessons.

(ii) Number of classrooms to be built, based on the projected enrolment can also be worked out by using the Average class size or student – classroom ratio. At the primary and secondary school, the standard average class size is 1:40, i.e. 1 classroom to 40 pupils. To calculate the required number of classroom, you need the following data:

- Projected pupil enrolment
- Approved average class

Illustration

If the projected pupil enrolment = 200,000, and
Average class size = 1:40

∴ Projected Required Number of Classroom $= \frac{200,000}{40}$

= 5,000 classrooms

This implies that 5,000 classrooms will be required to teach the 200,000 students in a future date. However, the planner should estimate the number of the existing functional classrooms, which will be subtracted from 5,000. It is the difference that government should aspire to build.

Example

Projected number of classrooms	=	5,000
Existing functional classrooms	=	3,000
Difference	=	2,000

(iii) The same method used in planning the classroom requirement can be used to project the desk/chairs to be used by the pupils.

In your projection, you should take into consideration that two (2) pupils sit on a chair/desk at the primary school, while it is 1 chair/desk per student at the secondary school level.

Illustration

Using the above figure:

- Number of projected pupils = 200,000
- Average pupils/class = 40
- Number of required classroom = 5,000

For primary school = 2 pupils per desk $= \frac{5000}{2} = 2{,}500$

= 2 pupils per chair $= \frac{5000}{2} = 2{,}500$

For Secondary School = 1 student per chair = 5000 chairs
= 1 student per desk = 5000 desks

You can see the difference between the two levels of education. With your knowledge of economics of education, you can equally project the cost of these facilities.

Self Assessment Exercise 2

1. Explain the steps to follow in using the student flow technique to project student enrolment.

2. What is the importance of enrolment forecast to facility planning in the school system?

4.0 Conclusion

Planning, as a process of taking a set of actions meant for future decision, can not be meaningful without a sound knowledge of the methods and techniques for near accurate predictions about the future.

Enrolment forecast or projection is one of the techniques a planner uses to plan for the future resource needs of the educational system. This is because the dynamics of the student enrolment overtime is important for resource allocation and utilisation, especially in providing the facility requirements to meet the future needs. Enrolment projection is a core aspect of the quantitative analysis in educational planning and you have learnt various methods of projection in this unit.

5.0 Summary

In this unit, you have learnt the core position of enrolment projection in the quantitative analysis of educational planning. It is a way of predicting the school enrolment in a future date. Two methods were studied. They are projections based on the extrapolation of the past trend and the projection based on the student flow. Various examples were used to aid your understanding of the technique. You equally learnt how the projected student enrolment can help you in school facility planning.

6.0 Tutor – Marked Assignment

1. With the following data, what will be the student enrolment in 2013?
   - Enrolment in 2005 = 211,000
   - Enrolment in 2009 = 325,000

2. If a state's primary school enrolment is projected to be 280,000 by 2014, how many additional classrooms should the state build, if the average class size is 50 and the existing functional classrooms by 2013 would be 2,700.

7.0 References/Further Readings

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Unit 2: TEACHERS/MANPOWER ANALYSIS AND PROJECTION

Content

1.0 Introduction

The teaching manpower in the school system constitutes the major force in the transformation process of all the inputs in the school system. The adequacy, in term of number and quality of teachers goes a long way in the standard of education of any nation. Thus, it is necessary to study the teacher demand-supply mix so as to understand the pattern f attrition and retention of teachers in a school system. Since student enrolment grows over time, it is also important to always project the number of teachers that will teach them. As such, an educational planner should understand the simple methods of projecting the required teachers by the school system over time. In this unit, you will learn the various techniques of teaching manpower projection. You will equally learn the forecasting methods for manpower requirements in other sectors.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the teacher demand-supply mix in the school system,
- identify the methods of teacher requirement projection,
- explain the procedure of using the identified teacher projection method,
- explain the methods of manpower projection in other sectors of the economy.

3.0 Main Content

3.1 Teacher Demand-Supply Analysis

The number of teachers available in the school system at a particular time, especially at the beginning of a school year constitutes the system's teaching stock. This stock is stabilized by the forces of demand and supply. The demand and supply forces are also controlled by the factors of student enrolment and government policy. The higher the enrolment, the higher will be the demand for teachers and the more teachers to be supplied by the relevant agency. This is however, when all things are equal. This is because government can decide not to employ teachers, even when enrolment is growing. Government may attribute the problem to funding. We have witnessed such situation in many states in Nigeria. However, unlike the real economic situation, the demand-supply situation of teachers in the educational sector does not assume a zero period. That is, there is no period when teacher will neither be demanded nor supplied as long as there is a school system. Similarly, there is no period when there will be no teachers in the school system.

3.2 Calculating the Attrition and Retention Rate of Teachers

The stock of teacher is not usually stable. This is because at the end of a year or during the academic year, some teachers leave the system for one reason or the other. These include:

- withdrawal of service,
- resignation,
- dismissal,
- death,
- retirement.

"Teacher go, teacher come" is a common maxim. This means that there is regular inflow and outflow of teachers in the school system.

However, a planner is interested in the loss of teachers due to the above reasons, because he or she must plan for replacement. The teacher wastage is measured by either the attrition rate or the retention rate. The teacher attrition rate measures the extent at which teachers leave the system, while retention rate measures the extent at which the system retains its teachers. Thus, teacher retention rate is written as:

$$Teacher\ Retention\ Rate\ (T_r^t) = \frac{T^{t+1} - N^{t+1}}{T^t} X\ 100, where$$

T_r^t - Teacher retention rate in year t

T^t - Stock of Teachers in year t

T^{t+1} - Stock of teachers in year t + 1

N^{t+1} - Number of teachers entering the service in year t + 1

Note: The teacher retention rate measures the teacher retention capability of the school system.

Example:

If there were 100,000 teachers in the teaching stock of a state in 2002 (year t), there were 103,000 teachers in 2003 (year t + 1) and 8,000 new teachers employed in 2003 (year t + 1), we can calculate the teacher retention rate in 2002 as:

$$T_r^t = \frac{103{,}000 - 8{,}000}{100{,}000} X\ 100$$

$$= \frac{95{,}000}{100{,}000} X\ 100$$

$$\therefore\ T_r^t = 95\%\ \ 0.95$$

This implies that the system's ability to retain teachers is 95%.

