

Allama Iqbal Open University Islamabad

# **PROCESS OF EDUCATIONAL PLANNING-II**

**Code: 8231**

**Units: 1–9**



**Department of Educational Planning  
Policy Studies and Leadership  
Allama Iqbal Open University, Islamabad**

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## **PREFACE**

EPM-6560 entitled as “processes of educational planning – II” is one of the core course of M.A degree program in educational Planning and Management, offered by EPPSL department faculty of education AIOU Islamabad.

The purpose of this course is to introduce the students to the latest tools and techniques used in the process of educational planning and to enable them to develop feasible plans within the available resources and under various constraints. The material includes the following topics:

What are the applications of computer in educational planning and management? What and how different calculation, diagnostic and projection techniques used in educational planning? What is the process of collection, processing, storage and retrieval of educational statistic data?

This course was initially designed with the collaboration of UNESCO Regional Office Bangkok, which was continuously reorganized, reviewed and updated in order to suit the Pakistani situation for prospect educational planners in Pakistan who want to acquire more knowledge and skills for advancement in their profession.

The EPPSL Department of AIOU is extremely thankful to unit writers, revisers and reviewers of the course for providing valuable guidance. It is due to their collaborative efforts that we have been able to present this course in the existing form. We will welcome all suggestions for the improvement of the course.

**(Dr.Hamid Khan Niazi)**  
Chairman EPPSL

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## **OBJECTIVES OF THE COURSE**

Following are the objectives of the course. After studying the course, the students should be able to:-

1. Understand the effective application of computer in educational planning and management.
2. Carry out computations relating to educational facilities.
3. Diagnose the personnel situation, financial analysis and student flow analysis of the educational system.
4. Project recurrent and capital costs for different levels of education using the projection formula.
5. Understand various mathematical models and types of data requirement for Educational Planning.
6. Analyse different components of strategic planning and strategic management.
7. Understand different kinds of equipment used for processing, storage and retrieval of data for educational planning.

## **Unit – 1**

# **USE OF COMPUTER IN EDUCATIONAL PLANNING**

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## 1. INTRODUCTION

Planning process based upon certain fundamental concepts of rationality, foresight, universality, continuity, administrative capacity. In planning process appropriate alternative for the solution of problems faced are to be rationally selected keeping in view the best possible use of the available resources. It is based on the past experience, present situation and projections of the observed trends for the future. The programs and projects are developed in order to achieve the desired objectives. The planning process is an organic and cohesive whole embracing the totality of the national socio-economic development. Such integration is achieved through appropriate coordination of the process. A plan is essentially a set of guesses about the future. But since there is no formula for predicting the future, a development plan is made in the light of a general philosophy on how development takes place. The basic issue understands the behavior of the force that lead to development. Statistical, economic, and computing expertise is secondary. (W. Arthur Lewis)

E.L. Morphet while explaining planning is of the view that planning is not a process of speculating on probable developments and preparing a theoretical blueprint for meeting needs. Rather it is a process of attempting to determine appropriate goals and objectives, obtaining and analyzing pertinent information that will bring into focus present and emerging problems and needs, and obtaining agreement on steps and procedures that are designed to meet those needs so that the objectives can be obtained.

The process of planning is unlimited in time. There may occur variations in objectives and extent of activities but the process is ever on-going.

The under mentioned definition given The Inter-American Seminar on Planning for Education, Washington D.C is best suited to the process of planning in Pakistan.

“Educational planning is a continuous, systematic process, involving the application and coordination of social research methods, and principles and techniques of education, administration, economics and finance, with the participation and support of general public, with definite aims and in well-defined stages, and to providing every one with an opportunity of developing his/her potentialities and making the most effective contributions to the social, cultural and economic development of the country”.

Educational planning involves willingness to size up the situation, to measure the country's capacity to respond to that situation, and to prescribe the action to be taken. It necessarily implies a global approach. It brings to light shortcomings and needs that hitherto had been ignored or were unknown. By placing these in proper perspective, it ensures a balanced distribution of efforts and resources for action. (Zaki, 1988).

## **2. OBJECTIVES**

When you have intensively gone through this unit, you should be able to:

1. Analysis the stages of the educational planning process, with reference to application of computer.
2. Understand the effective application of computer in educational planning.
3. Explain the advantages of computers in educational planning.
4. Understand the significance of management information system in educational planning.

### 3. COMPONENTS OF EDUCATIONAL PLANNING

Educational planning aims at creating an adequate future situation. In practice this means that the planner takes a series of steps:

- a) The planner analyses the present situation, tries to find out where this may be inadequate, studies the present trends development and forecasts the future situation during a number of years.
- b) The planner fixes targets for the future development in various fields and compares the forecast “natural” development with the development that would be necessary to reach the targets of the plan.
- c) If the present situations and the forecast future one are unsatisfactory, which is very often the case; he/she suggests means of arriving at the targets.
- d) The planner studies the real development during the period of the plan till the target date and compares it with the development that would be necessary in order to reach the targets; if the former turns out to be unsatisfactory, new and more efficient steps are suggested.

The plan is meant to allow the system to meet needs. In all educational planning it must be realized that the needs for education must always be the guideline. These needs are many and varied, and conflicts are likely to appear between them. In addition to the societal needs for educated manpower, there are such needs for people who know society and the cultural situation, and the individuals have needs for an education that secures them jobs, makes them understand society and the culture and fills their leisure time with new horizons. No educational plan can be considered complete unless it is based on studies of needs of various kinds.

#### **Planning As Integrated Approach:**

Planning calls for an integrated approach. The educational process is involved as new curricula are introduced, new materials and new equipments used, new teaching methods applied, and so on. Administrative steps must evidently be taken. As the educational system costs money and as the planner must necessarily see to it that expenditures stay within the limits of the available resources, economic factors enter. This is rather self-evident, of course, but less so is the fact that ways must often be found of going outside the educational system in order to affect the total social situation of the child. Sociological and psychological considerations therefore enter into the plan.

Planning is continues process. Student entering into the field of educational planning often think that a five-year or ten-year plan is drawn up and applied for a fixed number of years without changes. Then a new plan is created and applied for a fixed number of years, and so on. This is not a correct idea. In the first place plans of different durations overlap; the same country may have a long-range plan for the next 10 or 20 years, a medium-range one for perhaps 5 years, and a short-range one for the next year or so. Secondly planning is never finished. A plan is drawn up for a number of years, but it can only be regarded as tentative. Before the beginning of its execution and during it, things happen: new statistical information appears. Curriculum studies and other educational

work is carried out, new laws come into effect, the whole situation changes, and so on. This means that to a considerable extent the whole situation changes and the plan must take this into consideration. It must therefore be continuously revised when new data or new facts appear.

Educational planning is a cohesive force that coordinates and directs the many different components of an education system and ensures that widely accepted long-term goals are approached more objectively. It implies a realistic appraisal of the country's financial means, its human resources, institutional structure, and other factors bearing upon the success of an educational plan. Educational planning is an instrument of channel all knowledge about education and related disciplines into the preparation and implementation of long-term and short-term development plans.

### **1. Planning Process:**

The planning process starts out from policy statements which are also referred to as goals and aims. These are guides to decision-making. The policy is reflected in the objectives which are broad outlines of tasks to be accomplished. The objectives are specific, testable and, in some cases, measurable. The strategies are optional means or methods of achieving the objectives. There are of course people who would like to go straight to the strategies making like to straight to the strategies making them comprehensive enough to cover aims and objectives as well. You will study about policies of Pakistan in the course title Development Education I and II in detail.

#### **a) Pre-planning:**

The principle task in the pre-planning stage is formulation of educational objectives and their approval by the appropriate authorities. The next steps would be:

- Determining planning procedures
- Creation of administrative machinery
- Collection and analysis of relevant statistical data.

#### **b) Planning:**

The second stage in the process in planning

The main steps in the stage are:

- i. Diagnosis:** ascertaining the adequacy of current educational programs and facilities. The purpose is to identify weaknesses and shortfalls in nature, magnitude, quality, and level of achievement of educational objectives. In particular, the diagnosis is based on the criteria of:
  - relevance to social aspirations;
  - effectiveness in achieving national objectives; and
  - efficiency in the use of resources
- ii. Policy;** the diagnosis of the existing would reveal deficiency which need to be removed with a view to enhancing relevance, effectiveness and efficiency.

Such a corrective action has to be based on the national educational policy spelled out by the computer authorities.

- iii. **Cost:** costing of future needs is the next step. It would help determine the magnitude of financial outlay which should be available if the determined needs are to be satisfied.
- iv. **Targets:** by extrapolating data pertaining to past trends, the educational planner sets targets and establishes priorities, of course, keeping in view the resources likely to become available in the future. He also examines alternative means of achieving the objectives.
- v. **Feasibility:** the targets may be set according to the identifiable needs and the priorities assigned to them. But they have to be subjected to feasibility testing to ensure their consistency and achievability.

**c) Plan Formulation:**

It is the preparation of brief, succinct but adequate statements for the purpose of:

- i. Enabling the appropriate national authorities to make decisions and approve the program; and
- ii. Providing a blue-print for action and implementation.

**d) Plan elaboration:**

Before an educational plan can be implemented, it has to be elaborated so as to clearly identify individual action units. The process of elaboration passes through:

- i. **Programming:** it divides the plan into broad action areas each of which aims at accomplishing a specific objective.  
A program comprises activities usually supervised by the same administrative unit.
- ii. **Project formulation:** a project aims at achieving specific sub-objectives within the main objectives of the program. Project formulation is the working out the details of costs, time schedule, etc. for various activities to be launched.

**e) Plan implementation:**

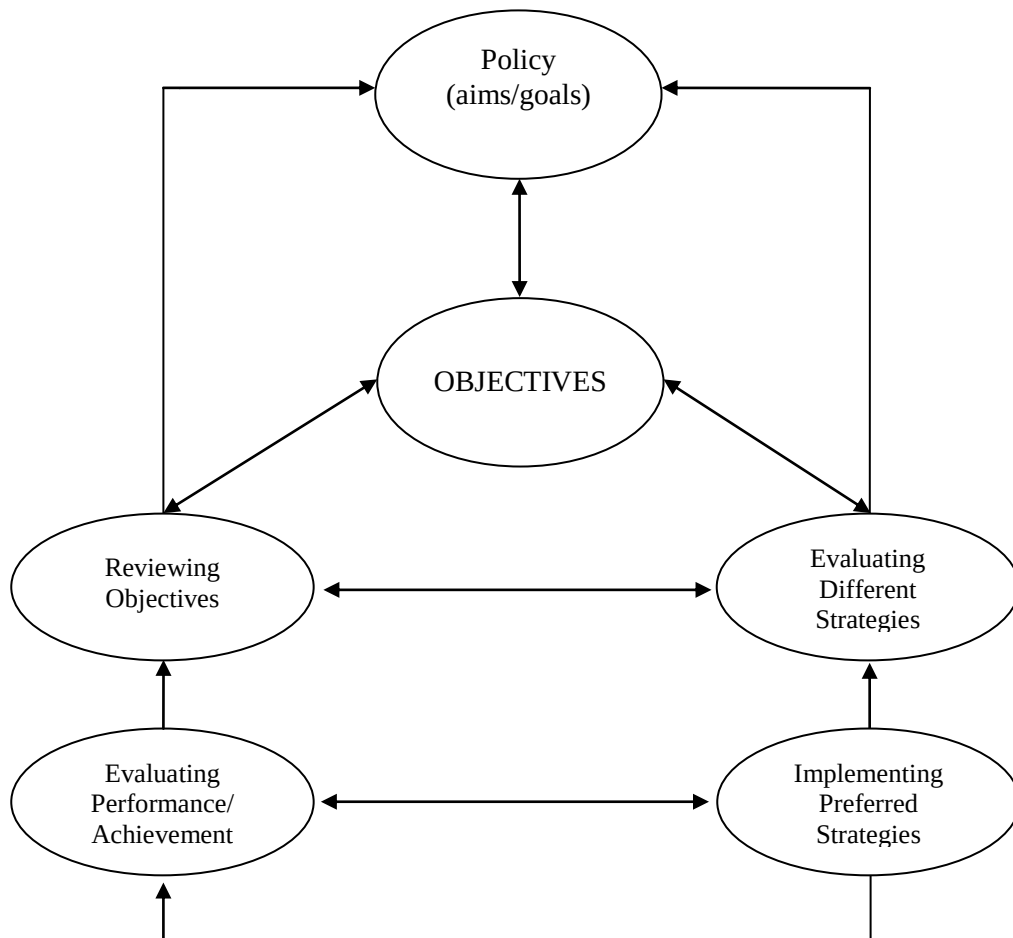
It is taking up of individual projects for execution. Here the planning process merges with the management process. Based on the annual budget, an organizational framework is developed for the various projects. The resources (men, money and materials) are mobilized to implement the projects of the plan.

**f) Evaluation:**

During the implementation of the plan, constant evaluation of the rate of progress and detection of deviations continues. This evaluation highlights weaknesses in the plan (e.g. unrealistic targets, inadequate financial provisions, improper phasing) and throws up matters for necessary revisions. It thus provides the basis for re-planning.

In the planning process of Pakistan to some extent following model is followed.

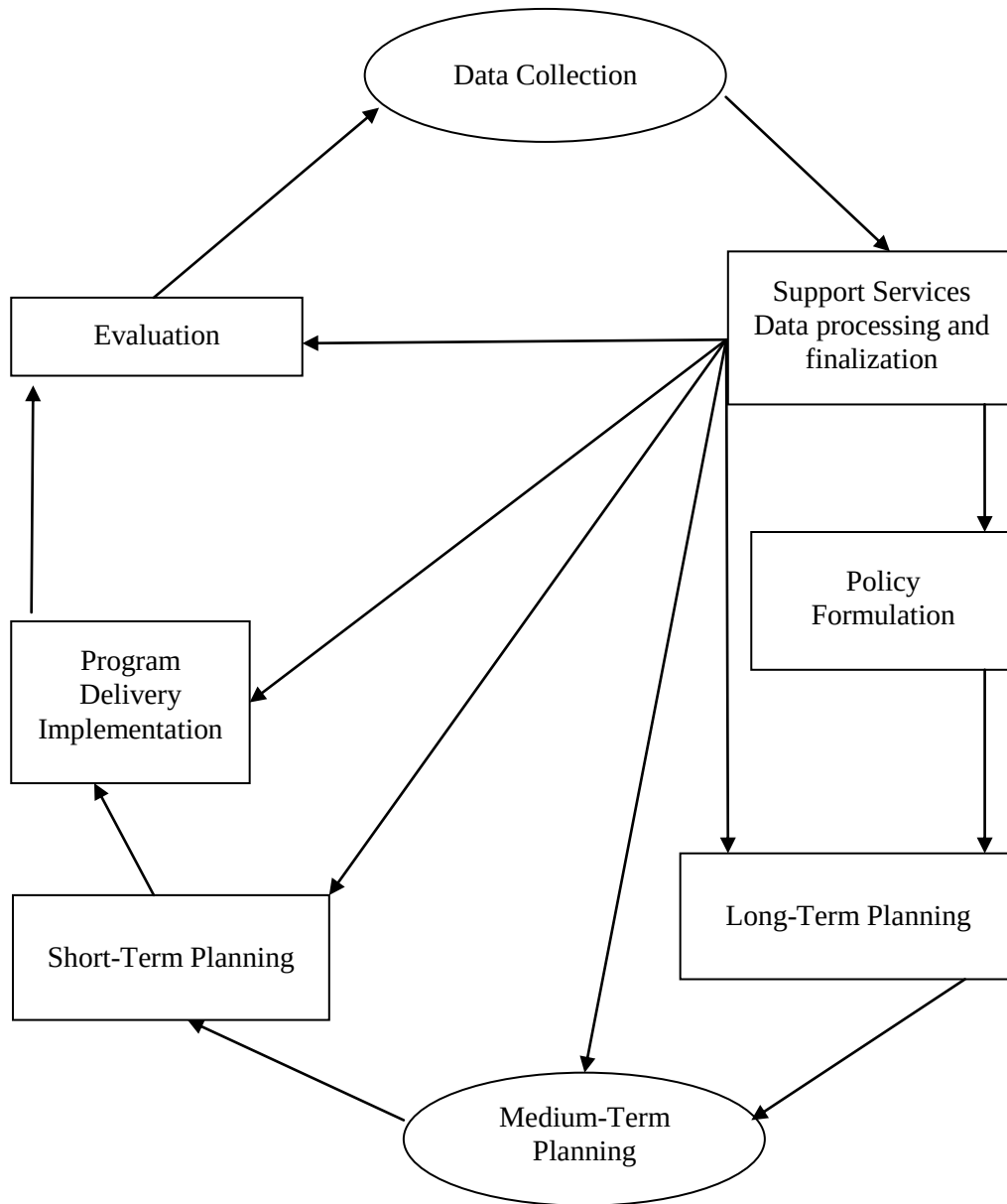
**PLANNING PROCESS:**



*Source: Educational Planning, Zaki, 1988*

The under mentioned illustration given a picture of data and information being processed in educational planning.

**USE OF DATA AND INFORMATION IN EDUCATIONAL PLANNING:**



Source: Educansult: Approach to strategic planning and coordination:  
Toronto; ministry of education. 1980

The diagram represents the sequence of steps involved in the planning process. In planning, three main functions must be performed:

- i) Decision making
- ii) Technical preparation of the plan; and
- iii) Implementation and control.

The **decision-making** is the determination of the main goals of the educational system. Usually this function is performed by the highest government authorities.