On the other hand, the teacher attrition or wastage rate is the measure of the extent at which teachers leave a school system. It is measured by

$$T_w^t = 1 - T_r^t \ (If\ it\ is\ recorded\ in\ decimal).$$

Or

$$100 - T_r^t \ (If\ it\ is\ recorded\ in\ \%), where$$

T_w^t - Teacher Wastage Rate in year t

Example

If we use the above data,

$$T_w^t = 1 - 0.95 = 0.05$$

Or

$100 - 95 = 5\%$

Or

$$\frac{5{,}000}{100{,}000} X\ 100$$

$= 5\%$

This means that out of the 100,000 teachers in the previous year, 5,000 left the system at the end of the previous year. It was the 8,000 newly recruited in the following year, added to the 95,000 that were retained at the end of the previous year that made up 103,000 teachers in the following year.

This implies that the teacher attrition or wastage rate is 5% or 0.05.

3.3 Projection Methods of Teachers in the School System

To effectively project the number of teachers that will be demanded by the school system in a future date, the following data and information are necessary; they are:

- total student enrolment in the school system,
- average number of hours received per week per student,
- average number of students taught per teacher per unit of time,
- average number of hours taught per teacher per week,
- benchmark on student or pupil – teacher ratio,
- benchmark on the average class size.

3.3.1 Student – Teacher Ratio Method of Projection

It is the simplest method of teacher projection. This is because it relies on the data from projected enrolment and the benchmark (approval standard), student – teacher ratio. It is very useful where complex data on hours taught by teacher or received by students are absent. In Nigeria, the approved student teacher ratio for the primary and secondary schools is 40:1. That is, 40 students to 1 teacher. In this method, teacher required is determined by dividing the projected enrolment by the student – teacher ratio. It is expressed as:

$$TR = {}^{S_s^t}\!/_{ST_r}, where$$

TR - Teacher Required

S_s^t - Student enrolment in year t

ST_r - Student – Teacher ratio

Illustration

If the secondary enrolment in a state in year 2010 is projected to be 280,000 and the approved student-teacher ratio in the state is 40:1, how many teachers will be required at this level in 2010?

Going by the above formula,

$$TR = \frac{280{,}000}{40}$$

$$= 7{,}000$$

This implies that the state secondary schools will require (demand) 7,000 teachers that should be supplied by the relevant authority. In doing this, the planner should consider what will be left in the teachers' stock by the end of 2009.

3.3.2 Calculation of the Full Time Equivalent Teacher Requirements or The Teacher Workload Method

The following data and information are needed for you to calculate the full-time equivalent teachers. They are:

- Average number of hours received per students per week

- Average number of hours taught per teacher per week.

The number of teachers required can be derived by the workload done by a teacher per unit of time. This can be illustrated as follow:

Step 1

Calculate the Average audience of the school. This is expressed as:

$$Average\ Audience = \frac{Total\ Students' Periods\ Per\ Week}{Total\ Teachers' Periods\ Per\ Week}$$

The Total Students' Periods in a week is the summation of individual students' periods in a week in all the grades (class) of the school system. That is, you will add the periods of all the students one by one.

The Total Teachers' Periods in a week is derived by summing (adding) up all the teachers' periods in a week one by one. You must also know the total number of teachers in the school.

Example 1

If the total number of teachers in a school is 30 with total weekly teaching load of 900 periods; and the total student enrolment is 450 with total weekly periods of 22,000, you can calculate the average audience as follows:

Summary of Data

Total Number of Teachers	=	30
Total Student enrolment	=	450
Total Teachers' weekly periods	=	900
Total Students' weekly periods	=	22,000

$$\therefore Average\ Audience = \frac{22{,}000}{900}$$

$$= 24.4$$

Approximately ($\cong$) = 24 (We do not have a fraction of human being).

This implies that on the average, a teacher teaches 24 students per period.

Future teacher requirements can also be projected by using the existing average audience in the belief that the situation will remain constant.

Example 2

If you have an average audience of 24 and projected enrolment of 100,000, you can forecast a future teacher demand figure as follow:

$$Projected\ Teacher\ -\ \frac{Projected\ Enrolment}{Average\ Audience}$$

$$= \frac{100,000}{24}$$

$$= 4166.66$$

$$\cong 4167 \text{ teachers.}$$

Step 2

To calculate the Full-Time Equivalent Teacher Requirement, the total teachers' weekly teaching periods is divided by the benchmark (standard), that is approved average teacher periods. This is usually approved by the government. It is expressed as:

$$Full - Time\ Equivalent\ Teacher\ Required = \frac{Total\ Teachers'\ Periods\ Per\ Week}{Approved\ Average\ Periods}$$

Examples:

If the total teacher periods in a week are 900, and approved teacher average periods is 25, the Full-Time Equivalent Teacher Required will be:

$$\text{Full-Time Equivalent Teacher Requirement} = \frac{900}{25}$$

$$= 36 \text{ teachers.}$$

From example 1 above, the 900 total teachers' weekly periods were taught by 30 teachers. But with the approved average teacher weekly period of 25, it is 36 teachers that will be required. This means that the school is in short supply of 6 teachers.

3.3.3 Students Per Class and Hours Taught By Teacher Method Or Projection Based on Class Size

Total Required Teachers can also be estimated by multiplying the projected enrolment by the hours taught per week per teacher, divided by average number of students in a class and multiplied by the average

number of weekly hours per full –time equivalent teacher (i.e. teaching load). It is expressed as follow:

$$T = \frac{h \, x \, p_e}{g \, x \, l}, \text{ where}$$

T	-	Full – Time equivalent teachers required
h	-	hours taught per week per teacher
p_e	-	Projected enrolment
g	-	Average number of student per grade (class)
l	-	Average number of weekly hours per full-time equivalent teacher (teaching load)

This expression is simplified to:

$$T = {}^{E}/_{G}, \text{ where}$$

T	=	Full – time equivalent teachers required
E	=	Enrolment
G	=	Average grade (class) size

This is because it is easy to obtain needed data on enrolment and average class. This is because one teacher is permanently in-charge of one class, especially at the primary school level. This method is similar to the student-teacher ratio method.

Example

If Enrolment is projected to be 200,000 and Average class size is 40, that is, 40 pupils per class, the Full-time equivalent teachers required will be:

$$T = \frac{200{,}000}{40}$$

= 5,000 teachers required.

This could be different at the secondary and tertiary institutions where class size and student – teacher ratio varies according to subjects and disciplines.

Self Assessment Exercise 1

1. What are the factors of attrition to the teaching stock in the educational system?

2. A state's projected school enrolment is 250,000. Student-Teacher Rato is 45:1. Calculate the required teachers in the state's schools.

3.4 Manpower Analysis and Projection

The manpower required by any economy for developmental growth can be projected. However, many of the known methods required detailed data, which are not readily available in many developing countries like Nigeria. The methods that can be used include:

(i) The employers' opinion method.
(ii) The incremental labour-output ratio method.
(iii) The density ratio method.
(iv) The international comparison method.
(v) The Parnes Mediterranean Regional Project approach.

Yesufu (1963), cited by Aghenta (1993) listed the following data requirements for manpower forecast:

- Population census by sex, age, level of training and education
- Industrial census or Labour force.

3.4.1 The Employer Opinion Method

This method is popular in making short-term forecast for high level manpower. In this method, employers of labour are asked through questionnaires their future manpower needs in quantity and type. This is applied mainly to organisations with at least ten or more workers. After the submission of the questionnaire, a summation of all the estimates is done. Also estimate of staff attrition, which is through death and retirement, is done. The result will give the demand of educated labour in a future date. It is expressed by this formula:

$$M_t = L_i, t - (R_i, t + D_i, t), where\ i = 1, 2, 3, 4 \dots n, where$$

M_t = Manpower demanded in target year t.
L_i, t = Labour demanded by employer i in target year t.
R_i, t = Retirements in establishment i in year t.
D_i, t = Deaths in establishment i in year t.

Illustration

If the summation of employers' manpower needs in year t = 50,000
Projected retirement = 5,000 and
Projected deaths = 3,000
The manpower demanded in year t will be

$$M_t = 50{,}000 - (5{,}000 + 3{,}000)$$
$$= 50{,}000 - 8{,}000$$
$$= 42{,}000$$

3.4.2 Incremental Labour – Output Ratio Method

This method takes labour to mean a particular manpower in a category of occupation. It takes output to mean industrial output or the national income. This method requires time series data, that is, data over a period of years on output per man. This shall be classified by sector, occupation and qualification. Many developing countries do not have this information. This method calculates the ratios at which labour increases output sector by sector, occupation by occupation over a period of time. Such ratios are then assumed to remain constant for the future dates.

For example if the Labour-output ratio increases, then the ratio of manpower production will be increased at the same ratio. If Labour-output ratio increases by 2% across sectors and occupation, the ratio of producing manpower by sector and by occupation will also be projected at 2%.

3.4.3 The Density Ratio Method

,
This is also called the "ratio of saturation" and commonly used by the Russian Planners. It is used for long-term manpower projection. It passes through two stages:

(a) Estimation of the stable fraction of qualified manpower in the labour force by sector. E.g. In the Health Sector. Take the fractions of Medical Doctors, Pharmacists, Laboratory Scientists, Medical Records Officer, etc.
(b) Apply these fractions to the demographic forecast of the total labour force as distributed among the sectors of an economy.

Illustration

1. - If the demographic forecast of the total labour force = 100,000,

- If the stable fractions of graduates in the sectors of an economy are:

Health = $\frac{1}{10}$

Education = $\frac{1}{8}$

Engineering = $\frac{1}{15}$

Agriculture = $\frac{1}{6}$

etc.

These fractions will be applied to 100,000 as:

Health = $\frac{1}{10} X\ 100{,}000 = 10{,}000$

Education = $\frac{1}{8} X\ 100{,}000 = 12{,}500$

Engineering = $\frac{1}{15} X\ 100{,}000 = 6{,}667$

Agriculture = $\frac{1}{6} X\ 100{,}000 = 16{,}667$

2. You can now use the same approach to project for each occupation in the sector.

Example: Health Sector (Projected Labour Force = 10,000)

		Fractions		
- Doctors	=	$\frac{1}{8}$	x	10,000 = 1,250
- Pharmacists	=	$\frac{1}{10}$	x	10,000 = 1,000
- Medical Laboratory Scientist	=	$\frac{1}{10}$	x	10,000 = 1,000
- Medical Records Officers	=	$\frac{1}{8}$	x	10,000 = 1,250
- Graduate Nurses	=	$\frac{1}{6}$	x	10,000 = 1,667
- Others	= about	$\frac{2}{5}$	x	10,000 = 3,833

You will do this for all the sectors to arrive at a country's total estimates.

The problem with this method is that there is doubt concerning the assumption of a stable employment fraction scientifically to allow such application across sectors.

3.4.4 The International Comparison Method

This is commonly used where there is limitation of data, especially in the developing nation. No time series data is required to use the method. What is required is to identify a developed country that shares certain characteristics with an aspiring developing country. Apply the indices of manpower production and sector productivity of such developed country to plan the developing country's manpower requirements. This is based on the assumptions that for the attainment of equivalent levels of productivity, parallel occupation groups in the economies must have equivalent educational characteristics.

3.4.5 The Parnes' Mediterranean Regional Project Approach

The method was developed by the Organisation of Economic Community and Developments (OECD) in 1962 to produce educational plans for certain member nations.

This method proceeds from the initial projection of a target Gross National Product (GNP) or the Gross Domestic Product (GDP) in future years to a supply of educational manpower needed to attain the set target. This goes through four stages, which are:

1. Break the target GNP or GDP in the years ahead into major sectors. The sectors can be: Social, Agriculture, Manufacturing, power, Transportation etc.
2. Apply the average Labour-Output Coefficients to the sector GNP or GDP targets to obtain the estimated future sector employment. For example, if Output (Q) of sector 'A' is valued at ₦100,000,000 in 2001 and the Quantity of Labour (L) employed in sector 'A' in 2001 is 1,000,000, the average Labour-Output Coefficient in 2001 will equal to:

$$Average\ Labour - Ouput\ Coefficients = \frac{LA}{QA} = \frac{1{,}000{,}000}{100{,}000{,}000}, where$$

LA = Quantity of Labour in Sector A
QA = Output of Sector A

= $\frac{1}{100}$

= 0.01 or 1%

3. Distribute the sector employment among the list of mutually exclusive occupational categories.
4. Determine the occupational structure. This is done by the application of the standard benchmark of the level of required education to successfully perform the listed occupations.

According to Blaug (1970) and Akangbou (1982), this method is summed up by multiplying the fractions of the GNP or GDP that are derived in the various sectors by the Labour-Output Co-efficient. According to them, this is then multiplied by a sector matrix and finally by an occupation education matrix. This is expressed mathematically as:

$$Q\left(Q_j/Q\right)\left(L_j/Q_j\right)\left(I_{.k}/L_j\right)\left(I_{.i}/L_k\right), \textit{which is a matrix of}$$

Required workers of education i in occupation k in industry j ; where

Q = GNP or GDP
Q_j = GNP or GDP originating in each sector (j = 1, 2, …, n)
L_j = Labour Force in each sector (j = 1, 2, …, n)
L_k = Labour Force in each occupation (k = 1, 2, …, m)
L_i = Labour Force with each level of education (i = 1, 2, …, t)

This mathematical expression will only account for the expansion in the stock of educated manpower. Naturally, there will be labour attrition through death, incapacitation, retirement and migration. Such attrition must be replaced. When the replacement has been done, the forecast of demand of educated manpower in a future date to meet the targeted GNP or GDP can be done. This method is technical and needs care during calculation.