To achieve the goal decided on, the educational system needs certain in-puts teachers, buildings, equipment. In the technical preparation of the plan, the quality and quantity of inputs required are estimated and estimate is made as to whether these inputs will be available. If they are available, the planners can proceed to more detailed planning. Such planning will include not only estimates of quantities of inputs needed to reach the goals but also a timetable showing when the inputs need to be available.

In the **implementation** of plan, the steps needed to attain the goals are taken and **control** is exercised in order to ensure that the necessary execution of the plan takes place. This operation is carried out by the administrative machinery of the country.

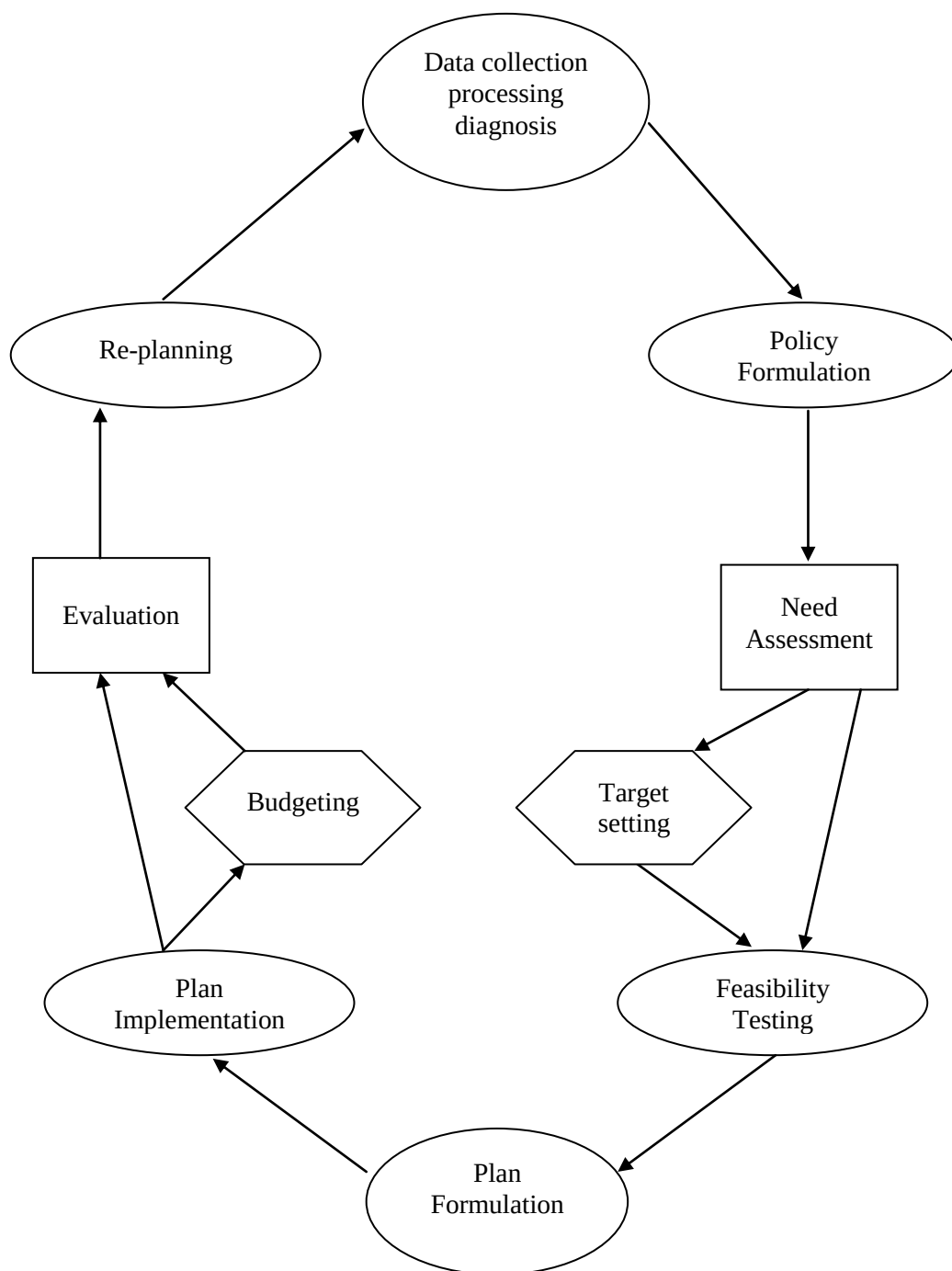
The educational plan implementation involves three major sub-plans:

- a) Facilities plan
- b) Equipment plan; and
- c) Staff plan

Educational planning comprises a series of complex and interlocking activities. The duration of an educational plan may be:

- a) Long-term or perspective extending over 10 to 20 years or even more. Education is a social activity whose result becomes measurable after a considerably long time. A long-term or perspective plan marks out and pinpoints the major highlights and landmarks over a considerable time span-sometimes decades.
- b) Medium-term plan usually covers 4-5 years and is prepared against the back-drop of a long-term perspective plan. It defined the goals and targets with greater clarity and provides for a definite basis for action.
- c) Short-term planning is adopted generally as an inevitable alternative to medium-term planning on an emergency basis. In short-term planning, we are not concerned with setting goals. We assume that the goals have been set already and our task is to draw up plans that the goals have been set already and our task is to draw up plans that will enable us to reach these goals have been set already and our task is to draw up plans that will enable us to reach these goals. We also assume that the short –term future will continue into the future. Trends are extrapolated into the future. The adoption of rolling plans eliminates the need for short-term planning.

Single –purpose planning is an operation which is usually adopted when a particular limited objectives, like building a medical college, is to be achieved.



Source: Gurgue. A.W.P, *An introduction to educational planning Process*.  
Paris; UNESCO, 1985

As technology continues to evolve, an increasing number of time-saving conveniences become available. The modern computer is one such tool. When combined with the Internet, it presents an efficient means to conduct research, compile information and communicate with people and institutions all over the world. Educational planning especially benefits from computer use for the purpose of locating and comparing schools, as well as requesting additional information and connecting with people and professionals of similar interests.

#### **4. ADVANTAGES OF USE OF COMPUTERS IN EDUCATIONAL PLANNING**

The advantages of computer-based educational planning are as follows:

- (i) Very large data can be stored in the computer for processing and getting useful information for a good planning and decision-making.
- (ii) The processing time of the data is greatly reduced.
- (iii) Accuracy of information processing is significantly improved for better planning, thereby improving the quality of decision.
- (iv) Often statistical and operations research techniques like regression analysis for forecasting, linear programming for maximization of the objectives/goals or minimization of cost etc. are used in planning and decision-making. It is very difficult to build these models manually or even using calculators.
- (v) Use of computers can help to make these tasks much easier reducing a lot of valuable manpower and time.
- (vi) More confidential information can be maintained through use of computers than the usual manual file system thereby reducing the chances of leakage of classified information.
- (vii) As the information retrieval time and data processing time is greatly reduced, the ability of manager to take quick decisions improves significantly.
- (viii) Also, the tasks like preparation of a set of alternative solutions and the assessment of their feasibility through simulation techniques becomes easier with greater accuracy.
- (ix) The time spent on various decision-making activities is reduced to a minimum
- (x) Lot of data and information collected and processed can be stored in computer for future use, data manipulations, forecasting, and preparation of comparative statements for better planning and decision-making.

From the list of the above advantages of the use of computers, the following benefits can be attributed to the area of educational planning:

- (a) Planning for adequate number of schools, school facilities, finances, personnel (teaching and non-teaching staff), and curricula are continuous process involving thorough information. Forecasting student population for the coming years for say

secondary education in a particular school, district, state or at national level will help the planners of education to prepare better plans in establishing new schools, appointing teachers and other supported staff, mobilizing resources etc.

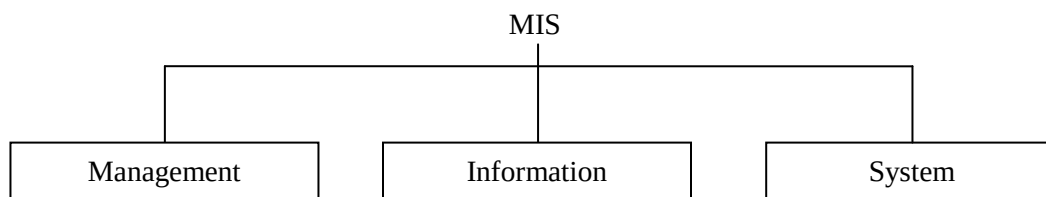
- (b) Based on the past data and new information and goals of an educational institution, one can easily prepare short term and long term projections for operational and strategic planning.
- (c) If the progress of a plan is not according to the anticipation the forecasts can be revised with new information and plan can be revised accordingly without looking much time and manpower.
- (d) The data about resources and its utilization can be processed through computers and useful information can be obtained for taking-wise decision on management of classrooms, buildings, and other activities of a school.
- (e) Monitoring of various educational programs based upon cost and benefit analysis can help the planners in planning for increases in educational productivity.

## **5. MANAGEMENT INFORMATION SYSTEM (MIS) AND EDUCATIONAL PLANNING**

MIS is an integrated man machine system for providing information to support the management operations and decision-making functions in an organization. The system utilizes computer hardware and software, manual procedures, management, decision models, and a database. A management information system is more than a technological development. It is related to the organization and human processes. A complete understanding of computer based organizational information systems includes an understanding of the concepts related to information, information use and information value. Information is very much a resource like labour, capital and land. It must be obtained, processed, stored, retrieved, manipulated, analyzed and distributed.

Despite the fact that computer is nothing more than a tool for processing data, many managers view it as the central element in an information system. This attitude tend to overate and distort the role of a computer. Its real role is to provide information for decision, for planning and controlling operations.

Following diagram is a mean to understand MIS and its three main elements.



MIS is a very highly organized combination of personnel, equipment and facilities performing data storage, retrieval, data processing, transmission and display, all in response to the needs of decision makers at all levels of management.

MIS as a system provides people with either data or information relating to an organization's operations. Management information systems support the activities of key people in the organization's environment. According to Gerald post, v. et al. (1997, p.6) "MIS consists of five related components: hardware, software, people, procedures, and collection of data."

In brief management information system is a fundamental requirement and requisite for effective planning and management. It is defined as a system, which provides each planner and manager with all information, that he needs in a form that aids his understanding and simulated action.

#### **A. Understanding MIS:**

Information processing is an institutional activity. Computers are widely used in information processing for not only in planning and decision-making activities of an organization but also in day-to-day administration because of their potential in handling large data in minimum possible time.

Davis and Olson defined MIS as "an integrated, user-machine system for providing information to support operations, management, and decision-making functions in an organization. The MIS can also be defined as computer based information process where Data/information is recorded, stored, processed, and retrieved for decisions regarding the managerial process of planning, organizing and controlling.

- MIS is any organized approach for obtaining relevant and timely information on which managerial decisions are based.
- MIS is integrated techniques for gathering relevant information for decision making by the planner and manager.
- MIS facilitate the decision making process and enable the organizational planning, controlling and operational functions to be carried out

#### **B. MIS Structure:**

The structure of MIS can be classified as:

- i. Operating Elements
- ii. Decision Support
- iii. Management Activity
- iv. Organizational Function

##### **i. Operating Elements:**

Operational elements for a MIS include:

- a) The physical components such as hardware (computer equipment), software (system software as well as application software), database, computer operating procedures, and computer operations personnel, and

- b) Processing functions such as data/information inputs, maintenance of master files, generating of reports etc.

**ii. Decision Support:**

The manager's decisions can be classified into programmed decisions, Non-programmed decisions and semi-programmed decisions. Programmed decisions are those in which the decision processes involve a pre-set well-defined procedure. These decisions are repetitive and routine which arise often and are capable of being modeled mathematically in their entirety. The decision procedure will also specify the information to be acquired before the decision rules as applied. One area of application of programmed decisions is inventory management decisions. Non-programmed decisions are those, which, do not occur frequently and cannot be handled with well defined, pre-specified procedure. The support requirements for non-programmed decisions are: access to data and a variety of data analyses for planning and decisions procedures that can be applied to the solution of the problem. Examples of this kind of decisions are marketing a new product, establishing a new school, introducing additional sections in a class or new subjects in a class etc. Semi-programmed decisions are those in which the decision process can be programmed and non-programmed. For example, the annual budget of a school can be prepared using a programmed decision process. When a comparison of the budget is made with the performance and significant deviations are observed then it may lead to non-programmed decisions.

**iii. Management Activity:**

MIS supports management activity. This means that the structure 'of an information system can be classified in terms of a hierarchy of management planning and control activities. Anthony (1965) has provided a framework, which distinguishes between different types of planning and control process that typically occur in organizations. Anthony defined the following categories of management planning and control:

- a) Strategic planning is the process of defining objectives of an organization, resources used to achieve these objectives, and policies to acquire, use, and disposition.
- b) Management control is the process by which managers acquire resources and use them effectively in achieving the objectives of an organization.
- c) Operational control is the process by which specific tasks are carried out effectively and efficiently.

**iv. Organizational Function:**

The structure of MIS can also be expressed in terms of the organizational functions which are informative. There is no standard classification of organizational functions, but a typical set of functions in a manufacturing organization includes production, sales and marketing, finance and accounting, logistics, personnel, and information systems. Top management can also be considered as a separate function. In a school some of the typical organizational functions could be

teaching, student admission and examination, student information, finance and accounts etc.

### **C. Levels of Information Handling:**

In a modern complex organization, the levels of information handling can be divided as decision support system (DSS), management information system (MIS), transaction processing system (TPS), and office automation system (OM). These levels of information handling as a pyramid structure. In some organizations there may be only three levels, namely DSS, MIS and TPS (where OM is merged with **TPS**) instead of four. At the top level managers may need DSS. Inputs for DSS can be some processed data, and mostly management-originated data. The DSS would involve queries and responses, operations research models, and simulation. The output from DSS would be special reports to resolve difficult questions and replies to management queries. At the middle management level MIS would deal with **an** organized set of procedures to provide information for middle level managers to support their operations and decision-making within the organization. At this level, inputs for MIS would be both processed and raw data and some management-originated data along with programmed models. The MIS process would involve report generation, data management, simple models and statistical analysis. The outputs from MIS would be filtered for some programmed decisions and replied to simple management queries. TPS is a computer-based system that would capture, classify, store, maintain, update, and retrieve simple transaction data for record keeping and for feeding MIS and DSS. The TPS is normally used at shop-floor management level. The inputs for TPS are the transaction data and the processing involves codification, and updating data. Outputs for TPS are the processed data and reports for programmed decisions.

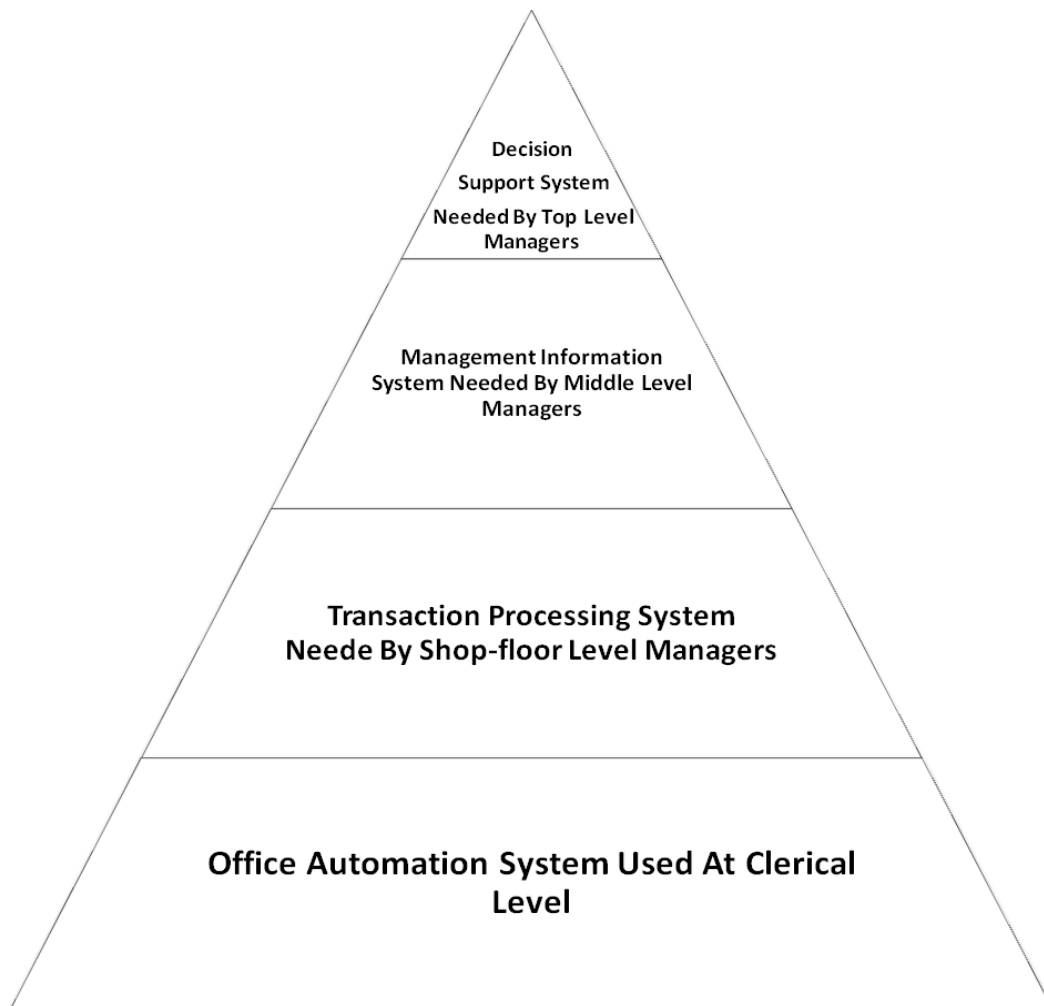
The OAS is used at the clerical level and it is a simple automated office having multiple functions. Inputs for OAS are appointments, documents, addresses etc. Here the processing involves word processing, data storage and retrieval. Outputs are schedules, memoranda, bulk mail, and administration reports.