Example

Let us project future manpower target for country B by following these steps:

→ Target year 2015

(A) Sector Distribution of GDP (at current prices) in ₦ million

Sectors	2005 Actual (Fraction)	2015 Estimates (Fraction)	2015 Estimates (Fraction)
1	400 (0.40)	550 (0.37)	820 (0.40)
2	200 (0.20)	300 (0.20)	480 (0.234)
3	250 (0.25)	350 (0.23)	400 (0.195)
4	150 (0.15)	300 (0.20)	350 (0.171)
Total	1,000 (1.00)	1,500 (1.00)	2,050 (1.00)

(B) Find the Average Labour Output Coefficient by Sectors in 2005

Sectors	Output (Q) (₦ million) 2005 (1)	Labour Employed (L) in 2005 (2)	Average Labour-Output Coefficient (L/Q), 2005 = (1) ÷ (2)
1	400	50,000	0.008
2	200	85,000	0.0026
3	250	46,000	0.0054
4	150	32,000	0.0047
Total	1,000	213,000	

(C) Project the Sector Employment

Sectors	2015 GDP Estimates (₦ million) (1)	Average Labour-Output Coefficient (2005) L/Q (2)	Projected Sector Employment (2015) (1) X (2)
1	820	0.008	820,000,000 x 0.008 = 6,560,000
2	480	0.0026	480,000,000,x 0.0026 = 1,240,000
3	400	0.0054	400,000,000 x 0.0054 = 2,160,000
4	350	0.0045	350,000,000 x 0.0045 = 1,575,000
Total	2,050*	**	11,535,000

* see Table (A)
** see Table (B)

You can see that the projected employment for the target years 2015 is 11,535,000 from the figure of 1,000,000 for the base year 2005. This is dictated by the growth in country B's GDP.

Self Assessment Exercises 2

1. Highlight the techniques for manpower projection.
2. List the necessary data information you require for manpower projection.

4.0 Conclusion

Manpower projection for all sectors, especially the teaching manpower for the school system is very important for future developmental process of any country and any system. This is because the adequacy of manpower, by sector and occupation is important for productivity enhancement and maintenance of standards. In the school system, it is crucial to maintain the teacher demand-supply equilibrium both for the present and future dates. As such, educational planner should understand the pattern of attrition of teacher stock and also understand the techniques of teacher projection for the future. In addition, he or she should understand the manpower projection techniques for the other sectors of the economy.

5.0 Summary

There are various methods of forecasting the future teacher requirements of the school system and also for the future manpower needs of any economy. In this unit, you have learnt the determination of attrition of stock of teachers and methods of teacher projection. The unit also discussed the projection methods based on student-teacher ratio, the hours taught by teacher per week or the workload approach as well as the average class size. The unit equally discussed the five methods of manpower projection for the other sectors of the economy.

6.0 Tutor – Marked Assignment

1. If you have the average audience of 30 in a school system and projected enrolment of 120,000, project the teacher requirements for the system.

2. If the average class size is 45, and projected enrolment is 300,000, calculate the full-time equivalent teacher required.

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Unit 3: FINANCIAL AND COST ANALYSIS IN EDUCATION

Contents

1.0 Introduction

Education is an expensive social service, which requires huge financial input from the government and non-governmental sources. As the quantum of money expended increases in the country today, so is the increase in the complaints of stakeholders about under - funding. It therefore behoves the planner in carrying out a thorough cost analysis by relating the allocated money cost to the utilization procedures and indices of utilization. This is to enable him to assess the adequacy of financial allocation and the cost effectiveness of educational operations and activities. Therefore, you will learn in this unit, the cost determinants, types of cost, cost analysis and projection as well as the cost reduction methods.

2.0 Objectives

At the end of this unit, you should be able to:

- explain the financial estimate determinants,
- highlight the types of cost in education,
- explain the process of cost analysis and projection in education,
- reduce the excess cost in education

3.0 Main Content

3.1 Determinants of Financial Estimates in Education

The major determining factors of financial estimates or budgeting are listed as follows:

(a) Educational Objectives
(b) The country's income measured by the Gross National Product (GNP) and Gross Domestic Product (GDP)
(c) Student Enrolment
(d) Teachers and Non-Teachers
(e) Curriculum of the School System
(f) Inflation

(a) Educational Objectives: Though can not be quantitatively measured, it is a major factor in estimating the financial expenditure in education. It guides the planner to identify the priority areas during appropriation.

(b) The Country's GNP/GDP: The macro financial analysis, which the main focus, is the relationship between investment in education and the GDP and the expenditure on all sectors of the economy.

The trends in the ratios of GDP and public expenditure in relation to the investment in education are used for forecasting the supply of resources for the educational sector (Pandit, 1980). When the GDP is growing there is a tendency that the financial allocation to education will also increase. The GDP determines an expected income to all sectors including education.

(c) Student Enrolment: The total expenditure on the system depends largely upon the student population. When preparing the school budget, the number of students, number of classes and the number of arms per grade must be considered. This is because, to a large extent, the expected income of the school depends on the school enrolment. For example, the number of students determines the total fees payable in the school. For example if

School A Enrolment	=	5,000
School B Enrolment	=	7,000
Average School Fee (₦)	=	10,000

Income Expected from:

School A = ₦50,000,000
School B = ₦70,000,000

Similarly, government's grant to school is done per student.

Example: If government' s grant is ₦500/Child/Annum i.e. ₦500 per student per annum,

Enrolment in State's A Secondary Schools = 200,000
Enrolment in State's B Secondary Schools = 280,000

Total Grants to:

State's A Schools = ₦100,000,000
State's B Schools = ₦140,000,000

You could see that State's B Schools has the higher grant.

Student enrolment also determines the expenditure pattern of the school system. This is because the school enrolment determines the number of teachers and non-teachers, facilities and equipment.

Example

If the student-teacher enrolment in a country is 40:1, that is 40 students to 1 teacher, and Enrolment in:

State X = 500,000
State Y = 400,000

∴ Number of teachers required in:

State X = 12,500
State Y = 10,000

If the average teacher salary in the two states is ₦700,000.00 per annum,

∴ Total Teachers' salary in:

State X = N700,000 X 12,500 = ₦8,750,000,000
State Y = N700,000 X 10,000 = ₦7,000,000,000

You can see that with the same annual average teachers' salary, State X will pay ₦1.75 billion higher than state Y because of the difference in

the number of teachers, which is determined by the student enrolment. The same result will be obtained in the expenditure on facilities and equipment because this quantity is determined by student enrolment.

(d) Teachers and Non-Teachers: The total number of teaching and non-teaching staff, together with their salaries and allowances, determine to a large extent the financial estimation of the educational system. Staff qualification, experiences are also factors that determine the expenditure forecast of the school system.

The higher the number of staff, the higher will be the tendency to increase expenditure. The same goes with the experience and qualifications.

Example

State A Schools with 5,000 graduate teachers
State B Schools with 3,000 graduate teachers
State C Schools with 2,500 graduate teachers

Average teacher salary in State:

A	=	20,000
B	=	20,000
C	=	20,000

Expenditure Estimates for State:

A	=	₦100,000,000
B	=	₦60,000,000
C	=	₦50,000,000

You can see the pattern, that the number of teachers recruited is an important determinant of financial estimates.

(e) The School Curriculum: The curricula of an educational system to a large extent determine the financial estimation of such system. The science and technological oriented curricula is more cost intensive and as such will cost higher than the humanities-based curriculum. Expenditure on the laboratories' and workshops' equipment to deliver the science and technological based curriculum will definitely increase the financial estimates.

(f) Inflation: The inflationary trend in a country will also influence the financial estimates in education. When the inflation index is high, there is bound to be an increase in prices of goods. The

educational facilities may not be spared. Not only this, the employees may also agitate for increase in their wages to cope with inflationary trend. All these will increase the financial estimates or sometimes distort the estimates.

Example

If in year 2008, a bag of cement cost ₦1,500 and in year 2009, the cost of a bag of cement jumped to ₦2,000 as a result of inflation. The expenditure estimates will be altered if the same number of classroom buildings is to be constructed.

State X
- To build 100 classrooms with 100,000 bags of cement in 2008 at ₦1,500 per bag of cement.
- To also build 100 classrooms with 100,000 bags of cement in 2009 at ₦2,000 per bag of cement.

∴ In 2008 = 100,000 bags X ₦1,500 = N150,000,000.00
In 2009 = 100,000 bags X ₦2,000 = N200,000,000.00

You can see the implication of change in price as a result of inflation on the expenditure estimates of the state in carrying out the same capital project in the schools.

Self Assessment Exercise 1

List and explain the major determining factors of financial estimates in the educational system?

3.2 Types of Costs in Education

Cost studies at the micro level provide a useful link between the inputs of educational system and their objectives. You must be familiar with the types of costs from your knowledge of economics of education and costing and budgeting in education. These are the courses you did at the Masters Level. To remind you, we have the following costs in education. They are:

(a) Real Cost
(b) Institutional Cost
(c) Household Cost
(d) Social Cost
(e) Fixed and Variable Cost
(f) Marginal Cost
(g) Unit Cost

You need to understand the concept of costs in education for you to be versatile in cost analysis and projection.

(a) Real Cost of Education:- Is the effort and sacrifice required to produce any good or service. It can be described as the 'price' paid by any consumer on goods or services obtained, including the alternative he or she could have used his time and money to achieve. This means that the real cost of education include the alternative opportunities (i.e. opportunity cost) a person have to sacrifice in obtaining education.

(b) The Institutional Cost:- It consists of the capital and current costs. The capital cost covers the cost outlay in school fixed and durable assets, such as building, furniture etc. The current cost covers the yearly recurring expenses on the school system. It covers salaries and allowances of workers, stationery, etc.

(c) Household Cost:- This covers the cost borne by the members of the household in educating any of their members. It also includes the earning foregone by such member in the school. The cost covers books, uniforms, food, etc. it also covers the tuition fee and other charges that are paid by parents. It can also be referred to as private cost.

(d) Social Cost:- This is the cost borne by the society. That is from the public purse as controlled by the government. It is simply described as: Institutional cost, minus scholarship and household cost minus tuition cost.

(e) Fixed and Variable Cost:- Fixed cost is the cost, which does not change, with variations in output, because certain factors of production are indivisible. An increase in enrolment may not necessarily alter the building of a faculty. On the other hand, variable cost is a cost that varies with increase in output. An additional lecturer to a Department will vary the cost of salary in the department.

(f) Marginal Cost:- This is the additional cost that will be incurred when one more unit is added to the total number of students enrolled in a school or class.

(g) Unit Cost:- This can also be called average cost. It is the arithmetic mean, whereby the total cost of education, that is monetary cost is divided by the total output or number of units. It is very important in the cost analysis and cost projection.

3.3 Cost Analysis and Projection in Education

3.3.1 Overview

Educational cost is very important for analysis in education. It can be used as a diagnostic measure. That is, it can be used as a diagnostic instrument to analyse the financial aspect in term of income and expenditure pattern in education. It can also be used as prognostic instrument of measurement of future cost demand in education. That is, as a parameter for projecting the future trend of development in the education system.

There are two types of cost analysis that are relevant to educational planning. They are:

(a) Overall Analysis
(b) Detailed Analysis

(a) Overall Analysis:- This approach provides a near accurate possible particulars of the flow of educational finances both as actual and prospective. This approach indicates the place of education comparatively to other sectors of the economy. It also facilitates international comparisons.

(b) Detailed Analysis:- This deals mainly with the detail consideration of the breaking of educational expenditure by various criteria. It deals with cost trend analysis in education. Our focus in this section will be on the detailed cost analysis in education.

To guide us in this section, we will discuss in detail the unit cost analysis and projection because it is the basic unit of analysis.

3.3.2 Unit Cost Analysis in Education

Unit cost is the monetary expression of producing or servicing one unit. Such unit can be a student-year, a completer of a course or graduate, a class, a school, a student, a teacher etc. Unit cost analysis enables a planner or economist to understand the cost of production and also to be able to predict the future cost requirements of he educational system. Thus, unit cost can be calculated as follow:

- Cost per school
- Cost per graduate
- Cost per teacher
- Cost per pupil – year
- Cost per classroom

— Cost per furniture

The unit cost can easily give us the total cost of education.

Illustrations

(1) Cost Per School or Unit Cost of School:- This is obtained by finding the arithmetic mean of the cost incurred on all schools. That is the total cost on the schools divided by the total number of schools.

Example:- Total number of schools in State A in year t = 800
Total monetary cost on all the schools in year t = ₦10,000,000.00

$$\text{Unit Cost or Cost per School} = \frac{10,000,000.00}{800}$$

$$= ₦12,500.00$$

₦12,500.00 is the cost of running each school in year t.

(2) Unit Cost of Graduate or Cost Per Graduate:- This is the cost of seeing 1 graduate through the school system. It depends on the number of grades he or she has to pass through. The total cost from the initial grade to the final grade will be added and divided by the total number of students in that group, it could be a cohort.