### **D. Factors for Successful Implementation of MIS:**

In one organization a well designed MIS fails; while a similar but poorly designed MIS in another organization succeeds. The reason can usually be traced to human rather than technical.

A few factors that increase the chances of a successful implementation of MIS are:

- i. Involvement of top management in the computerization effort while defining the purpose and goals of computers with the organization.
- ii. Selection of an electronic data processing manager who has the skills to involve managers in choosing application areas, identifying information needs, and designing reports.
- iii. A computer staff which has interdisciplinary skills in computers, management, and operations research.
- iv. A balanced expenditure in hardware and software.



### **Levels of Information Handling**

Information has very important role in MIS and Planning as well. Different levels of information handling are given in the above illustration.

#### **E. Role of MIS in Educational Planning:**

##### **Information Needs for Planning in Education:**

**MIS** has been widely used in business organizations to accomplish a variety of tasks. However, the application of **MIS** in education particularly in developing countries is not popular. As seen in the earlier section, the computer based management information system can be used at different levels of management for planning and decision-making. The vertical relationship of information requirements to the different user levels of a school management.

Administration is shown in Figure. Although **MIS** could be used both in planning and administration of an educational organization, but this section covers here the role of **MIS** in educational planning only.

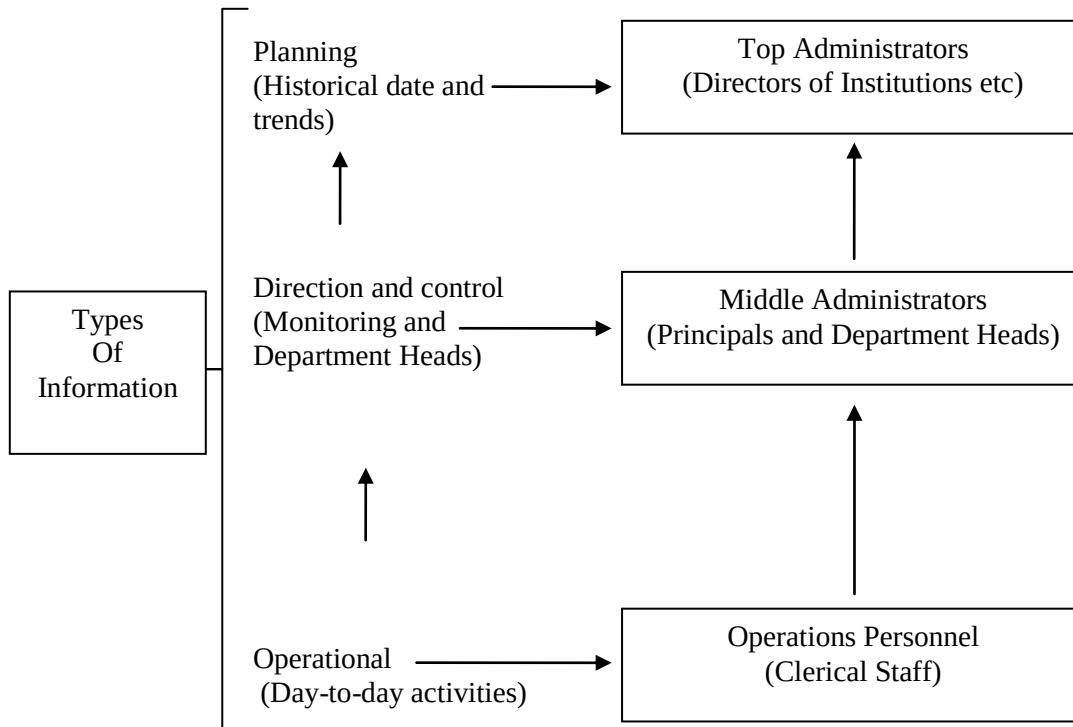


Figure. The vertical relationship of information needs to user on different educational administration levels.( adapted from Hussein, K.M.(1973), development of informational system for Education, prentice Hall, Englewood Cliffs, N.J.)

Operational information is the factual reporting of the current operations of the schools. The period of these reporting could be daily, weekly, monthly and/or annually. For example, data could be collected on student progress, attendance, grades, classroom usage etc. Though the operational persons (clerical staff) process the data at this level, middle level managers like principal and department heads use these processed data in the form of reports for planning, decision-making, and control of the school. The middle level managers use the operational information to compare desired performance with actual performance for better planning and decision-making. When exceptions are noted, remedial or corrective steps can be taken. For example, expenditure may exceed the budget and student grades may be different from expected. Analysis of data on these activities enables principals to have the facts necessary to plan and make necessary decisions.

Top administration of a school like, chairman/Directors need information to study objectives, make projections, assess the different activities of school, and prepare plans.

Planning of information is required to define objectives and establish strategies to achieve these objectives. Operational information and direction and control information are used to accomplish planning purposes. In addition it is necessary to collect information at district, state, and national level, for better planning, and attaining the objectives.

### **I. Information Flow and Planning:**

The interrelationship of the three information levels to the administration hierarchy and internal and external sources of information is shown in Figure.

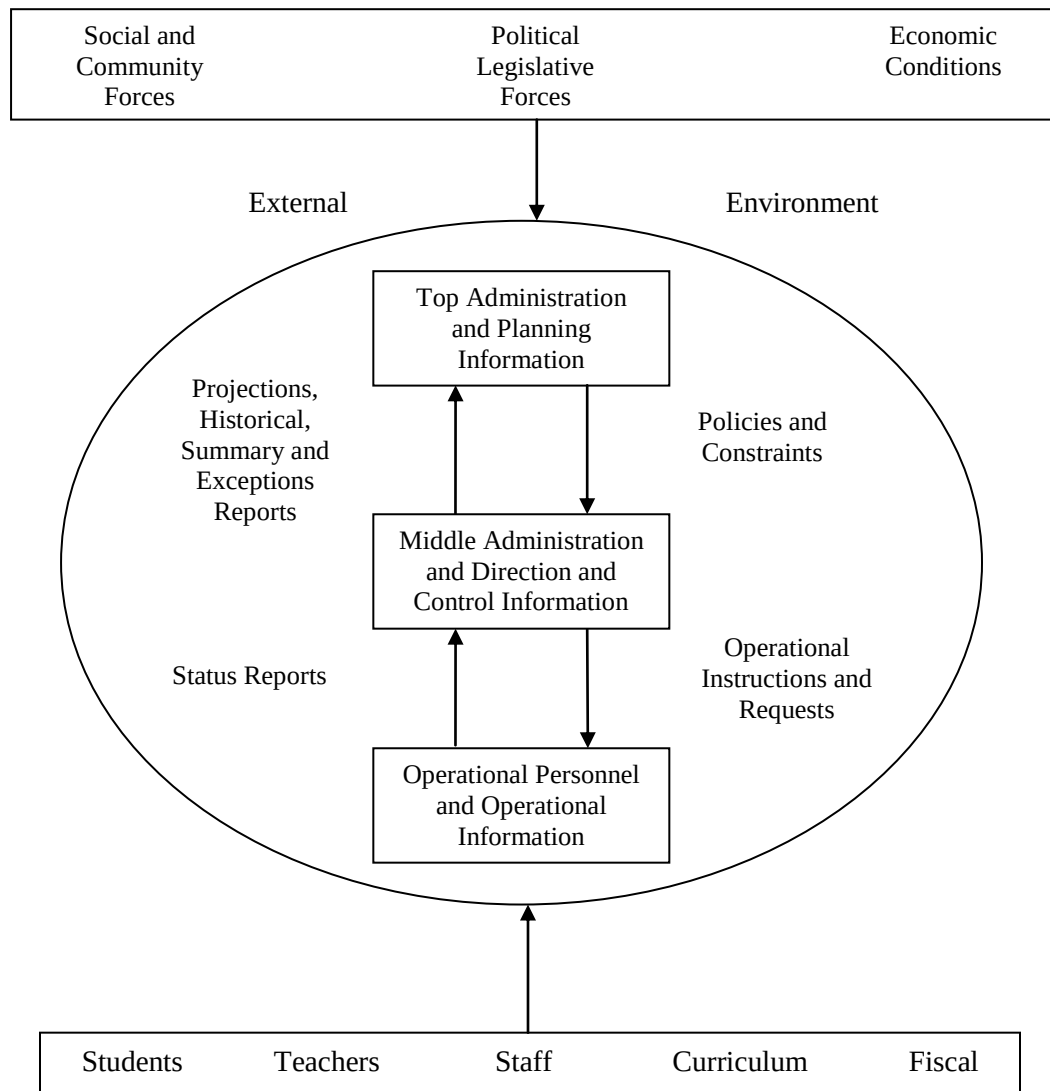


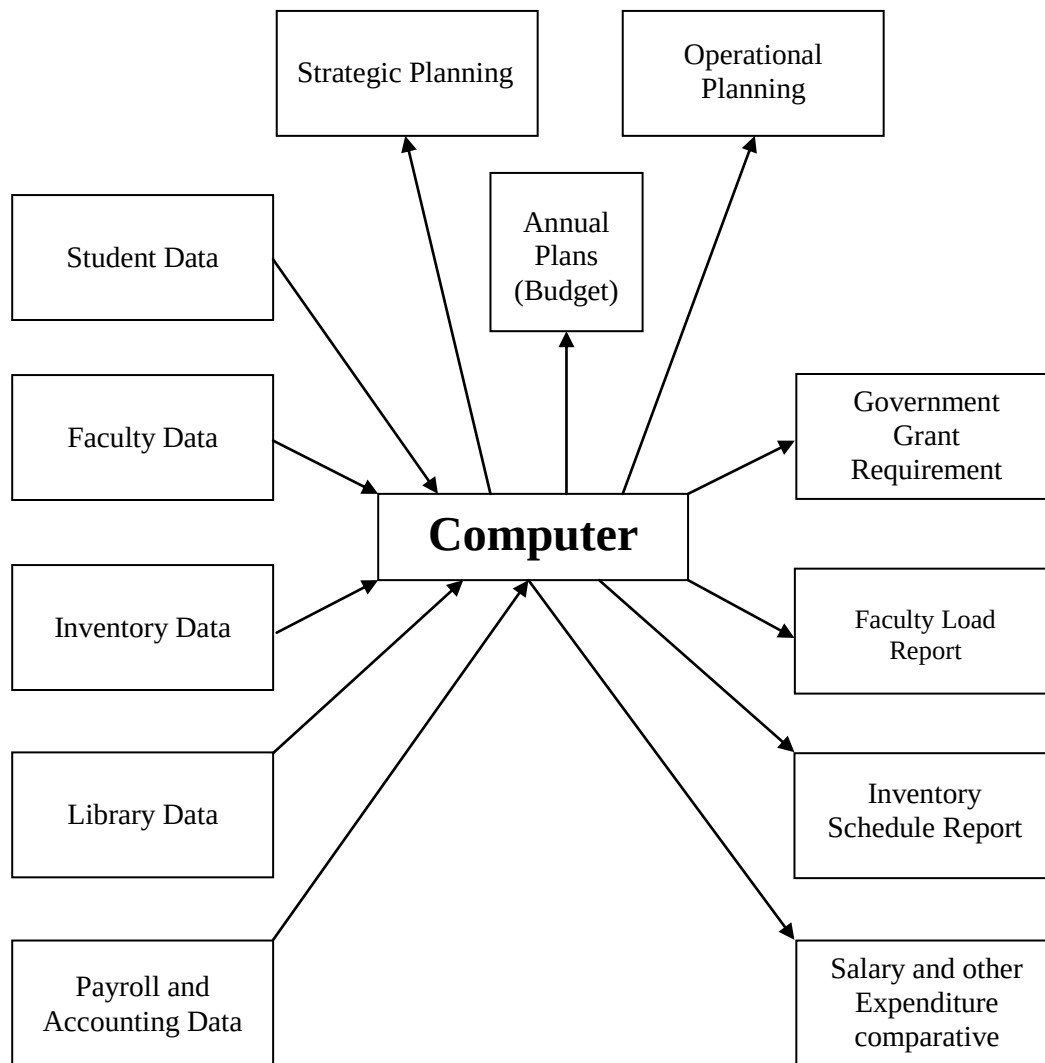
Figure. The vertical relationship of information needs to user on different school administration levels.( adapted from Hussein, K.M.(1973), development of informational system for Education, prentice Hall, Englewood Cliffs, N.J.)

It should be recognized that dependency exists between users and their information needs and the forces that impinge on organizations. Externally, social and community forces, political/legislative forces and economic conditions operate to influence management policy and planning. Social and community forces may be represented by pressure groups and concerned citizens who want either special concessions or changes in the education. Political/legislative forces operate to affect policy issues, budgets, and appropriations. Economic conditions such as recession and inflation erode budgets, with a resultant effect on the salary and funds for equipment and buildings. Internally, the information system compiles and processes data on students, teachers, staff, curriculum and sources of revenue. The decisions of management depend on the effectiveness of information system that produces quality data. If successful, internal organization needs can be met and effectiveness achieved in coping with external forces or conditions.

The computer based information system can be further divided into:

- (a) Student information data processing system and
- (b) Management information system.

The information on student attendance, academic performance, course schedule, etc. would be entered into the computer. Data files on grades, attendance, scheduling, and testing would subsequently be established. The review of the data by the management on historical day-to-day operations of the school would help in better planning and taking corrective decisions. The management may periodically compare actual performance with projected ones. When exceptions occur or things are out of line, the management would be better prepared to make needed decisions regarding corrective action. A functioning of MIS provides them with the information necessary to determine which of several alternative courses of action is best. It also may assist the management in determining which factors need to be controlled to facilitate better management or increase the productivity.



***Figure: Components of a Management Information System***

The components of educational management information system are shown in the above Figure.

Decision support system (DSS) utilizes projection and simulation procedures to predict trends and simulate the future state of educational based upon the assumptions and conditions furnished by management. To accomplish this, the DSS utilizes not only the output generated from the data processing systems and MIS, but relevant outside information. An effective DSS assists management in determining strategic plans and operational plans of the schools in the future.

To facilitate planning in the DSS, computer planning models might be developed. One type of such planning model could be forecasting model of student number based on historical data. A computer-planning model may not be either feasible or practical. It is for the management to decide whether such model would be useful.

## **6. INFORMATION NETWORK AND EDUCATIONAL PLANNING**

An information network is two or more computers linked together for the purpose of sharing data and information. As we have seen in earlier sections, data and information are vital components of any planning activity. Educational planning is no exception to this. Also, the MIS for planning requires not only data/information from within educational institutions but also from outside. Collecting, compiling, and processing outside institution data is tedious, time consuming and involves lot of expenditure. Therefore, information network help us to collect and process the data in quickest possible time with minimum cost which can be used in projections and simulations for better and effective planning.

Currently, several versions of information networks, namely Local Area Network (LAN), Wide Area Network (WAN), Internet, e-mail, and teleconferencing are widely used for information sharing. A LAN is so named because it usually consists of two or more computers linked in a network and housed in a building or in a small area.

LAN and the information available on one computer can be shared by the other except that if it is classified information. A WAN also consists of several computers linked to each other like LAN but the major difference is the geographical/institutional spread of the network. For example, the library information of several universities and other educational institutions are networked through a network and this facilitates the planners to optimize the scarce resources and buy only those expensive books that are not available in the sister libraries in the network. The internet is a network of networks. The evolution of internet transformed the entire information world into a global village. This has facilitated the planners to easy access to the data/information available outside his/her school, district, state, or nation for developing more accurate forecasting models and better planning in attaining educational objectives. Similarly, the data/information can be shared using e-mail cutting the time and cost constraints. Sometimes it may be necessary to discuss and deliberate online with experts and people involved in decision-making process who are away from the site of the decision-making.

Teleconferencing will be very helpful in such situations.

## **7. CONCLUSION**

This unit provides a brief account of the role of computers in educational planning. We have introduced to you various types of educational planning concepts and the process of educational planning to familiarize them for application in your school environment. We have also tried to list out various advantages of the use of computers for educational planning.

Establishment of information system is the key for any educational system for better planning, and efficient decision-making to run the system efficiently. Therefore, we have provided to you a brief account of the MIS structure, levels and factors for its successful implementation.

The structure and flow of computer processed information and its utility in educational planning and decision-making is also explained. The role of information networks in educational planning is also described in an effective way. Educational planners and school administrators need to be computer literate to promote the establishment of computer information system in the schools for better planning and decision-making.

## **8. EXERCISES**

1. Explain the interrelationship between three information levels of school administration for planning.
2. Explain the purpose of management information system. Give some of its applications in educational planning.
3. Computer processed information data provides the basic ingredient in planning and decision-making? Explain.
4. Discuss the advantages and disadvantages of computers in educational planning.
5. In what way information networks improve educational planning? Explain briefly.

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## **Unit – 2**

# **USE OF COMPUTER IN EDUCATIONAL MANAGEMENT**

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# 1. INTRODUCTION

In view of the new technologies of the information age, education is experiencing “a shift from formal, centralized and segmented operations to increasingly complex, decentralized and integrated levels of organization” (Uys, 2000). Expectedly administrative functions in schools (educational institutions) are becoming increasingly complex in terms of enrolments, population mobility and social problems.