Example: Total number of students in the graduating group = 300
Total monetary cost from Initial Grade to Final Grade = ₦25,000,000.00

$$\text{Unit Cost of Graduating a student} = \frac{₦25,000,000}{300}$$

$$= ₦83,333.33$$

This implies that the unit cost, that is, cost of producing a graduate in the state is ₦83,333.33.

(3) Unit Cost or Cost Per Teacher:- This is the average cost incurred on a teacher in the school system. It is obtained by dividing the total wages of teachers by the total number of teachers.

Example:

Total number of teachers in a State's Secondary School = 5,000
Total wages (Salaries & Allowances) paid to them in a year = ₦1,000,000,000.00

$$\text{Unit Cost} = \frac{₦1,000,000,000.00}{5,000}$$

$$= ₦200,000$$

This implies that on the average, a teacher costs the state ₦200,000 yearly.

(4) Unit Cost of Student – Year or Cost Per Student – Year:- It is the cost of each school-year a student spends in the school. It is useful in determining the cost of wastage in the school system. It is calculated by summing up the total expenditure on a cohort of student divided by the total student –years spent by them in the course of their education. It can be done session by session and it can also be done level by level.

Example

If the total student –years = 250,000
Total expenditure = ₦100,000,000,000
∴ Unit Cost of Student – year = ₦400,000

This implies that each student – year cost ₦400,000.

(5) Unit Cost or Cost per Classroom:- This can be obtained by summing up the total cost of building certain number of classrooms and divided by the total cost of building the classrooms.

Example

Total number of classrooms built = 1,000
Total Cost of building = ₦500,000,000.00

$$\text{Unit Cost} = \frac{₦500,000,000.00}{1,000}$$

$$= ₦500,000.00$$

This implies that ₦500,000.00 is spent on building each classroom.

(6) Unit Cost or Cost Per Furniture:- This is the cost of producing a unit of furniture. It is measured by dividing the total cost of producing

a certain number of furniture by the total number of furniture in the school system.

Example

Total number of desks produced for a school = 2,000
Total cost of producing them = ₦2,000,000.00

Unit Cost = $\frac{₦2,000,000.00}{2,000}$

= ₦1,000.00

This implies that one desk is produced at the cost of ₦1,000.00.

You can compute the unit cost for all the items utilized in the teaching-learning process. The analysis of unit cost can enable you make cost projection in the educational system.

3.3.3 Cost Projection in Education

Unit cost analysis can enable you to do a cost effectiveness analysis and cost projection. Unit cost enables planner to estimate the cost of inputs to education. For example, if a unit cost of any item is known, it will be easy to estimate the total cost. For example, if the unit cost of a textbook is known, it will be easy to determine the cost of purchasing 100 of such books for the library.

Illustration

If the unit cost of a school bus is ₦5,000,000, to buy 50 of such buses for the schools, it is just by multiplying the total items of purchase (buses) by the unit cost.

∴ Total cost of 50 buses = No of Items x Unit Cost
= 50 x ₦5,000,000
= ₦250,000,000

The budgetary plan makes use of the unit cost approach in its packaging.

Example 1:

If State X plans to build 100 classrooms at a cost per unit of classroom of ₦200,000; recruiting 500 teachers at ₦500,000 per teacher; 1,000 chairs at ₦200.00 per unit, the total estimated cost will be:

Table 1: Cost Projection Based on Unit Cost

Items	Number of Units	Unit Cost (₦)	Total Cost (₦)
Classrooms	100	200,000	20,000,000.00
Teachers	500	500,000	250,000,000.00
Chairs	1000	200	200,000.00
Total			270,200,000.00

Example 2

You may want to project the total cost of educating primary school pupils among the Local Government Council Areas in a state. Let us assume that the unit cost, that is cost of educating 1 pupil stands at N1,000.00.

Let us make use of the data in Table 2.

Table 2: Total Cost Projection of Primary Education in a State

LGA	Total Enrolment	Unit Cost ₦	Total Cost Estimate ₦
A	1,500	1,000	1,500,000
B	1,300	1,000	1,300,000
C	1,350	1,000	1,350,000
D	1,200	1,000	1,200,000
E	890	1,000	890,000
F	780	1,000	780,000
G	450	1,000	450,000
Total			7,470,000

The projected total cost is ₦7,470,000.

3.4 Cost Reduction Methods

The cost of education is enormous. As such educational planner and economist of education should strive to produce cost reduction models. To reduce the cost of education, we should be able to identify the major determinants of cost of education. It is after this that we can effectively manipulate these cost variables to bring down the cost of education.

3.4.1 Cost Determinants in Education

The major factors that determine the cost of education are:

(i) the average class
(ii) the average cost of classroom construction

(iii) the student-teacher ratio
(iv) the teachers' salary; qualification and experience
(v) the school size

(i) The Average Class:- As explained in Unit 5, average class size is measured by dividing the total enrolment in the school system by the number of the total functional classrooms. Higher number of classrooms will cost more money than few numbers of classrooms. For example, if the average class size in state 'A' is 40 and state 'B' is 30, and if the two states have the same enrolment of 20,000, the number of classrooms the two states will build will be as follow:

State A = $\frac{20,000}{40}$ = 500 classrooms

State B = $\frac{20,000}{30}$ = 667 *classrooms*

This implies that state B will spend more to build classrooms. This is because the state has a smaller class size.

(ii) The Average Cost of Classroom Construction:- Capital projects are cost intensive. However, the cost of capital projects or items can be influenced by the nature, type and design of such item or project. The mode of construction, the design of building and the location of school can equally affect the cost of the building – mud blocks are cheaper than cement blocks, iron sheets are cheaper than asbestos zinc, simple classroom design will be cheaper than sophisticated design. Similarly, land will be cheaper in the rural setting than urban setting.

(iii) The Student – Teacher Ratio:- This relates to the number of students per teacher. You have learnt the detailed computation in unit 5. Teacher salaries and allowances constitute the largest part of Total Recurrent Cost of education. Because of this, the number of teachers on roll will influence the cost of education. Therefore, when the ratio of students to teacher is high, the recurrent cost may be reduced, but when it is low, the recurrent cost may increase.

Example:

State A Student – Teacher Ratio = 25:1
Sate B Student – Teacher Ratio = 35:1
State A Student Enrolment = 100,000
State B Student Enrolment = 100,000

No of Teachers Required in State A = $\frac{100,000}{25} = 4,000$

No of Teachers Required in State B = $\frac{100,000}{35} = 2,857$

Our result shows that State A will spend more on teachers than State B, because of the numbers to be recruited, which is dictated by the student-teacher ratio.