This complexity required the use of powerful administrative tools resulting in better communications, efficient operations and better personnel (staff and students) services one of such tools is the computer. Computers, if properly programmed, could help educational managers take decision to ease the burden imposed by many administrative tasks.

Prof. H.A.Simon views the computer as the fourth great breakthrough in the history to aid man in his thinking process and decision-making ability. The first was the invention of writing which gave human beings a memory in performing mental tasks. The remaining two events prior to the computer were the devising of the Arabic number system with its zero and positional notation, and the invention of analytic geometry and calculus, which permitted the solution of complex problems in scientific theory. Now the electronic digital computers combine the advantages and attributes of all these break through and make them available for decision-making and management of organizations.

## **The computer:-**

Computer is programmable machine designed for the input of data and information. The computer may also be defined as an electronic device which accepts and process data by following a set of instructions (Programs) to produce accurate and efficient results at a high speed (Gbadeyan, 2005). The two principal characteristics of a computer according to webopedia (2002) are that it responds to a specific set of instructions in a well defined manners, and it can execute a pre-recorded list of instructions called a program.

The data management function of the computer is accomplished in three stages, namely input process and output. During input, data, which is a collection of new unprocessed facts, is fed into the computer. Process ensures the conversion of data into information, useful for decision-making, while output refers to the desired result obtained from the processed data (information) modern computer are electronic and digital. The actual machinery, wires, transistors and circuits is called hardware, which the instructions and data are called the software. Hardware components are the mechanical and electronic parts of computer system that are seen and touched. They include input devices, output devices, memory, mass storage devices and the central processing unit.

Input devices are usually a keyboard and a mouse which are the conduit through which data and instruction enter a computer, by procedures such as typing and copying files. Output devices include a display screen (monitor), printer or other devices that bring out

what the computer has accomplished, on screen on paper or disk. The memory enables a computer to store, at least temporary data and programs.

Mass storage devices include hard/disk drives and tape drives which allow computer to permanently retain large amounts of data. In addition to these fixed and permanent storage devices, removable storage devices such as diskette/floppy, disks, hard disks and compact disks (CD) flash devices exist which allow information to be saved and removed from the computer, which the central processing unit is the brain within the computer. The CPU/micro processor is mounted on the system board of the computer (the mother board). It is the component that actually executes instruction by controlling and manipulating all data within the computer.

The computer software is the non-physical aspect of the computer system. It is a series of simple computer instruction carefully organized to computer complex tasks. Software can divide into two namely the system software and applications software. System software is used by the computer itself to carry out its basic operations, which application software is designed and introduced into the computer by the user to perform specific tasks such applications include word processing application for typing documents such as Microsoft word and word perfect, graphic application such as CorelDraw and Instant Artist for graphic productions and Databank such as Dbase and Oracle for data analysis.

Computers have some performance characteristics which make them amenable and appropriate for management (decision making) these characteristics, according to Gbadeyan (2005) account for the supremacy of their functions over manual operations. These characteristics include accuracy/corrections, speed, consistency and repetitiveness. Other characteristics are automatic control, storage facilities and networking.

There are different types of computer generally classified by size and power. Computers can also be categorized into types by purpose, types by operations process and types by age of technology (Yusuf & Onasanya, undated).

These include microcomputers, Laptop, Notebook, Palmtop, workstations which are small single-user computers. Others are mini, mainframe and supers computers which are powerful multi-user computers for specialized application.

Computers are also classified on the basis of mode of operation as analog, digital and hybrid.

Analog computers represent data in continuous manners by converting physical raises to numbers; usually represent data in discrete or discontinuous manners using binary system. Hybrid computers combine the operations of both analog and digital computers and are applicable in solving problems of optimization and simulation in scientific environments.

## **2. OBJECTIVES**

When you have intensively gone through this unit, you should be able to:

1. Explain the advantages of computers in educational management.
2. Understand the significance of management information system, information system and decision support system in educational management.
3. Analyse the process of educational management.
4. Know the specialized soft educational management.
5. Suggest different measures towards effective application of computer in educational management.
6. Identify major components of a computer and computer system.
7. Have a broad idea about the important languages used in the computers.
8. Know the different software used in educational management.

### **3. EDUCATIONAL MANAGEMENT**

Management may be defined as a process designed to ensure the cooperation, participation, intervention and involvement of others in the effective achievement of determined educational objectives. Being a social process, it lays major emphasis on the interaction of people, both inside and outside the educational institution/organizations. To be called an educational manager is to be placed in a position from which one has to ensure change in other people's behavior patterns for the purpose of achieving the educational objective entrusted to him.

#### **3.1 Functions of Educational Management:**

Educational management, in a broader sense, describes the functions of planning, organizing, decision-making and control of education.

1. Planning
2. Organizing
3. Decision-making
4. Control

##### **1. Planning:**

Educational planning is the determination of overall educational objectives and the necessary policies, programs, procedures, and methods for attaining them. It includes executing action programs, reviewing, revising and reporting activities, measuring actual performance against objectives and coordinating interrelated plans and programs. In all this process computer play a very important role.

##### **2. Organizing:**

Educational organization include developing appropriate educational institutions and establishments and operation organizational life cycles, organizing human resources, implementing organizational change, establishing lines of authority, and monitoring organizational efficiency. It is the process by which an educational manager coordinates and directs personnel, materials, equipment, and other resources towards the accomplishment of the objectives. This function involves defining activities necessary for the fulfillment of pre-determined goals and delegating authority and responsibility.

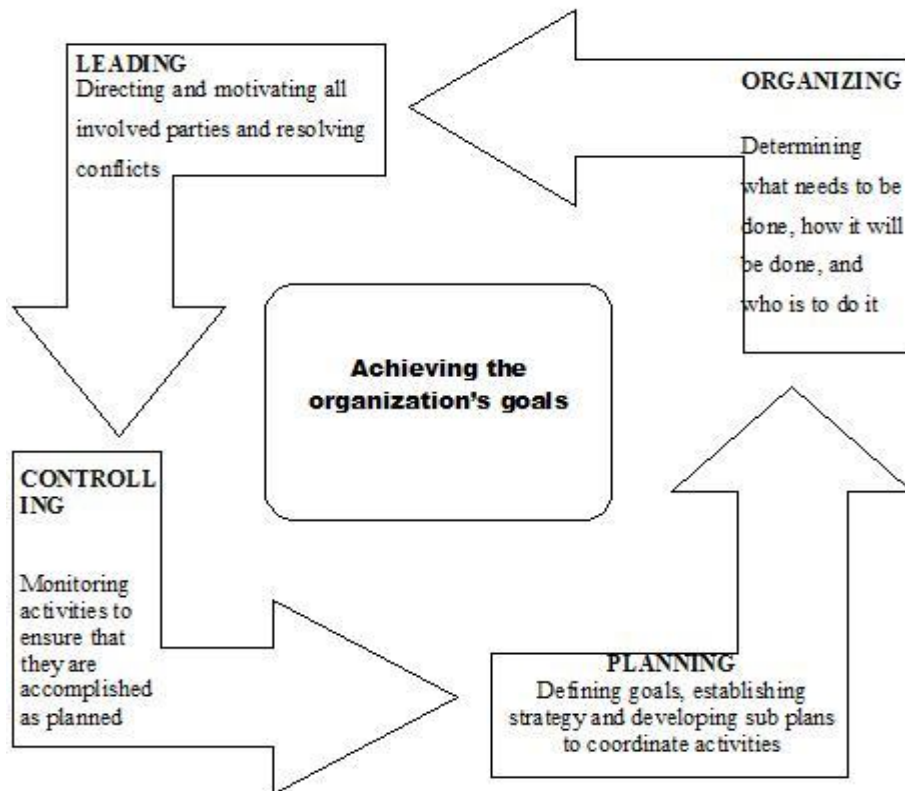
##### **3. Decision-making:**

Decision-making involve developing and improving and applying relevant skills. It also covers using appropriate techniques of problem solving and problem prevention. Further, it include group problem solving, implementing and communicating decision, and determining effects of decisions.

##### **4. Controlling:**

Controlling consists of verifying whether everything occurs in conformities with the plans adopted, instructions issued and principles established. Controlling ensures that

there is effective and efficient utilization of organizational resources so as to achieve the planned goals. Controlling measures the deviation of actual performances from the standard performance, discovers the causes of such deviations and helps in taking corrective actions. According to Breach, “controlling is a systematic exercise which is called as a process of checking actual performance against the standers or plans with a view to ensure adequate progress and also recording such experience as is gained as a contribution to possible future needs.”



### 3.2 Basic principles for Effective Management of Educational Institutions:

There are also basic principles that are essential for effective and efficient management of educational institutions and organizations. The institutions/organizations having efficient managements would reflect:

1. Operational plans clearly defined and communicated to those responsible for their implementation. The task would be simplified into elementary activities that could be systematically programmed and executed.
2. Specific tasks would be assigned to functional units that were readily comprehensible throughout the educational system. Formalized planning and scheduling procedures would be used to allocate personnel, materials, equipment, finances and other resources.

3. Hierarchy would be clearly defined to allow coordination of functional areas. Authority would be delegated based on assigned responsibilities.
4. Each level within an educational organization would be staffed with efficient and qualified personnel. Unity of command and common objectives would be pursued throughout the organization.
5. All resources used and production would be regularly recorded. Coordination and communication between different departments, institutions or organizational levels would be encouraged.

Flexible management of educational activities, programs and plans, and resources is necessary in order to allow educational institutions/organizations to adjust and coordinate continually to:

- The dynamics of the specific needs of the groups concerned;
- The priorities and urgencies of socio-economic development;
- The regional peculiarities;
- The pace of economic and social life; and
- The inevitable and unpredictable vicissitudes of life.

The education system, like any other system, has to operate within an increasingly uncertain and environment of the developing countries. This changing environment requires educational management to be able to assume different roles in order to adjust the system to the environment. The system must constantly adjust to changing needs, technological transformations, the appearance of new constraints on resources, and ever-changing priorities and urgencies due to evolving relations and conflicts between social groups. This is particularly true for the education system which is closely linked with the problems and stresses inherent in socio-economic development.

Managing an educational system requires one to try to strike a balance between the function of differentiating, coordinating and establishing a structure for the system.

- Differentiation is the function which allows the system to confront the uncertainty in the environment and to gather from it, in large amounts and frequently, the information it needs. That requires flexibility, i.e. the system's ability to adjust by assuming a great variety of states and by anticipating events.
- Establishment of a structure is the function which allows the system to avoid being choked or overwhelmed by too much information arriving at too great a speed. This requires a certain degree of control over information flows, using mechanisms or structures which operate as filters.
- Coordination is the function which deals with complexity in the environment. If the system has too much differentiation in a complex environment, there is a risk that the system's unity will be shattered. So differentiation must be offset and controlled by mechanisms that coordinate the parts of the system and thereby preserve its integrity.

### **3.3 Educational Organizations:**

Educational organizations refer to a group of individuals located in a specific place or institution whose purpose is to impart knowledge, skills and attitudes to students or pupils in order to achieve pre-determined educational objectives on goals. Such organizations include schools, colleges, training institutes and centers as well as universities.

## **4. MANAGEMENT FUNCTIONS**

The following specific areas have been identified by Grace Morlock as the management functions in educational institutions/organizations:

1. Strategic planning
2. Managing projects
3. Improving program quality
4. Program reviews
5. Needs assessment
6. Institutional assessment
7. Student outcomes
8. Planning and budgeting
9. Decision support systems
10. Education and industry
11. Resource allocation

## **5. APPLICATION OF COMPUTERS TO EDUCATIONAL MANAGEMENT**

Educational management, in a broader sense, describes the functions of planning, organizing, directing, controlling and staffing of education. If these functions of management are to be practiced in the context of the emerging global information or knowledge society then appropriate use of computers becomes mandatory. The administrative uses of microcomputers fall into following four broad categories.

1. Data Management
2. Data Analysis
3. Word Processing
4. Communications

Among the school records that can be stored and manipulated by microcomputers include student records, personnel records, financial records, inventories of school equipment and special management records such as transportation, food, service, energy management and sports program management, (Ellis, 1984).

Information device from these records could be used to take administrative decisions, towards achieving the set school goals.

In addition, microcomputers can be a potent tool in analyzing data. The analyzed data can be presented in various concise ways such as graphs and tables on which sound administrative decisions are taken.

Word processing programs enable administrators to compose, address, edit and produce written copy in wide variety of formats. These written reports form a very versatile tool for written communication.

Data and information communication is possible through the linkage of microcomputers with one another or with a mainframe computer. Messages can be sent and received through such applications such as e-mail.

Through the use of modem administrators can also send or receive information, via telephone lines, to and from another computer anywhere in the world. Therefore, the overall application of computers to management of education is in arriving at effective decisions towards achieving the goals of education. With computers, decision tables can be drawn to analyze problems, manage programs and arrive at effective solutions.

A decision involves making a selection from a set of alternative choices. Decision making is an integral part of management. In fact, decision making, according to Swann (1993), is synonymous with management. It is the dynamic element that activates and sustains the managerial process (Harrison, 1987). The decision making process relies on information about the alternatives. The quality of information in any decision situation determines to a very large extent the quality of decision made. There is thus the need for methods and techniques that assist in information processing at the various stages of the decision making process. The stages according to Donnelly Gibson and Ivancovich (1995) are:

**I. Problem Identification:**

This requires correct information otherwise the decision made are directed towards solving the wrong problems.

**II. Developing Alternatives:**

Once the problem is diagnosed and defined feasible alternatives (actually potential solutions) to the problem should be developed. This search process, according to Cowan (1991), investigates the relevant internal and external environments of the organization to provide the relevant information that can be developed into possible alternatives.

**III. Evaluating Alternatives:**

The developed alternatives are compared and evaluated, using the available information towards the set objectives.

**IV. Choosing an Alternative:**

The best alternative is chosen based on the gathered and analyzed information. The solution is facilitated by evaluating each choice on a set of criteria, which must be measurable.

## **V. Implementing the Decision:**

The chosen alternative is put in to use. Implementation often includes the allocation of funds and other resources.

## **VI. Control and Evaluation:**

After implementation, decision outcomes must be monitored and assessed, using the built-in information. Each of these stages required accurate and timely information to be analyzed in order to arrive at sound decisions. Computers, if programmed correctly, can make a lot of decisions without human intervention. Criterion outcomes of decision alternatives can be collected in a table called decision matrix or a decision table.

The International educational commissions, 1972 (learning to be) have rightly reported that in educational system and establishments computers are widely used for solving administrative problems such as; payment of salaries, control of funds, invoicing and accounting. They have been found useful in ongoing school transport networks with maximum efficiency, in solving complex problems of organization and in planning and building etc. Especially, when the volume of data involved is massive, computer can identify, evaluate, collect and classify information in all its complexity and detail and supply it when required. Moreover, there will be less chance of human error if tabulation of result is done through the computer.

# **6. SPECIALIZED SOFTWARE**

There are some specialized software of computer for taking decision on personnel, planning and administration. These software packages applicable in the management of education are described:

## **1. Office Management:**

Word processing, Database / use for prepare documents such as notices, letter, reports, students and personnel information.

### **Spread sheets:**

Stores and updates tables needed for budgeting projections and planning.

## **2. Instructional / Students Welfare Management:**

- a. Education Track Software:  
Scheduling, class registration and credit payment for college education.
- b. Z Track:  
Manages student discipline and welfare in educational institutions like, schools, colleges and universities.
- c. Modular Management System:  
Empowers different educational stake holders like, parents, educational institution, staff and students with online access to view and enter data on

student's biographical information, attendance scheduling grades, discipline, health and fee tracking e.g. ADM 2000 parent WEB, staff WEB and student WEB, financial system etc.

- d. Administrative Solution (3(AS3)  
Monitors, leads and advertise, enrolls and schedules students, track grades and attendance and finds jobs for students within career services.
- e. Grade minder:  
Authmates class grade recording and reports.
- f. Master scheduling system:  
Manages the academic scheduling process.
- g. Library edge:  
Catalogs all types of media, provides search modes and circulation features.

### **3. Personnel Management:**

- i. Job Plus TM:  
Develops job description, job performance and compensation evaluates employee performance.
- ii. HRM Plus TM:  
Develops and maintains applicant and employee data to efficiently recruit and hire employees and then manage employee data.

### **4. Financial Management:**

This includes different financial packages.

- i. Financial Packages:  
Prepare accounts, payable payroll and a general ledger.
- ii. (Win) Private Fund Manager:  
Provides a range of reports to assist school bursars manage school private funds.
- iii. Account Track:  
Provides accurate audit trial.

The ultimate use of computer in educational management is towards “networked educational management” (Uys, 2000). This stems from the on-going globalization brought about by the new information age. This globalization has resulted in “internetworked business, interworked government, internetworked learning and internetworked business, internetworked government, internetworked learning and internet worked health care”.

“(Tapscott, 1996, P. 55)

The resultant networked education, especially at the tertiary level, facilitates connectivity or networking or educational opportunities across the boundaries of space and time.

The proposed networked educational management has many dimensions, including networking, globalization, boundary orientation, computer mediation and being information-based (Uys, 2000).

The main issue in these dimensions in provision of adequate access to educational opportunities anywhere in the world access to internet is possible.

## **7. SUGGESTED MEASURES TOWARDS EFFECTIVE APPLICATION OF COMPUTER IN EDUCATIONAL MANAGEMENT**

The basic measure towards effective application of computer in educational management is computerization of schools at all levels of education. The three basic steps towards computerization of schools are:

- i. Deciding what tasks should be automated and in what order of priority after conducting a cost-benefit analysis for each task.
- ii. Identifying software that best automates these functions.
- iii. Identifying hardware that runs the selected software (Ellis 1994).

<http://doc.utwente.nl/26601/1visscher96information>

The tangible advantages of computer use in terms of efficiency and effectiveness have led to the wide utilization of computer technology for the operation and management of education. Information technology in education management is rapidly increasing in importance worldwide and is becoming an enterprise of importance in its own right, while one country may be further along than another in the status of computer application. Information, the added value of IT in comparison to manual modes of operation is recognized in many countries.

The term "Information systems" has become very popular it is not always clear what is meant by it. The concept can be used in a very broad sense referring to the information system of an organization which encompasses all formal and informal manual, computer-supported and verbal activities directed at collecting, distributing and processing all kinds of data within an organization.

The narrower and more current meaning points to computer assisted recording, processing and production of data.

In this context, various terms are being used, for example:

1. Information System
2. Management Information System
3. Decision-Support System

Visscher (1992, P-65) has offered the following working definition:

*“An information system (IS) is based on one or more computer, consisting of a database and one or more computer applications, enabling the user to record, process, retrieve, output and distribute data”.*

Since the technology forming the basis of information systems is developing continuously, the contents of the “information system” concept are also always under change.

An IS can provide depends on the number and type of computer applications included (e.g., student registration, financial planning, attendance registration, financial planning, educational evaluation). In some cases the applications are by nature registration in other the assistance the system can offer is more directed to the management of an institution.

## **8. COMPUTER AIDED MANAGEMENT INFORMATION SYSTEM**

Information is a broad term, which not only includes facts and figures related to a particular area but also includes specially selected or prepared materials related to a specific problem at a special time. Processed data, when presented in some useful form is called information.

Information is the life blood of an organization because without a proper flow of appropriate information, management is unable to make decisions on adequate grounds and control the undertaking.

### **8.1 Management Information:**

It comprises that data and information necessary for making management decision and is derived from such areas; market trend reports, sales analyses, cost benefit reports and so on. Some of this information comes from business information reports and some from research reports especially prepared for management purposes.

### **8.2 System:**

There are many definitions of what a system is; some are depending upon the nature of work. Some commonly used definitions are as under:

System is a set of procedures involving people, requirement and information that processes inputs (prime resources) to produce output.

A system is an organized assembly of interrelated and mutually dependent elements which together form a diagrammatic unit. System is a functional unit or a set of elements joined together for a common objective. A sub-system is a part of a larger system with which we are concerned.

### **8.3 Management Information System:**

Management Information system (MIS) can be defined, according to *Joel E. Ross*, as a communication process where in information (input) is recorded, stored, processed and retrieved for decisions (output) regarding the managerial process of planning, organizing and controlling.

A management information system can be formal system to provide all levels of management and supervision with all the relevant information required to make appropriate decisions for the total control of the organization.

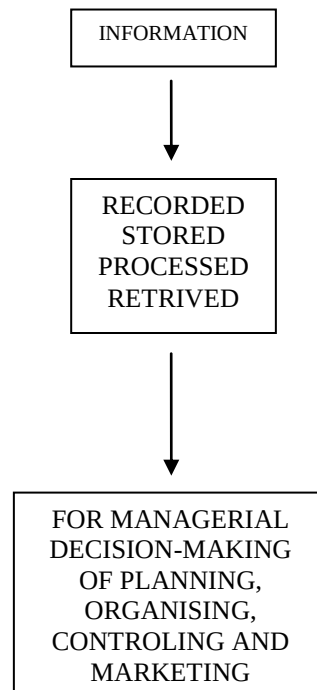
It will be seen from this definition that an information system is not concerned with how the information is processed but only with what it should produce and that the system should be formal. Nevertheless an efficient system is really possible only with the aid of computer, because of the need for comprehensive analysis and accuracy.

Information system constitutes a linkage channel between problem-solving and a data bank meant to store and supply information to people according to their needs. MIS aids the managers in making timely and informed discussions. Logical decision-making requires an understanding of the circumstances surrounding an issue and knowledge of the alternative available. Thus the more applicable and timely the information the better resulting decision.

It may be stressed here that terms MIS is not new, only its computerization is new. MIS existed long before the advent of computers because MIS techniques existed to supply administrators with the information. With the introduction of computer, new dimension have been added to MIS such as, speed, accuracy and increased volume of data by virtue of which a number of alternatives could be considered in a decision.

Since decision-making is the key element of management process, the purpose of MIS is to facilitate decisions necessary for planning, organizing, directing, coordinating and controlling the work of the department.

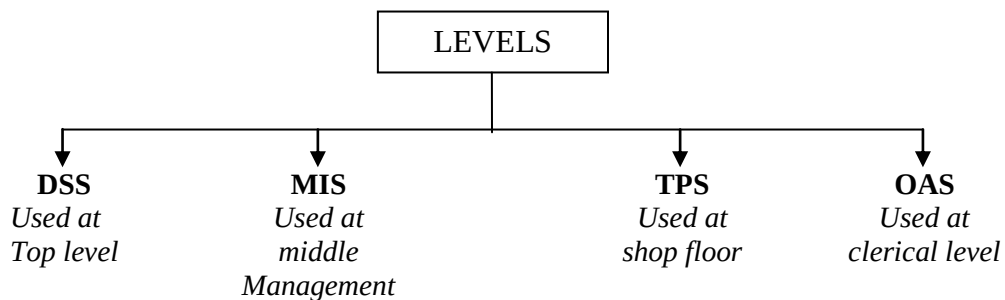
Computerized MIS cannot technically make a decision but it can yield processed data and follow instructions to the extent of its capacity. For example, the computer can be properly instructed to compare inventory levels with programmed decision-rules on re-order level and re-order quantity, and generate purchase requisition, purchase enquiry and purchase order. This can resemble an automatic control of purchase documents.



**Figure 1. Definition of MIS**

#### **8.4 Levels of Information Handling:**

There are four levels of computerized information handling. These are:



**Figure II: Level of Information Handling**

In the modern complex organization, the levels of information handling can be divided as decision support system, management information system, transaction processing system, and office(and other) automation system.

## **9. LEVELS OF MANAGEMENT**

### **1. Top Level of Management**

It consists of board of directors, chief executive or managing director. The top management is the ultimate source of authority and it manages goals and policies for an enterprise. It devotes more time on planning and coordinating functions.

The role of the top management can be summarized as follows -

- a. Top management lays down the objectives and broad policies of the Institutions
- b. It issues necessary instructions for preparation of department budgets, procedures, schedules etc.
- c. It prepares strategic plans & policies for the enterprise.
- d. It appoints the executive for middle level i.e. departmental managers.
- e. It controls & coordinates the activities of all the departments.
- f. It is also responsible for maintaining a contact with the outside world.
- g. It provides guidance and direction.
- h. The top management is also responsible towards the shareholders for the performance of the enterprise.

### **2. Middle Level of Management**

The branch managers and departmental managers constitute middle level. They are responsible to the top management for the functioning of their department. They devote more time to organizational and directional functions. In small organization, there is only one layer of middle level of management but in big enterprises, there may be senior and junior middle level management. Their role can be emphasized as -

- a. They execute the plans of the organization in accordance with the policies and directives of the top management.
- b. They make plans for the sub-units of the organization.
- c. They participate in employment & training of lower level management.
- d. They interpret and explain policies from top level management to lower level.
- e. They are responsible for coordinating the activities within the division or department.
- f. It also sends important reports and other important data to top level management.
- g. They evaluate performance of junior managers.
- h. They are also responsible for inspiring lower level managers towards better performance.

### **3. Lower Level of Management**

Lower level is also known as supervisory / operative level of management. It consists of supervisors, foreman, section officers, superintendent etc. According to *R.C. Davis*, "Supervisory management refers to those executives whose work has to be largely with personal oversight and direction of operative employees". In other words, they are concerned with direction and controlling function of management. Their activities include -

- a. Assigning of jobs and tasks to various workers.
- b. They guide and instruct workers for day to day activities.

- c. They are responsible for the quality as well as quantity of production.
- d. They are also entrusted with the responsibility of maintaining good relation in the organization.
- e. They communicate workers problems, suggestions, and recommendatory appeals etc to the higher level and higher level goals and objectives to the workers.
- f. They help to solve the grievances of the workers.
- g. They supervise & guide the sub-ordinates.
- h. They are responsible for providing training to the workers.
- i. They arrange necessary materials, machines, tools etc for getting the things done.
- j. They prepare periodical reports about the performance of the workers.
- k. They ensure discipline in the enterprise.
- l. They motivate workers.
- m. They are the image builders of the enterprise because they are in direct contact with the workers.

## **10. APPROACH TO COMPUTERIZATION**

The first important stage of organizing MIS at the corporate level is to build up comprehensive data-base from TPS for the clerical systems. Valid data should be initially classified and codes attached to each data-set. Thereafter data-based should be constantly updated. The analogy to a reference library system is almost uncanny, where books have to be classified according to the subjects. Thereafter the books need constant updating through cataloguing and indexing. A library, however, is not as amenable to easy cross-reference among a vast number of books, as a computerized data-base is. With classification, codification, and updating, a computerized data- base can help the user with almost instant retrieval of any amount of cross-classified and cross-revised data, thus helping tremendously the decision-making process.

The second important stage to MIS at corporate level is to decide on the principles of evaluating the raw data for decision-making. For this purpose, the four principles that can unhesitatingly recommend are: selection, pattern, linkage and overview. The first principle of selection looks at a screened segment of data which can focus attention on variances from standards, deviations from norms, fluctuations from targets and differences from budgets they are, to that extent, not required to be looked at any further. But whatever are not conforming to the steady state are worth looking at for decision-making purposes. The second principle of pattern is to look at the collections and forecasts. Essentially this is a principle of gaining insight into the given mass of data. The third principle of linkage is a way of looking at a number of widely dispersed data-sets and to formulate a coherent picture. The last principle of overview is to derive a total picture which cuts across a number of control parameters and sums up the managerial position.

The third stage of MIS is to realize the above four principles in actual practice. The first principle of selection can be implemented by generating expectation-based reports. This requires the safe-keeping of classified, codified and updated data on the computer and

retrieving only specially meaningful reports on the basis of expectation. The second principle of pattern can be implemented by using mathematical modeling and statistical analysis. Such analytical approach requires the data-sets to be treated with mathematical models and statistical methods in order to derive meaningful indicators for decision-making.

The third principle of linkage can be implemented by inter-relating different data-sets from disparate files or data-bases. The inter-relationships would provide again available insight across the board. The fourth principle of overview can be implemented by aggregating data. Such a process of aggregation can connect together the classified and codified data for purposes of deriving a managerial insight into the total span of operations.

### **10.1 Phases of Management Information System:**

In order to design and implement an efficient and effective “Management Information System” we must go phase by phase.

Following are major phases of MIS that must be kept in mind while designing and installing a system:

**a. Study Phase:**

- Identify the problem
- Define system performance
- Study alternate solutions
- Select and recommend feasible system

**b. Design Phase:**

- Identify functions to be performed and allocate them as manual, equipment or computer program tasks
- Prepare input/output designs
- specify system/component test requirement

**c. Development Phase:**

- Prepare implementation plan
- Acquire and install equipment
- Prepare computer program
- Train personnel (users)
- Complete system test

**d. Operational Phase:**

- Complete conversion
- Operate system
- Evaluate system performance
- Maintain system and manage changes

## **10.2 Requirement for a successful MIS**

There must be direction, involvement and commitment on the parts of those administrators who will use the system. People will accept and use their own creation must more readily than one imposed by outsiders.

The system must provide an early warning signal about any significant future events. Management must be aware of changes before or as they develop, while there is still time to take action that have some effect on these changes.

The system must be flexible and evolutionary. The number of locations of input stations, the data elements within files and the frequency and content of reports should be able to be changed as per requirements.

The system should produce meaningful results quickly. This usually means action reports on an interim basis or immediate responses to inquiries.

Data in the system must describe the external universe as well as the internal operations of the organization. Although some external data may not be placed in the computer, it should nevertheless be a part of the information that must be considered by management. It may be in their files, notes. Or merely in someone's head, but it is still part of the system.

Computer Resources must be collected, summarized, compared, and digested before it is useful for decision-making. The more of this process that can be done efficiently by computer, the better the execution.

If a management information system is such a logical combination of people and machines working for a common purpose, why have the higher flown plans and systems described in workshops, seminars, and conferences not been implemented? Why are the increasing number of computer installations being devoted almost entirely to routine MIS have spent on designing and programming efforts? Here are some of the reasons.

- i. Some managers are reluctant to undertake a project that seems formidable, with little chance of success. Unhappy experiences with extravagant promises by hardware or software suppliers have left many of them understandably cautious.
- ii. There has been a communication gap between management and data processing personnel. The computer jargon spoken by programmers and analysts has confused and discouraged potential users of MIS.
- iii. The information to be put into the system has been specified by analysts rather than by managers. In part, this situation has resulted from management's inability or reluctance to spell out what it wants.
- iv. Systems have been rigid and unresponsive to changing needs or to special requests for information.
- v. Attempts have been made to use the computer for some application that could better be done manually.

- vi. There has been a lack of standard names for data items, the same element of data is referred to by five different names in five different departments. This problem may be alleviated by developing a data dictionary, which gives such characteristics as:
  - (1) Length or size of the data.
  - (2) Type ( whether alphabetic, alphanumeric, or numeric)
  - (3) Minimum and maximum values the data can take.
  - (4) Source of the data
  - (5) Codes for all files in which the data element appears
  - (6) Editing pattern, if appropriate.
- vii. Users offer resistance, usually because they feel they have not been consulted or have not contributed to the development of the plan.
- viii. Costs often greatly exceed estimate. Cases have been reported where teams worked as long as four years on a MIS. Some users, accustomed to extensive manufacture support, have not dared or been able to develop their own systems.
- ix. While providing hardware and software, the manufacture often makes no promise of providing an operational MIS. Some users, accustomed to extensive manufacture support, have not dared or been able to develop their own systems.
- x. The increase in middle management personnel. This results in greater diffusion of management responsibility. Design of a MIS to meet the need of many levels of management becomes increasingly difficult and complex.
- xi. Some executives refuse to use terminals installed in their offices. They think that the operation of the keyboard is a 'clerical' job somewhat beneath their status and dignity. In other instances, they do not understand the routine obtaining or supplying information.
- xii. No system, however, well designed or supplied with be effective if people refuse to use it. Until the objections and problems just stated can be eliminated, there is little real hope for the development of full fledged management information system.

## **11. ADVANTAGE OF COMPUTER-BASED MANAGERIAL DECISION-MAKING**

The advantages associated with computer-based managerial decision-making can be the following:

- 1. Response time is greatly reduced;
- 2. Very large data are stored for information in decision making;
- 3. Accuracy of information is considerably improved, thereby improving the quality of the decision;
- 4. Problems are handled more easily by using various operation research models;
- 5. The cost involved in the decision-making process is reduced;
- 6. More secrecy is observed as compared to manual file system;
- 7. Ability to take quick decision improves considerably as the time for retrieval of information is very fast.

8. Paper work is reduced to the minimum as all the information is stored in the computer itself;
9. Lots of information are stored for future reference;
10. Chances of leakage of classified information are reduced;
11. Accuracy in manipulation is increased very much;
12. Time spent in various decision-making activities is reduced to minimum.
13. The availability of accurate forecasts within 1 percent of net income
14. The preparation of short-term profit plan and long-term projections
15. The provision of pre-plan information is budget preparation
16. The calculation of variances between budgeted and actual results
17. The triggering of revised forecasts if not proceeding in accordance with plans;
18. The indication of income and cash flow by following alternate investment strategies
19. The assistance to the planning of new facilities and a host of special strides; and
20. The accomplishment of the preceding items at a great speed.

## **12. USE OF COMPUTER IN DISTANCE EDUCATION**

In recent years, education have witnessed the rapid development of computer networks, dramatic improvements in the processing power of personal computers, and striking advances in magnetic storage technology. These developments have made the computer a dynamic force in distance education, providing a new and interactive means of overcoming time and distance to reach learners.

Computer applications for distance education fall into four broader categories.

- 1. Computer Assisted instruction(CAI):**  
Uses the computer as a self-contained teaching machine to present discrete lessons to achieve specific but limited educational objectives there are several CAI modes , including: drill and practice, tutorial, simulations and games. And problem-solving.
- 2. Computer Managed Instruction(CMI)**  
Uses the computer branching, storage, and retrieval capabilities to organize instruction and track students records and progress. The instruction need not be delivered via computer, although often CAI (the instructional component) is combined with CMI.
- 3. Computer Mediated Communication (CMC)**  
Describes computer application that facilitate communication. Examples include electronic mail, computer conferencing, and electronic bulletin boards.
- 4. Computer-Based Multimedia**  
HyperCard, hypermedia, and a still-developing generation of powerful, sophisticated, and flexible computing tools have gained the attention of distance

educators in recent years. The goal of computer based multimedia is to integrate various voice, video, and computer technologies into a single, easily accessible delivery system.

### **12.1 Advantages of Computers**

1. Computers can facilitate self-paced learning. In the CAI mode, for example, computers individualize learning, while giving immediate reinforcement and feedback.
2. Computers are a multimedia tool. With integrated graphic, print, audio, and video capabilities, computers can effectively link various technologies. Interactive video and CD-ROM technologies can be incorporated into computer based instructional units, lessons, and learning environments.
3. Computers are interactive. Microcomputer systems incorporating various software packages are extremely flexible and maximize learner control.
4. Computer technology is rapidly advancing. Innovations are constantly emerging, while related costs drop. By understanding their present needs and future technical requirements, the cost-conscious educator can effectively navigate the volatile computer hardware and software market.
5. Computers increase access. Local, regional, and national networks link resources and individuals, wherever they might be. In fact, many institutions now offer complete undergraduate and graduate programs relying almost exclusively on computer-based resources.