(iv) Teachers' Salary, Qualification and Experience:- As mentioned earlier, teachers' salaries and allowances dominate the recurrent cost of education. Also, the higher the teachers go up the career ladder in the teaching profession plus a higher qualification, the higher the wages paid. Therefore, it will cost more to manage a school with highly experienced and qualified teachers than the opposite.

Example

School A	School B
20 Graduate Teachers	25 Graduate Teachers
10 NCE Teachers	5 NCE Teachers

Average Salary of Graduate Teacher = ₦100,000
Average Salary of NCE Teacher = ₦80,000

School A Total Teacher Cost		School B Total Teacher Cost	
Graduates Teacher	₦2,000,000	Graduates Teacher	₦2,500,000
NCE Teachers	₦800,000	NCE Teachers	₦400,000
Total	₦2,800,000	Total	₦2,900,000

School B spends more on teachers because it has more graduate teachers.

(v) The School Size:- The size of the school will also influence the cost of education, especially the recurrent cost. This is mainly on the overhead cost. Overhead expenses are spread on students. A small school in term of enrolment will incur higher cost because its unit cost will be high. For example, a University with 5,000 students will pay a Vice-Chancellor, Registrar, and Bursar; while a university with 50,000

students will also have one Vice-Chancellor, Registrar and Bursar . The overhead expenses of a large institution are lower than that of small institutions.

3.4.2 Cost Reduction Techniques in Education

We have identified and explained the determining variables of cost of education. These variables can therefore be manipulated to bring down the cost of education, especially in developing countries, with poor economic base. This implies that we will manipulate the factors of average class size; cost of classroom construction; student-teacher ratio; teachers' salary, experiences and qualification; and the school size. However, we must be careful in the manipulation process of cost so as not to jeopardise the quality of education. Let us now consider in detail how the cost reduction can be done.

(i) Average Class Size:- You have learnt that a large class size will lead to the building of few classrooms, whereas a small class size will lead to the building of many classrooms. Since the cost of building classrooms is a major item of the capital cost, then we can reduce capital cost by constantly and moderately regulate the average class size.

Example

State A Secondary School — Average Class Size	=	25
State B Secondary School — Average Class Size	=	40
State A and State B have the same Enrolment	=	500,000
Unit Cost of Classroom	=	₦100,000

State A: Total Cost of Classrooms

$$\frac{500,000}{25} = 20,000$$

= 20,000 x ₦100,000
= ₦2,000,000,000.00

State B: Total Cost of Classroom

$$\frac{500,000}{40} = 12,500$$

= 12,500 x ₦100,000
= ₦1,250,000,000.00

You can see the difference between the costs of classrooms in the two states. Therefore, if you want to reduce cost of classroom, the average class can be manipulated.

(ii) Average Cost of Classroom Construction:- In regulating the cost of construction of school building, factors that influence the cost of construction, such as design, quality and types of materials should be regulated. In this case, simple designs should be encouraged. Cheaper materials should be used. However, sub-standard materials should be avoided, so as not to compromise quality.

(iii) Student – Teacher Ratio:- You have learnt that the lower the student – teacher ratio, the more teachers that will be recruited and the more cost to be incurred vice versa. It is similar to the case of average class size. Therefore, to reduce the cost of teachers, the student – teacher ratio should be reasonably manipulated. However, we must be careful not to compromise standard in our manipulation.

(iv) Teachers' Salaries and Allowances:- As discussed earlier, recurrent cost is dominated by teachers' cost. We also learnt that teachers' cost is influenced by teachers' qualifications and experience. To reduce recurrent cost, teachers' cost must be reduced. And to reduce teachers' cost, the quantity of teachers to employ must be regulated, especially their qualifications and experience. Two options can be used:

(a) recruit less qualified teachers to lower cost
(b) recruit young and less experienced teachers to lower cost. NCE teachers may be recruited instead of graduate teachers. Again, we must be careful. No reasonable nation will adopt this approach, to sacrifice quality for cost saving.

(v) School Size:- Planner should regulate the size of school so as to achieve its optimum cost effectiveness. School size should be increased to the point at which the unit cost is lowest so as to save cost. However, we must be careful not to over-stretch the available teaching – learning facilities in an attempt to maximise size. If not, we may be increasing cost instead of reducing it.

Self Assessment Exercise 2

1. Highlight the types of cost.
2. Explain the factors to be manipulated in the process of reducing the cost of education.

4.0 Conclusion

Financial and cost analysis constitutes the major quantitative aspects of the economics of education. As such, educational planner should understand the various approaches and methods of carrying them out. The factors of financial estimates guide the planner about income and spending pattern in education. The cost analysis indicated the value of unit cost as a basic unit of cost analysis and projection. The cost of education is noted to be very huge; as such the factors of cost of education should be identified for manipulation, so as to reduce the cost of education, especially in a weak economy.

5.0 Summary

In this unit, you have learnt the factors that determine the financial estimates in education. You learnt the types of cost, which include institutional, social and household costs. You studied the unit cost analysis and learnt the place of unit cost in cost estimates and projection. You learnt that the average class size; student – teacher ratio; cost of school; building construction; size of school; and teachers' salaries, qualification and experience are determinants of cost, which can reasonably be manipulated to lower the cost of education.

6.0 Tutor Marked Assignment

1. Find the unit cost of classroom in state X, if the total number of schools in the state is 1,000 and the total cost of classrooms is ₦9,000,000.00

2. Estimate what it will cost state Y if it has
   2,000 teachers at unit cost of ₦250,000
   20 schools at unit cost of ₦3,000,000
   500,000 chairs at unit cost of ₦200

7.0 References/Further Readings

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Answers to Self-Assessment Exercises

Module 1

Unit 2:

1. Primary sources of data are the collection of original data through the use of self developed instrument, e.g. questionnaire or checklist while secondary sources of data are data collected from existing sources which have brought the data together from the primary sources e.g. textbook, school records etc.
2. Data can be obtained from any of the following places:
    - Schools (records)
    - Ministry of Education (State and Federal)
    - Schools Board
    - Local Education Departments
    - Department of Planning and Research of Ministries and Parastatals
    - Ministry of Finance
    - Ministry of Labour and Employment
    - National Manpower Board
    - Federal Office of Statistics
    - National Population Commission
    - Educational Agencies (NUC, NCCE, NBTE, NERDC etc)

Unit 3:

1. Statistics in planning are used for decision making and policy formulation; collecting basic indicators, assessment and evaluation.
2. Educational planner requires the knowledge of statistics to be able to diagnose educational management problems, project/estimate resource input, forecast, set target and evaluate educational programmes.