### **12.2 Limitations of Computer**

1. Computer networks are costly to develop. Although individual computers are relatively inexpensive and the computer hardware and software market is very competitive, it is still costly to develop instructional networks and purchase the system software to run them
2. The technology is changing rapidly. Computer technology evolves so quickly that the distant educator focused solely on innovation “not meeting tangible needs” will constantly change equipment in an effort to keep pace the “latest” technical advancements.
3. Widespread computer illiteracy still exists. While computers have been widely use since the 1960’s. There are many who do not have access to computes or computer networks.
4. Students must be highly motivated and proficient in computer operation before they can successfully function in a compute based distance learning environment.

### **12.3 The Internet and Distance Education:**

The internet is the largest, most powerful computer network in the world. It encompasses 1.3 million computers with internet addresses that are used by up to 30 million people in more than fifty countries. As more and more colleges, universities, schools, companies, and private citizens connect to the internet either through affiliations with regional not for profit networks or by subscribing to information services provided by for profit

companies, more possibilities are opened for distance educators to overcome time and distance to reach students.

With access to the internet, distance educators and their students can use:

1. **Electronic mail (e-mail)** – Like postal mail, e-mail is used to exchange messages or other information with people. Instead of being delivered by the postal services to a postal address e-mail is delivered by internet software through a computer network to a computer address.
2. **Bulletin boards-** Many bulletin boards can be accessed through the internet. Two common public bulletin boards on the internet are USENET and LISTSERV. USENET is a collection of thousands of topically organized newsgroups, covering everything from supercomputer design to bungee cord jumping, and ranging in distribution from the whole world to single institution. LISTSERV also provides discussion forums on a variety of topics broken out by topic or area of special interest.
3. **World-Wide Web (WWW)-** The WWW is an exciting and innovative front – end to the internet. Officially WWW is described as a "... Wide area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents" (Hughes, 1994). The WWW provides internet users with a uniform and convenient means of accessing the wide variety of resources (pictures, text, data, sound, video) available on the internet. Popular software interfaces, such as Mosaic and Netscape, facilitate navigation and use of the WWW. The central organizing feature of the WWW is the "home page" Every organization and even every individual user of the WWW can create a home page that contains whatever information they want to present. The hypertext capabilities of the WWW facilitate linking of information within your own home page and with all other home pages on the WWW.

#### **12.4 Instructional Possibilities of the Internet.**

Distance educators can use the internet and WWW to help students gain a basic understanding of how to navigate and take full advantage of the networked world into which they will be graduating. Some instructional possibilities of the internet include:

1. Using e-mail for informal one-to-one correspondence. Feedback from the instructor can be received more quickly than messages sent by mail. Students can read messages at their convenience and easily store them for later reference.
2. Establishing a classroom bulletin board. Distant students often work in isolation without the assistance and support of fellow students. Setting up a class bulletin board can encourage student-to student interaction. With a class computer conference, individual students can post their comments or questions to the class, and every other individual is free to respond. The conference can also be used to post all modifications to the class schedule or curriculum, assignments / tests and answers to assignments / tests.
3. Engaging students in dialogue with other students, faculty, and researchers by encouraging them to join a bulletin board(s) on topic(s) related to the class.

4. Developing a classroom home page. The home page can cover information about the class including the syllabus, exercise, literature references, and the instructor's biography. The instructor can also provide links to information on the WWW that would be useful to students in the class (e.g real research data on agricultural markets, global climate change, or space missions) other links could access library catalogs or each student's individual home page.

## **12.5 Teaching Considerations**

When incorporating the Internet into a distance delivered course, remember that:

1. All students in a course must have Internet and WWW access to ensure equal opportunities for computer interaction and feedback. Also, convenient access to a computer at home or work may influence student success.
  - Students may face the concurrent challenges of learning basic computer skills, new software, and appropriate online communication skills. Trouble-shooting students compute problems will probably become a part of normal instructional responsibilities. Setting up a specific classroom conference for ongoing discussions of specific hardware and software problems may help students to work through these problems on their own.
  - Some students might hesitate to contribute to computer conferences or to send e-mail because of a lack of familiarity with the proper protocols. Encourage students to use e-mail, classroom conferences, electronic bulletin boards, and the WWW early in the course so they overcome inhibitions. Specifying a minimum number of e-mail communications per week will encourage active participation.
  - Using e-mail can help the instructor provide feedback more quickly than surface mail or telephone. Prompt response generally increases student motivation and performance.
  - Prompt responses might not always be appropriate. Computer conferences can foster student-to-student interaction. To ensure that this interaction is sustained, work towards a facilitative role. It might be appropriate to delay response to a query in a classroom conference in order to allow students to respond to the issue and to each other.
2. Becoming familiar with the resources available on the Internet and the most effective ways to use them will be part of the instructional challenge. A number of helpful guides to the Internet and WWW are available (see Kochmer, 1995; Hughes, 1994).

### 13. CONCLUSION

Computer provides a number of benefits to the management of education, In educational management, decision making for the present and future is very crucial. For effective decisions, data and information must be accurate, timely and up-to-date. The computer has capabilities for information gathering, storage, processing, retrievals and communication. The capabilities are developed into various systems such as DSS, MIS, IS for effective planning and administration of education. All hands must be seen to be on deck towards computerization of schools towards globalization of education and networked educational management. This networked educational management would only be practicable with the provision of necessary computer infrastructure, computer training and appropriate database and internet connectivity.

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## **Unit – 3**

# **CALCULATION TECHNIQUES USED IN EDUCATIONAL PLANNING**

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## 1. INTRODUCTION

- 1.1 Once the quantitative data have been collected, through school census or sample and their exactness and consistency properly checked, we can move to the next stages of analysis and presentation of statistics. In the analysis of statistics several computational techniques are used. Through these techniques the statistician obtains, from the raw statistical data, useful indicators which describe level and trends of educational development.
- 1.2 Computational statistical techniques are applied to the raw statistical data. The purpose is to analyse the data and to derive indicators which are meaningful and lend themselves to immediate interpretation.

In this unit the following indicators and techniques will be discussed:-

1. Central Tendency
2. Dispersion
3. Range
4. Frequency distribution
5. Index Numbers
6. Rates and Ratios
7. Growth Rates
8. Extrapolation
9. Interpolation
10. Computations relating to Facilities

## **2. OBJECTIVES**

When you have gone through this unit, you should be able to:-

1. Understand different computational techniques for the analysis of statistics used for educational planning.
2. Differentiate between rates and ratios.
3. Carry out computations relating to educational facilities.

### 3. CENTRAL TENDENCY

- 3.1 Central tendency is an indicator which gives the average of a set of observation. Take a big primary school with 10 classes (five grades and 2 classes in each grade). The class-sizes are 48, 45, 36, 39, 37, 31, 25, 29, 21 and 26.

The class-size is an important variable that has to be taken into account for decisions regarding size of classroom, furniture, teaching methods, etc. If the decision-maker has to use 10 different class-sizes he will never be able to come to a decision. He has to look for an indicator which in one figure combines the information of the 10 class-sizes.

This indicator can be calculated by either finding out the Arithmetic Mean or Median of class sizes. In what follows, we shall describe these two methods of finding out the central tendency.

#### **Arithmetic Mean:**

We define Arithmetic Mean as the sum of values of all observations, divided by the number of observations.

$$\text{Arithmetic Mean} = \frac{\text{Sum of the Values of all observations}}{\text{Number of observations}}$$

In our example of class sizes, the Arithmetic Mean will be given by:-

$$= \frac{48 + 45 + 36 + 39 + 37 + 31 + 25 + 29 + 21 + 26}{10}$$

$$= \frac{337}{10} = 33.7$$

Formula of Arithmetic Mean:

$$M = \frac{\sum X}{N}$$

Where M = arithmetic mean

$\Sigma$  = "The sum of"

X = each of the measurement of scores in turn

N = number of measurements or scores

Consider the following examples:-

*Example:-* In a High School, the number of teachers during three years was given as under:-

| Year | NO. |
|------|-----|
| 2009 | 60  |
| 2010 | 64  |
| 2011 | 65  |

$$\text{Arithmetic Mean} = \frac{60+64+65}{3} = 63$$

Thus the average number of teachers during the above period has been 63. We can say that the central value of these observations is 63.

### 3.2 The Median and Centile Value:-

*Median:-* Given a number of observations, the median is the middle value of observations, when these are arranged in order to magnitude. If the number of observation is odd the median will be the middle observation. If the number of observations is even the median will be given by the arithmetic mean of two middle values.

Consider the following examples.

*Example i.* Consider the population of five classes of a school given by 50, 60, 35, 40, 32. Find out the Median.

*Example ii.* Consider the example of a middle school, with class-sizes given by 35, 39, 70, 78, 25, 40, 45, 50. The number of observations in this case is even. Arranging the terms in order of magnitudes as in the previous case, we have 25, 35, 39, 40, 45, 50, 70, 78. The two middle terms are 45 and 40, the median is thus give by  $\frac{45+40}{2} = 42.5$ .

The median of this set of observations = 42.5

In the light of the above description, we define Arithmetic Mean and median as follows:-

|                   |                                                             |
|-------------------|-------------------------------------------------------------|
| Arithmetic Mean = | Sum of values of all observations<br>Number of observations |
|-------------------|-------------------------------------------------------------|

AND

|          |                                                                                        |
|----------|----------------------------------------------------------------------------------------|
| Median = | Middle value of observations when the observations are arranged in order of magnitude. |
|----------|----------------------------------------------------------------------------------------|

OR

|         |                                                                        |
|---------|------------------------------------------------------------------------|
| Median= | The mid point of which 50% values lies above and 50% values lie below. |
|---------|------------------------------------------------------------------------|

You might have noticed that mean and median both give the central value of observations and demonstrate the central tendency. There is, however, difference in calculating the central value through these two methods. For calculating the Arithmetic Mean, we sum up all the values of observations and divide it by the number of observations the magnitudes of observations have thus some effect on the mean. In case of Median, we do not add these values. The magnitudes of observations are important only up to the extent of ordering with respect to it. The extremely large or extremely small values at the end do not effect the median. For illustration consider the following example:-

*Example iii.* The number of teachers in seven middle schools is given by 7, 5, 9, 15, 13, 20, 22. The central value on the Arithmetic Mean is given by

$$\frac{7 + 5 + 9 + 15 + 13 + 20 + 22}{7} = 13$$

Now we calculate the median. Arrange the values in order of magnitude. We have 22, 20, 15, 13, 9, 7, 5.

Median 13.

Change the highest value from 22 to 100

Mean in this case will be 24.1

You can see that by changing the highest values the mean has gone up by a little less than two times of its previous value, whereas the median remains the same. This shows that mean can be made large or small by changing the extreme values, whereas median is not effected by them. We conclude thus:-

|                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------|
| Median is less effected by extreme values. The mean can be made high or low by a small number of extreme observations. |
|------------------------------------------------------------------------------------------------------------------------|

This should not however, give the impression that median will always be a better representative of the central value of the set of observations. Our choice of Mean or Median as representative of the central tendency will depend on the nature of observations and the methods of analysis that we shall choose to apply.

When to employ the mean and median.

Several desirable properties of arithmetic mean preferred it. It is generally the most reliable or accurate of the measures of central value. It means that from sample to sample from the same population, the mean ordinarily fluctuates less widely than median.

The mean is better suited to further arithmetical computations. Deviations of single cases from the central value give important information regarding any distribution.

## 4. DISPERSION

Look at the first example of class-sizes, where the numbers were taken as 48, 45, 36, 37, 31, 25, 29, 21 and 26. Draw a line on suitable scale and represent these numbers on  
33.7

0    21        25    26        29    31        36    37        39    45        48  
this line. All the observations are scattered over this line and lie between 21 and 48, (magnitude-wise), both the points inclusive. The length over which the values are scattered is  $48-21 = 27$  units. As we noticed the mean of these observations is 33.7, which lies in the middle, with five values on both sides.

The scattering or the spread (dispersion) of the observations can thus be measured in two ways:-

- i. By describing the total length over which the values are spread;
- ii. By finding out the median and measuring the spread (Dispersion) from there by taking it as a central point.

We define thus:-

Dispersions: The degree of scattering of the values of observations is called Dispersion.

## 5. RANGE

Range is a measure of dispersion of observations. When we measure the dispersion by help of length in units over which the observations are spread. We are actually describing the range of the observations. The range is the “distance between highest and the lowest values of observations”, In our previous example of class-sizes the range is  $48-21 = 27$  units. We can say that the length over which the observations are spread is the range of observations.

|        |                                                                                             |
|--------|---------------------------------------------------------------------------------------------|
| Range: | Difference (Distance) between the highest and lowest values of the observations is “range”. |
|--------|---------------------------------------------------------------------------------------------|

## 6. FREQUENCY DISTRIBUTION

Given below are the marks obtained by a class in one of the examinations on Educational Planning.

Marks obtained:

|    |    |
|----|----|
| 64 | 65 |
| 80 | 80 |
| 71 | 68 |
| 51 | 75 |
| 70 | 89 |
| 69 | 64 |
| 55 | 86 |

Pick up the first number 64. Glance through the entire list. You will find that 64 occur twice. The next number 80 occurs twice. The third number 71 occurs only once. Picking up all the number one by one, we can find out the number of times each one of them occurs. We define thus:-

|            |                                                                                        |
|------------|----------------------------------------------------------------------------------------|
| Frequency: | The number of times an observation occurs is called the frequency of that observation. |
|------------|----------------------------------------------------------------------------------------|

In the above group the frequencies of 64,80, 71 are 2 and others 1. We tabulate the frequencies of the above group in the following table:-

| <b>Observation (X)</b> | <b>Frequency (f)</b> |
|------------------------|----------------------|
| 64                     | 2                    |
| 80                     | 2                    |
| 71                     | 1                    |
| 51                     | 1                    |

|    |   |
|----|---|
| 70 | 1 |
| 69 | 1 |
| 65 | 1 |
| 68 | 1 |
| 75 | 1 |
| 89 | 1 |
| 86 | 1 |
| 55 | 1 |

This table is called the frequency table. The frequency table shows the distribution of frequencies of the values of observations. This distribution is called frequency distribution, and the symbol  $f$  denotes the frequency.

If the number of observations is very large, we distribute the observations into classes. If for example we have to survey 10,000 classes in 2,000 primary schools with a view to finding out the average class-size in a primary school. In such a case, it will not be possible to list down the frequencies, as we did in the preceding example. We group the class-sizes within certain ranges. The following table demonstrates this technique.

1. The number of cases falling within each class interval is a frequency.

| <b>Class-size</b><br><i>(Number of pupils)</i> | <b>Frequency</b><br><i>(Number of observations)</i> |
|------------------------------------------------|-----------------------------------------------------|
| <b>Less than 11</b>                            | 230                                                 |
| 11 – 15                                        | 180                                                 |
| 16 – 20                                        | 550                                                 |
| 21 – 25                                        | 640                                                 |
| 26 – 30                                        | 1,380                                               |
| 31 – 35                                        | 2,120                                               |
| 36 – 40                                        | 1,550                                               |
| 41 – 45                                        | 1,230                                               |
| 46 – 50                                        | 980                                                 |
| 51 – 55                                        | 720                                                 |
| 56 – 60                                        | 290                                                 |
| 61 and more                                    | 130                                                 |
|                                                | 10,000                                              |

The frequencies as given in the table are called the **class frequencies**. The grouping of observations as 11-15, 16-20, etc. is called **class interval**.

The frequency distribution can also be used to calculate the arithmetic mean:  
To do this, the middle value of each group is multiplied with the number of observations in that group:-

|               |                |
|---------------|----------------|
| 5 x 230       | 1,150          |
| 13 x 180      | 2,340          |
| 18 x 550      | 9,900          |
| 23 x 640      | 14,720         |
| 28 x 1,380    | 38,640         |
| 33 x 2,120    | 69,960         |
| 38 x 1,550    | 58,900         |
| 43 x 1,230    | 52,890         |
| 48 x 980      | 47,040         |
| 53 x 720      | 38,160         |
| 58 X 290      | 16,820         |
| 65 X 130      | 8,450          |
| <u>10,000</u> | <u>358,970</u> |

N.B. The middle values of the first and last group are chosen arbitrarily

$$\text{Arithmetic Mean} = \frac{\text{Sum of class-middle multiplied by class frequencies}}{\text{Number of observations}}$$

$$= \frac{358,970}{10,000}$$

$$= 35.9$$

2. In general, a frequency distribution is any arrangement of the data that shows the frequency of occurrence of different values of the variable or the frequency of occurrence of values falling within arbitrarily defined ranges of the variable known as class intervals.

## 7. INDEX NUMBERS

In Educational Planning, we often need to analyse the increase or decrease in enrolment and compare the growth in expenditure with the growth in enrolment. In each case the given figures, either do not admit of analysis or working with them is quite cumbersome. In such cases, we make use of Index numbers. Examine the following example of grade-I enrolment in Pakistan:-

| <i>Year</i> | <i>Enrolment</i> |
|-------------|------------------|
| 2006        | 15,60,000        |
| 2007        | 15,80,000        |

|      |                  |
|------|------------------|
| 2008 | 16,20,000        |
| 2009 | 16,50,000        |
| 2010 | <b>17,40,000</b> |

Suppose that we have to analyse the growth in enrolment. This can be done very easily by the following method:-

Enrolment in 2006      15,60,000  
Say that 15,60,000      100

Enrolment in 2007 by this assumption =  $\frac{100 \times 15,80,000}{15,60,000} = 101$  approx.

Enrolment in 2008 =  $\frac{100 \times 16,20,000}{15,60,000} = 104$  Approx

And finally enrolment in 2010 =  $\frac{100 \times 17,40,000}{15,60,000} = 112$  approx.

The figures 101, 104 and 112 are the Index Numbers. They are derived by relating the value of enrolment in any year to the value in the first year. The value in the first year is equated to 100. Index Numbers, therefore, express the trend in terms of the value in the base year (first year). It is easy to see that the enrolment, in the above example, has increased 12% by 2010 above the 2006 level.

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Index Numbers: | The number expressing the trends, in terms of a base value are called the index Numbers. |
|----------------|------------------------------------------------------------------------------------------|

Index Numbers can be extremely useful for comparing the entities, which are not directly comparable. Look at the following example relating to Pakistan.

|  | <b>Year</b> | <b>Enrolment in Primary Schools</b> | <b>Numbers of Primary Schools</b> |
|--|-------------|-------------------------------------|-----------------------------------|
|  | 2006        | 41,80,000                           | 50,574                            |
|  |             | Index No. 100                       | Index No. 100                     |
|  | 2010        | 60,40,000                           | 53,853                            |
|  |             | Index No. 144                       | Index No. 106                     |

Comparing the absolute numbers in this case is not possible. The units of measurement are different. The use of index numbers, however, brings out clearly the contrast in trends. It can be easily seen from the index numbers that the enrolment in primary schools is increasing more rapidly than the number of primary schools. Consequently the schools are getting over-crowded. The index numbers can therefore be used very effectively for comparing the trends in conceptually different entities.

## 8. RATES AND RATIOS

Generally, the words “rate” and “ratio” are used interchangeably. However, we will use a more precise terminology in which a ratio is a “stock” and a rate is a “flow” parameter.

The enrolment ratio will relate the enrolment in a certain school level to the number of children in certain age-groups. Since the number of children and the enrolment are taken on the same date this forms a stock indicator.

The promotion rate, on the other hand, tells us what proportions of the students in grade-I this year are promoted to grade-II next year. A rate indicates the flow of students between two consecutive years.

The computation of a rate or ratio is very simple since it involves only division.

In the following paragraphs, we shall demonstrate how the words rate and ratio are used and how we calculate them.

## 9. SOME RATIOS

### a. Enrolment ratio

|              |                                                                         |
|--------------|-------------------------------------------------------------------------|
| Definitions: | Enrolment ratio                                                         |
|              | Enrolment at a certain level of <i>Education in a given year</i> x 100. |
|              | Population in corresponding age groups in that year.                    |

According to an estimate in the year 1985, the enrolment in all primary schools of Pakistan will be 90,70,000. The population of primary school age-group (5-9) in that year is estimated to be 1,35,00,000. Find the enrolment ratio.

$$\text{Enrolment ratio} = \frac{90,70,000 \times 100}{1,35,00,000}$$

$$\frac{1814}{27} = 67\%$$

or we say that out of every 100 in the age group (5-9), 67 will be enrolled.

*Example:-* Enrolment ratio for first level of education in Pakistan in 1983.

Enrolment at the first level (grade I-VI) 1,538,611

Population age group 6-11, 1,596,000

$$\text{Enrolment ratio} = \frac{1,538,611 \times 100}{1,596,000} = 96\%$$

## b. Student Teacher Ratio

Definition: 
$$\frac{\text{Student Teacher Ratio}}{\frac{\text{Enrolment at a certain level in a given year}}{\text{Number of teacher at the same level in the same year.}}}$$

Not to be multiplied by 100, by convention.

*Example:-* Student Teacher Ratio  
(Primary Education in Pakistan 1975-76)  
Enrolment at primary level = 52,30,000 in 1975-76  
Number of teachers in Primary School = 1,30,300  
Student Teacher Ratio =  $\frac{52,30,000}{1,30,300} = 40$

This is expressed as 1:40. This means that for every 40 students there is one teacher.

*Example:-* Student Teacher Ratio at first level of education. Singapore 1973.  
Enrolment at the first level = 345,284  
Teacher at the first level = 11,397  
Student Teacher Ratio =  $\frac{345,204}{11,397} = 30$

This is expressed as 1:30, which means that for every 30 students there is one teacher.

## c. Literacy Ratio

Definition Literacy Ratio 
$$\frac{\text{Number of persons literate in an age group}}{\text{Total population in that age group}} \times 100$$

*Example:-* Literacy Ratio  
Pakistan 1972  
Number of persons literate in age group 15 + = 93,18,772  
Population in age groups 15 + = 4,29,16,910  
Literacy Ratio =  $\frac{93,18,772}{4,29,16,910} \times 100 = 21.7\%$   
We say that out of every 100 in the age group 15+ only 21.7% are literates.

**d. Ratio of total educational expenditures to GNP**

|             |                                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition: | Ratio of total educational expenditures to GNP<br>$= \frac{\text{Total educational expenditures in a given year}}{\text{Gross National Product (GNP) in that year}} \times 100$ |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Example:-* Ratio of total educational expenditures to GNP Pakistan  
1971-72 (Million Rupees)  
Total Public expenditures on education = 616.5  
GNP = 52,110.0  
Ratio =  $\frac{616.5 \times 100}{52,110.0} = 1.2\%$

## 10. SOME RATES

For lack of recent and consistent information we will illustrate the rates with examples based on some imaginary data. The figures are presented below:-

|                    | Grade – I | Grade – II | Grade – III | Grade – IV |
|--------------------|-----------|------------|-------------|------------|
| 2007 Enrolment     | 14,82,000 | 11,74,000  | 11,05,000   | 9,32,000   |
| of which repeaters | 3,41,000  | 1,41,000   | 88,000      | 47,000     |
| 2008 Enrolment     | 14,88,000 | 11,76,000  | 11,00,000   | 9,53,000   |
| of which repeaters | 2.98,000  | 1,53,000   | 66,000      | 29,000     |

**a. Promotion Rate:**

|             |                                                                                                                                                                      |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition: | Promotion Rate =<br>$\frac{\text{No. of students promoted to grade } g + 1 \text{ in year } t + 1}{\text{No of students in grade } g \text{ in year } t} \times 100$ |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Example:-* Promotion rate from grade-I in 2007 to grade-II in 2008  
In 2008 in grade-II No. of promotion: 1,176,000 – 153,000  
= 1,023,000  
Promotion Rate 2007 =  $\frac{\text{No of students promoted to grade-II in 2008}}{\text{No. of students in grade - I in 2007}} \times 100$   
Promotion Rate =  $\frac{1,023,000}{1,482,000} \times 100 = 69\%$

**b. Repetition Rate:**

|             |                                                                                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition: | $\text{Repetition Rate} = \frac{\text{No. of students repeating grade } g \text{ in year } t+1}{\text{No. of students in grade } g \text{ in year } t} \times 100$ |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Example:-* Repetition Rate in grade-II in 2007

$$\text{Repetition Rate 2007} = \frac{\text{No. of repeaters in grade - II in 2008}}{\text{No. of students in grade - II in 2007}} \times 100$$

$$\text{Repetition Rate} = \frac{153,000}{1,174,000} \times 100 = 13\%$$

**c. Drop-out Rate:**

|             |                                                                                                                                                                            |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition: | $\text{Drop-out Rate} = \frac{\text{No. of students dropping out from grade } g \text{ during year } t}{\text{No. of students in grade } g \text{ in year } t} \times 100$ |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

*Example:* Drop-out Rate from grade-III in 2007

$$\frac{\text{No. of drop-outs from grade - III in 2007}}{\text{No. of students in grade - III in 2007}} \times 100 =$$

No. of student is obtained as residual

Enrolment grade-III in 2007 = 1,105,000

Repeating grade-III in 2008 = 66,000

Promoted to grade-IV in 2008 = -990,000

953,000 – 29,000 = 924,000

Dropped out = 115,000

Drop-out =  $\frac{115,000}{1,105,000} \times 100$

= 10% = 1,105,000 10%

## 11. GROWTH RATES

Primary school enrolment in Pakistan in 1973 was 41,80,000. In 1974 it rose to 49,80,000.

$$\begin{aligned} \text{Rate of growth} &= \frac{49,80,000 - 41,80,000}{41,80,000} \\ &= 1.9\% \end{aligned}$$

If we want to compare enrolments over a period longer than one year, the above simple formula is not sufficient.

For example, in 1973 the primary school enrolment was 41,80,000 in Pakistan. In 1979 it rose to 65,60,000 (Fifth Plan Projection)

$$\text{Rate of growth} = \frac{65,60,000 - 41,80,000}{41,80,000} \times 100$$

$$= 80.9\% \text{ over 6 years.}$$

The term 80.9% over 6 years is not meaningful, because it is not easily comparable. If for another country, we find a rate of growth 75% over the same number of years, it is impossible to say immediately whether this represents a faster or slower growth rate. To enable this comparison, we calculate the average annual rate of growth.

For calculating the average rate of growth two methods can be used:-

- i. Calculating the growth rate for each year in the period and thereafter deriving the arithmetic mean of these growth rates.
- ii. Using the formula  $E_n = E_o (1 + i)^n$   $E_o$  = enrolment in the base year.

$$E_n = \text{enrolment in the terminal year}$$

$$I = \frac{\text{Rate of growth (percent)}}{100}$$

$$N = \text{number of years}$$

*Example:-*

|                                         |   |           |
|-----------------------------------------|---|-----------|
| Pakistan:- Middle level (Class VI-VIII) |   |           |
| 1973                                    | – | 10,97,000 |
| 1974                                    | – | 11,96,000 |
| 1975                                    | – | 12,47,000 |

#### **Method-I**

- a. Growth from 1973 to 1974 = 9%
- b. Growth from 1974 to 1975 = 4.2%
- c. Average annual growth =  $\frac{9 + 4.2}{2} = 6.6\%$

#### **Method-II**

$$E_n = 12,47,000$$

$$E_o = 10,97,000$$

$$n = 2$$

We have to find out “i”

$$12,47,000 = 10,97,000 (1 + i)^2$$

$$\frac{12,47,000}{10,97,000} = (1 + i)^2$$

$$1.137 = (1 + i)^2$$

Taking logarithm of both sides

$$\begin{aligned} \text{Log } 1.137 &= \text{Log } (1 + i)^2 \\ &= 2 \text{ Log } (1 + i) \quad (\text{Log } a^b = b \text{ Log } a) \end{aligned}$$

Taking logarithm to the base 10

$$\frac{0.557}{2} = 2 \text{Log } (1 + i)$$

$$\frac{0.0557}{2} = \text{Log } (1 + i)$$

Taking anti-log

$$\text{Log}^{-1} 0.0279 = \text{Log}^{-1} \text{Log } (1 + i)$$

$$= 1 + i$$

$$1.066 = 1 + i$$

$$i = 0.066$$

$$\frac{\text{GrowthRate}}{100} = 0.066$$

$$\text{Growth Rate} = 0.066 \times 100 = 6.6\%$$

Let us try to find out how do we derive the formula

$$E_n = E_o (1 + i)^n$$

Suppose Enrolment in the base year  $Y_o = E_o$

Rate of Growth = 5% (Suppose)

$$\begin{aligned} \frac{\text{Enrolment in the year}}{Y_o + 1} &= E_o \left( 1 + \frac{5}{100} \right) \end{aligned}$$

$$\begin{aligned}
Y_o + 2 &= E_o + E_o \times \frac{5}{100} + (E_o + E_o \times \frac{5}{100}) \times \frac{5}{100} \\
&= E_o + E_o \times \frac{5}{100} + E_o \times \frac{5}{100} + E_o \times \frac{(5)^2}{100} \\
&= E_o (1 + 2 \times \frac{5}{100}) + \frac{(5)^2}{100} \\
&= E_o (1 + \frac{5}{100})^2 \\
Y_o + 3 &= E_o (1 + \frac{5}{100})^2 + E_o (1 + \frac{5}{100})^2 \times \frac{5}{100} \\
&= E_o (1 + \frac{5}{100})^3 \\
&= \text{Hence } E_n = E_o (1 + i)^2
\end{aligned}$$

It is clear that both methods give the same results and it would seem that first method is simpler, but that is only because our example is so simply chosen. If the period would be longer, the number of annual rates to be calculated would become quite large and, for those who can handle logarithm calculation, the second method should be preferred.

## 12. EXTRA POLATION

The average annual rate of growth of growth can also be used for extrapolations or projections.

In Thailand the primary enrolment was given as:-

|      |           |
|------|-----------|
| 1960 | 3,936,000 |
| 1973 | 6,380,000 |

The average rate of growth is 3.8% per year over the period 1960-1973.

If the question is asked “What will be the primary school enrolment in 1930”, the most straightforward approach seems to be assume that the enrolment will continue to increase with 3.8% per year.

The same formula as for the average annual rate of growth can be used.

$$E_n = E_o (1 + i)^n$$

In our example  $E_n$  now represent enrolment in 1980 and  $E_o$  is the base year for our projections.

Enrolment in 1980      Enrolment in 1973  $(1 + 0.038)^7$

- i.  $E_{1980} = 6,380,000 (1 + 0.038)^7$
- ii.  $\log E_{1980} = \log 6,380,000 + \log (1 + 0.038)^7$  since  $\log ab = \log a + \log b$
- iii.  $\log E_{1980} = \log 6,380,000 + 7 \times \log (1 + 0.038)$  looking up the values of the logarithms in the table gives.
- iv.  $\log E_{1980} = 6.8048 + 7 \times 0.0162$
- v.  $\log E_{1980} = 6.8048 + 0.1134$
- vi.  $\log E_{1980} = 6.9182$  looking up the antilog of 6.9182 we find
- vii.  $E_{1980} = 8,282,882$

Here we know the average growth during the period 1960-73. With the help of this growth rate, we have to project enrolment in 1980. Assuming that this rate will remain constant we have made the projection. Thus if we are given data between two points in time and make estimate, on the basis of this data, over a third point in time beyond the above two points, the process is known as extrapolation.

## 13. INTERPOLATION

Interpolation follows the same principles as extrapolation. We need interpolation to estimate data between two points in time. In the following example, we want to estimate the population of a country in 1973:-

Population in 1970: 537,050,000

Project population in 1980: 717,380,000

For planning purposes we may want to know the 1973 population.

The approach is as follows:-

- i. Over the period 1970-80 the average annual growth of population is 2.9%.

- ii. Using the formula  

$$\text{Population in 1973} = \text{Population in 1970} (1 + 0.029)^3$$

$$P_{1973} = 537,050,000 (1 + 0.029)^3$$
 which gives as result.
- iii. Population in 1973 = 585,121,590.

## 14. COMPUTATIONS RELATING TO FACILITIES

The material in the previous sections relates to computational techniques in general, but it can also be applied to that special area of educational planning concerned with facilities.

**Definition:**

Educational facilities are a term which includes sites, buildings and fixed and loose furniture such as laboratories and chairs for classrooms.

It should be noted that the term, “educational facilities” does not include equipment, audio visual aids, laboratory equipment and the like.

Computations relating to facilities are always in terms of individual students. This is reflected in the terminology used as for example, “area per student” or “area per place”, “cost per student” or “cost per place” and so on. The computations never involve the cost of a classroom or the cost of a laboratory. Thus, if a new school is to be provided, the first question that might be asked is “for how many students” rather than “how many classes?”

Planning for educational facilities requires first, statistical data on the existing building stock. Stock statistical data and their importance were mentioned in previous unit.

The data required will be of two sorts, first the capacity of the building stock and, secondly an assessment of the state of building maintenance indicating the proportion of the stock that needs replacement.

The capacity will be obtained by calculating the gross area of the building stock and dividing it by an agreed space standard.

**Definition:**

The gross area of a building is the total floor area of the building, measured on all the floors of all the spaces within the walls; that is educational area, administration spaces, circulation areas, areas of sanitary facilities, dining facilities, etc.

**Definition:**

Space standard is the gross area per place that is agreed nationally to be minimum requirement.

Space standards will usually differ between primary education and secondary education.

*Example:-*

The annual returns from principals show the gross area of all primary schools in a country to total 6,068,464 square metres. It is decided that the gross area per place as space standard for primary schools should be 1.10 square metres. What is the capacity of the existing stock?

Capacity                      Gross area of building stock  
                                         Gross area per place

$$\frac{6,068,464}{1.10} = 5,516,785 \text{ places}$$

Many countries do not have established norms and standards for gross area per place required for primary and secondary education and it may thus be necessary for planner to establish standards in order to estimate the needs for educational facilities. The establishment of norms and standards of this sort is a complex business with which it would be inappropriate to deal here. As a general rule primary education requires a gross area per place of from 1.1 to 1.5 square meters and secondary education, about 3 square meters. These figures are adequate for macro-planning purposes but could obviously be refined at the micro-planning level.

**Definition:**

The cost per place is the cost per student for building and furniture. It is derived by dividing the building and furniture costs by the number of students.

The planner attempts to find places for a number of children in school. Some places are available in the existing building stock, others may have to be provided either in rented buildings or by adding to existing schools or by constructing new schools.

*Example:-*

If the existing stock of buildings provides places for 5,513,785 students but it desired to provide places for 6,170,859 students at a cost per place of US \$ 57, what will be the total cost?

$$\begin{aligned} \text{Total cost} &= \text{cost per place} \times \text{number of places} \\ &= 57 \times (6,170,859 - 5,516,785) \\ &= \text{US \$ } 37,282,218. \end{aligned}$$

## 15. TEST AND APPLY YOUR KNOWLEDGE

Five questions are given below to test your understanding of the unit. The answers to the questions are to be found on the next pages.