Module 2

Unit 1:

The population structure of a country is the composition of all human beings within the country. This could be categorised by age, sex, occupation, economic and geographic. The most important to the educational planner among these factors are age and sex.

Unit 2:

When population growth rate is based on arithmetic progression, it means that there is a constant amount of increase per unit of time in the population. But when population growth rate is based on geometric progression, it means that population is growing at a compounded rate.

Unit 3:

1. Sprague's Multipliers or Table of Coefficients is used to determine the population of a specific or single age group say age 6 or age 7 from the entire population of a country.
2. There are two ways through which the school age population can be obtained from an unknown age distribution – through international comparison and by using the imposition of the age structure of population projection developed by the United Nations.

Unit 4:

1. Gross level enrolment is the enrolment of all the pupils in a specific level irrespective of their age, while net level enrolment is the enrolment of the specific age group that are enrolled in a specific level.
2. Gross Enrolment ratio

$$= \frac{38{,}000}{160{,}000} \times \frac{100}{1}$$

$= 23.8\%$

Net Enrolment ratio

$$= \frac{25{,}000}{65{,}000} \times \frac{100}{1}$$

$= 38.5\%$

Unit 5:

1. Progression ratio indicates the movement of pupils/students from one grade level to the next grade level with the school system.

   Sex ratio indicates the development of female enrolment in school as compared with the male enrolment.

   Non-schooling rate is the percentage difference between those who are in school and those that are supposed to be in school who are not within a specific age group.

2. JSS1 in 2002 enrolment = 185,000
   JSS2 in 2003 enrolment = 165,000

   Progression rate $= \frac{165,000}{185,000} \times \frac{100}{1}$

   $= 89.2$

Unit 6:

Exercise 1

1. The three parameters for intra flow analysis are promotion rate, repetition rate and dropout rate.

2. Enrolment of primary 1 in 2004 = 500
   Number of pupils promoted to primary 2 in 2005 = 470

   Promotion rate $= \frac{470}{500}$

   $= 0.94$

Exercise 2

Repetition rate is the expression of the rate of a number of students repeating a given grade in year t + 1.

Dropout rate is the expression of the rate at which a given number of students dropped out of a particular grade in year t + 1.

Unit 7:

Exercise 1

Internal efficiency shows the extent to which the resources available to educational system are optimally utilised to achieve immediate objectives of the school. But external efficiency shows the extent to which the educational system meets the set educational goals and objectives.

Exercise 2

The inputs of educational system are the teachers and non-teachers, the students and physical resources.

The inputs are the resources used up in the process of producing finished goods, in this instance, the students. But outputs are the finished goods (graduates).

Unit 8:

Exercise 1

1. Progression ratio is the rate at which students' progress from one grade to the other within a level of education, while standard progression ratio is the average of the progression ratios for all the grades and over some years.
2. The ratios in A, B, C and D show inefficiency in the school system. But the level of inefficiency varies. The ratio in D indicates a very high level of wastage. It could be said that 83% of the total money spent was a waste. The wastage ratio in B is equally high, but for A and C the inefficiency level is minimal and could be tolerated since there is no system with perfect internal efficiency.

Exercise 2

1. The following procedure could be adopted in costing educational wastage: obtain the data of student graduates, the actual input-output, the student year under ideal situation, the annual unit cost, cost per unit of output, cost of graduate in an ideal situation and finally determine the cost of wastage by subtracting the ideal situation cost from actual situation cost.
2. Wastage in education could also be reduced by providing adequate teaching and learning facilities in schools, adequate teachers' motivation and through proper monitoring of school activities by the designated education officials.

Module 3

Unit 1:

Exercise 1

2006 = 120,000 = E_o

2008 = 140,000 = E_n

n = 2

r = ?

2011 = ?

Growth rate = $\text{Antilog}\left(\frac{\log\left(\frac{140,000}{120,000}\right)}{2}\right) - 1$

= $\text{Antilog}\left(\frac{\log 1.2}{2}\right) - 1$

= Antilog (0.0396) – 1

= 1.0955 – 1

= 0.0955 $\cong$ 0.10 or 10%

2011 enrolment projection

$En_t = E_o(1 + r)^n$

E_o = 2008

E_n = projected enrolment
n = 2
r = 0.10
t = 2011
by substitution:

$= 140{,}000(1+0.10)^2$
$= 140{,}000\ (1.1)^2$
$= 140{,}000 \times 1.21$
$= 169{,}400$

In year 2011, projected student enrolment would be 169,400.

Exercise 2

1. The following steps could be adopted: project the school going age from the population (given or estimated); find the admission rate for the existing years, and calculate the promotion, repetition and dropout rates for all the classes.
2. The importance of enrolment forecast to facility planning in the school system is that it would help educational planners to determine the amount of facilities required that would be adequate for the system.

Unit 2:

Exercise 1

1. The factors of attrition to teaching stock in the educational system are withdrawal o f service, resignation, dismissal, death and retirement.
2. Number of teachers in the state

$= \frac{250{,}000}{45}$

$= 5{,}555.5 \cong$ 5,556 teachers would be required.

Exercise 2

1. The techniques for manpower projection include employers' option method, incremental labour-output ratio method, density ratio method, international comparison method and Parne's Mediterranean regional project approach.
2. The necessary data required for manpower projection are: population census by sex, age, level of training and education, and labour force.

Unit 3:

Exercise 1

The major determining factors of financial estimates in educational system are: the educational objectives, which guide planners in prioritising; the country's GNP/GDP which presents the economy buoyancy of a nation and thereby the higher its

percentage, the higher the amount of money that would be available for the country to spend; student enrolment, the size of student enrolment determines the required facilities that would be needed; teachers and non-teachers – the quality and number of staff in an educational system affects the total amount paid to service human resources; the curriculum of the school system determines the type, quality and number of resources needed for its operation and inflationary trend in a country influences the financial estimates in education.

Exercise 2

1. The types of cost in education are: real cost, institutional cost, household cost, social cost, fixed and variable cost, marginal cost and unit cost.
2. The factors to be manipulated in the process of cost reduction are: average class size – class size can be constantly regulated to prevent the need of building more classrooms, which constitute major cost in capital expenditure. Average cost of classroom construction – A moderate classroom type may be built in place of a sophisticated type of classroom design which will incur more cost. Student-teacher ratio – a reasonable manipulation of student-teacher ratio should be done, since the smaller the student-teacher ratio the more teachers and facilities that would be required. Teachers' salaries and allowances – to reduced teacher cost, less qualified teachers and young and less experience teachers should be recruited. But this must not be done to the detriment of the system. School size can be increased so as to enjoy a low unit cost. But care must be taken so as not to over stretch the available resources which might lead to deterioration in the system.