- Question-1. In the median always smaller than the arithmetic mean?
- Question-2. Under what conditions should you see:-
- a. Median rather than a mean?
  - b. Range as measures of dispersion, and not just indicator of central tendency?
  - c. Index number rather than absolute numbers.
- Question-3. What is the difference between:-
- a. Rate and ratio
  - b. Stock and flow data
  - c. Sample and a school census
- Question-4. With the exception of the definition of educational facilities, no reference has been made to sites for schools. What are the probable reasons for this omission and in what way could sites be included in the provisions of an educational plan?
- Question-5. Do the definition of “space standard” and “cost per place” rather refer to maximum, minimum or both? Explain your answer.

## 16. ANSWERS

- To question 1. The median is less affected by extreme values of observations. If a set of observations includes a few extremely high values the mean will tend to be higher than the median. On the other hand, if a number of extremely low values are recorded the mean will be lower than the median.
- To question 2.
- a. Whenever there are extreme values of observations.
  - b. Range is complementary computational technique to the central tendency to be used whenever there is a reason to believe that the values of observations are much dispersed.
  - c. Whenever you compare trends in conceptually different entities.
- To question 3.
- a. A ratio is a “stock” parameter. A rate is a “flow” parameter.
  - b. Stock data describe the situation of the educational system at a given point in time, for example, enrolment, the number of teachers, etc. flow data describe the internal dynamics of the educational system, for example, promotion, repetition and drop-outs, etc.
  - c. Suppose that total number of educational institutions, of all levels, in the country to be 4,000. In a school census all 4,000 institutions would receive a questionnaire. A sample would select a restricted number of schools to be questioned, may be 10% of the total number. This sample of 400 schools would include schools of all levels, of all types of management, out of all regions of the country so that the sample will be really representative for the total educational system.  
Census and samples are no alternatives, they are complements. A census is required to obtain total number of students, teachers, etc. A sample may function to obtain information on repetition, dropout, attendance, costs, etc.
- To question 4. The means of acquiring sites and the variations in their size in the countries of the Asian region make generalization on the topic of sites impossible. In (the few) countries where sites are purchased, then a mean cost per place for sites could be calculated for sites acquired in previous years. This mean cost per place should be added to the per place cost for buildings and furniture to give a cost per place for educational facilities.

To question 5.      A space standard is a minimum area required for a specific function. The standard has to be a minimum as there has to be a point at which less than a certain standard will prevent the performance of the desired activity. If more than the space prescribed is provided, then obviously the function could be performed.  
Cost per place is always the maximum cost that can be afforded. If a place can be provided for less than well and good but the plan collapses if the per place cost is exceeded.

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## **Unit – 4**

# **DIAGNOSTIC TECHNIQUES PERSONNEL AND FACILITIES**

**(Unesco material)**

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## 1. INTRODUCTION

- 1.1 Every country has a stock of educational personnel (i.e. teachers, administrators, non-teaching employees and physical facilities comprising school sites, school building, and furniture. The question that faces the planner is the adequacy of this stock, both quantitatively and qualitatively, in relation to the needs of students and national plans for educational development.
- 1.2 Most plans involve increasing the numbers of students receiving education, either through increases in enrolment or by increasing the duration of education. To meet these new needs it may be possible to make better use of existing personnel and facilities rather than to recruit new personnel or construct new buildings. It may be, however, that the existing personnel and facilities are already being fully used and the additional personnel and facilities are required to meet the increasing demand of the system. Most commonly some of the personnel are not functionally suitable. There are teachers who are unqualified or untrained. There are subject areas like science and technology and mathematics in which qualified teachers are in short supply. Similarly, administrators and other personnel would be either scarce or not adequately oriented to educational development. Some of the existing stock of buildings and furniture is sub-standard; that is to say the facilities are worn out or, as in the case of rented building, totally unsuitable for education as well as very costly. There are specialized facilities like science laboratories and workshop which are inadequate. Both in the distribution, the remote rural areas usually getting the least in quantity and quality.
- 1.3 There are very few countries in the Asian region which maintain an adequate account of either the number qualifications and capacities of educational personnel or number and condition of their facilities. Because of this the planner are sometimes forced simply to plan their needs of new personnel and remedying existing shortages and defects. In doing so, the planners overburden the existing cadre of personnel to the detriment of satisfactory functioning. As regards facilities, they rely on an ill-defined maintenance budget to take care of the unspecified repairs and renovations of the existing stock.
- 1.4 What is needed and needed urgently for personnel and facilities are data which will enable the planner to diagnose the actual requirements both in terms of the quantity and quality. There are unfortunately, no short cuts, statistical devices or other means to arrive at an answer to this problem, what has to be done to design a survey. The survey on personnel has to cover all types and grades and particularly the critical categories such as teachers and supervisors. It should gather information in age, gender, areas and qualification distribution. These surveys should analyze the data in such a way that the quantitative aspects of the stock of personnel and facilities are fully understand. Let us examine how we should proceed with such surveys. For convenience we will first deal with personnel and take up facilities later on.

## **2. OBJECTIVES**

By the time you have worked through this unit, you should be able to describe the types of data needed to give an overview of the stock of existing personnel and facilities from both a qualitative and quantitative view point:

1. determine norms applicable to educational personnel;
2. diagnose the personnel situation of the educational system;
3. design the sample survey which will provide the data needed for a diagnosis of the status of physical facilities;
4. diagnose the facilities situation from the data.

### 3. DATA ON EDUCATIONAL PERSONNEL

- 3.1 The educational personnel or the manpower required to maintain a national system of education in several categories. The teachers, being the largest single component, consists of a common classification of the educational personnel is into two categories namely:

- i. Teaching staff and
- ii. Non-teaching staff

Teachers form a heterogeneous a group as the non-teaching staff. First, teachers are classified according to level and type of education (e. g. primary school teachers, secondary school teachers, instructors of technical education, teacher educators, university professors and lecturers, etc). Then they are classified according to qualifications and subject specialization. Qualifications are usually of two types; academic (relating to the general level of education of the teacher) and professional (meaning his or her training to function as a teacher). So teachers are categorized also as qualified or unqualified (i.e. academically) or trained or untrained (i.e. professionally). They may further be classified according to the location of the educational institutions (e.g. urban and rural). In a developing country like Pakistan, some levels of education the proportion of female teachers to male teachers has implications for female education and as such, the distribution of teachers by gender is equally important.

Data needs to be collected not only in respect of these categories separately, like trained, untrained or rural, urban of Science English etc, but also in respect of combined categories like trained science teachers, untrained English teachers etc.

- 3.2 An educational planner needs precise information relating to each category of teachers of each level and type of education, because his first task is to diagnose the current situation. The questions to be asked in his diagnostic analysis are:

- a) Are there enough teachers to meet the education system?  
This is a simple body-count on determined standards or norms; e.g. there should be a teacher for every classroom or for so many pupils. To answer this question we need the total number of the existing stock of teachers.
- b) Are there enough female teachers to encourage and sustain female education? This again is a simple body-count. For this question we need the total number of teachers according to gender distribution.
- c) Is the distribution of teachers/female teachers equitable between rural and urban areas among different regions or districts of the country?  
Now, the body-count becomes a bit more complex because data for various geographical entities are to be collected. To answer this question data analyzable into the following form become necessary.

| Region or District | Urban |        | Rural |        |
|--------------------|-------|--------|-------|--------|
|                    | Male  | Female | Male  | Female |
| —                  | —     | —      | —     | —      |
| —                  | —     | —      | —     | —      |
| —                  | —     | —      | —     | —      |

- d) Their academic qualification level: Each teacher is expected to have a minimum level of academic qualification to teach in a particular level or type of education. The range of qualifications regarded or prescribed as the minimum for each level or type could be very wide.
- e) Their professional level: What is meant by this question is, whether the teacher has gone through a prescribed course of professional training in pedagogy. To answer the question d) and e), data are needed on the educational and professional qualifications of teachers. These data would give numbers of teachers according to such classifications:-
- Unqualified and untrained (UU).
  - Unqualified and trained (UT).
  - Qualified but untrained (QU).
  - Qualified and trained (QT).

But, usually each of these classifications would be further elaborated by specifying the kind of qualification or training. Assuming that twelve years of schooling or high-school graduation with one year's training is the minimum for secondary school teacher, we would find that the data on the qualified teachers could be refined to such categories as the following:

- Post graduate degree in both academic and professional aspects (e.g. M.Sc. and M.Ed. Master of Science and master of Education).
- Academic degree with professional post-graduate degree (e.g. B.Sc. and M.Ed.).
- Academic and professional degree (e.g. B.Sc. and B.Ed.)
- Academic degree plus one year's training.
- Sixteen or fourteen years schooling and one year's training etc.

Some of these refinements may be of the little or no use to the educational planner. But most countries tend to collect them as a means of presenting as detailed a profile of the teaching profession as possible. The main argument in favour is an assumption that higher the qualification of teachers, the better the quality of education. The educational planner prefers to work with well-defined minimum qualifications for each level or type of education. Most countries have prescribed such minimum qualifications. The table below gives a list of minimum qualifications (academic and professional) for a number of Asian countries:

| Country     | Primary School Teachers |                    | Lower Secondary % Middle School Teachers |                    | Higher Secondary % High School Teachers |                         |
|-------------|-------------------------|--------------------|------------------------------------------|--------------------|-----------------------------------------|-------------------------|
|             | Length of Schooling     | Length of training | Length of schooling                      | Length of training | Length of Schooling                     | Length of Training      |
| Afghanistan | 12                      | 1                  | 12                                       | 2                  | 12                                      | 4                       |
| India       | 10                      | 2                  | 10                                       | 2                  | 10                                      | 4                       |
| Iran        | 8                       | 4                  | 12                                       | 2                  | 12                                      | 4                       |
| Japan       | 12                      | 2                  | 12                                       | 2                  | 12                                      | 4                       |
| Korea       | 12                      | 2                  | 12                                       | 4                  | 12                                      | 4                       |
| Malaysia    | 11                      | 2                  | 11                                       | 2                  | 13                                      | 4                       |
| Nepal       | 8                       | 1                  | 10                                       | 2                  | 10                                      | 4                       |
| Philippines | 10                      | 4                  | 10                                       | 4                  | 10                                      | 4                       |
| Singapore   | 10                      | 2                  | 12                                       | 2                  | 12                                      | 4                       |
| Thailand    | 10                      | 2                  | 12                                       | 2                  | 12                                      | 4                       |
| Pakistan    | 10                      | 1                  | 12                                       | 1                  | 14                                      | 1<br>(for High Schools) |

Source: Art Harisadangkul and K. Janson: *Qualifications of Teachers. A statistical, Survey of Selected Asian Countries* Bangkok, UNESCO, 1974

- f) Are the qualified and trained teachers equitably distributed between rural and urban areas and among different regions or districts of the country?  
It would be appropriate to combine the answer to this question with that to question c). What we need are data analyzable in the following forms:

| Urban          |                |                |                | Rural          |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Male           |                | Female         |                | Male           |                | Female         |                |
| Q              | U              | Q              | U              | Q              | U              | Q              | U              |
| $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ | $\frac{UT}{T}$ |

Q: Qualified, U: Unqualified, UT: Untrained, T: Trained

- g) Are there enough teachers with specialist qualifications and training to teach languages, science; mathematics and technical subject? Are they equitably distributed throughout the country?  
There are further refinements of questions (e) and (f). what we need to answer them is the total number of teachers of each specialization and their distribution between rural and urban areas and among different regions or districts of the country. In addition, we need to have some idea of how many teachers are required for each subject. This calls for an analysis of the curriculum of the relevant level of type of education. Let us take the

curriculum. We find that out of the 40 periods of work (100 percent) per week, the following are allotted to special subjects:-

|                     |   |   |       |
|---------------------|---|---|-------|
| English             | 6 | = | 15%   |
| General Science     | 5 | = | 12.5% |
| Mathematics         | 5 | = | 12.5% |
| Vocational Subjects | 6 | = | 15%   |

On this basis we could assume that the total stock of teachers in this level of education should have specialist teachers of these same percentages i.e.

|       |                                                  |
|-------|--------------------------------------------------|
| 15%   | teachers qualified to teach English              |
| 12.5% | teachers qualified to teach General Science.     |
| 12.5% | teachers qualified to teach mathematics.         |
| 15%   | teachers qualified to teach Vocational Subjects. |

These percentages give us a working basis to determine the size and the nature of the existing gap between teacher supply and demand.

- h) What is the age distribution of the teaching service? What categories of teachers will need replacement immediately or within the next five or six years? What is the rate of wastage for each category of teachers? To answer these questions we need to construct the age pyramid for each category of teachers. This information is vital to the educational planner, because it helps him to determine the nature, the magnitude and the time scheduling of the teacher education programme. The intake to teachers training institutions, the pattern of in-service training activities, the subjects for which incentives are to be provided to attract more teachers etc: The data on age structure of teachers with different qualifications teaching different subjects will help in seeking answers to these and other similar related questions.

- 3.3 The educational planner needs data to answer these eight questions. Data relating to the stock of teachers are generally available in all countries. Some data are available on their geographical distribution also. But that is not so with regard to their qualifications, subject specialization, age distribution and wastage. The importance of getting detailed and accurate data on teachers cannot be over-emphasized. There are several sources from which they could be obtained. The accounts divisions, dealing with salary payments, have been found to have the most up-to-date data. Next in completeness and accuracy are the personnel management or establishment divisions of Education Department or Directorates of education. They can, of course, be collected from the institutions – schools, colleges, etc. In face this is what Sri Lanka does once a year through a school census. In Pakistan this data is collected annually through provincial departments of education. The provincial departments obtain this data from the District Education Officers. The data are collected for the whole country and ultimately consolidated by the NEMIS (National Educational management information System) at federal level.

3.4 The educational planner needs data on other categories of educational personnel also. What is required in regard to each category may be summarised as follows:-

1. Institutional Administrators (i.e. headmasters, principals).
  - a) Stock (including information on unfilled vacancies).
  - b) Whether trained or not.
  - c) Gender distribution.
  - d) Age distribution and wastage.
2. Supervisors/Instructors.
  - a) Stock (including information on unfilled vacancies).
  - b) Subject specialization.
  - c) Whether trained or not.
  - d) Workload (including regional imbalances in workload).
  - e) Gender distribution
  - f) Age distribution and wastage.
3. Educational Specialists (Curriculum Developers, Specialists in Text-books, teaching materials, examinations, Architects, Engineers etc. etc.).
4. Administrators.
  - a) Stock (including information on unfilled vacancies).
  - b) Whether trained or not.
  - c) Age distribution and wastage
5. Clerical and other personnel.
  - a) Stock (including information on unfilled vacancies).
  - b) Distribution according to administrator norms.

Being relatively smaller in numbers, these categories of personnel (from serial No. 3 to 5) present less difficulties in the collection and processing of data relating to them.

## **4. DIAGNOSIS OF THE EXISTING POSITION OF EDUCATIONAL PERSONNEL**

4.1 The eight questions for which we identified the data requirements relating to teachers can from the basis of our diagnostic analysis of all categories of personnel. We as planners are mainly concerned with the following:-

1. Whether the existing stock meets our norms for the particular services;

2. Whether it is of the expected quality (i.e. academic and professional qualifications):
3. Whether its gender distribution shows an imbalance affecting female education:
4. Whether its age profile shows how some critical categories of personnel need to be replaced; and
5. Whether there is going to be an acute shortage of some category of personnel in near future:
6. Whether its regional distribution (particularly of critically important categories) is equitable.

With regard to each of these aspects we are expected to have established norms or standards to meet requirements of the system from time to time in different parts of the country.

4.2 With regard to the adequacy of the stock of teachers we express our norms in either of two ways:-

- i) Number of pupils per teachers, called the pupil-teacher ratio; and
- ii) Number of teachers per class, called the Teacher-class ratio.

The more popular norm is the Pupil-Teacher Ratio. The latter is being used in some countries of the Asian Region specially in relation to the planning of individual institutions specially at primary level i.e. from class I to V. There is still no research evidence to support any particular norms relating to the Pupil-Teacher Ratio. The assumption that smaller classes do better because the teacher could give greater individual attention to pupils is the basis for our arguments in favour of improving the Pupil Teacher Ratio. In most countries, this norm is administratively established on the basis of available resources. The educational planner's task in diagnosing the adequacy of the stock of teachers is to work out teacher-pupil ratio by dividing the enrolments by the number of teachers. This has to be done for each level and type of education. But it must be remembered that this is only a crude measurement. Although it would not tell us whether the stock of teachers in the country is the optimum (the most favourable from the functional point of view), it does however, indicate very emphatically the disparities in regional distribution. The pupil-teacher ratio, however, does not tell us whether we have enough of qualified and trained teachers or specialist teachers. For these we need other norms developed on the basis of requirement of different subjects to different categories of pupils from different marginalised segments of population.

4.3 A proper set of norms on the number and the distribution of qualified and trained teachers and specialist teachers could only be worked out on the basis of a Work Study. We have already indicated how we could work out a crude measure of distribution by calculating the percentage of time allotted to different subjects in the curriculum. The same type of calculation should be under-taken by analysing

the curricula in greater detail. The kind of question that would be raised in such an exercise would be as follow:-

What minimum qualifications (professional and academic) should teacher posses to teach such and such subject in such and such classes?

Most countries have some rules and regulations on the minimum qualifications of teachers. Very often they occur in legislation applicable to private educational institutions which are approved or aided by government. The educational planner would find it useful to scan such legislation to find a set of working norms. Once the norms are established he could proceed to diagnose not only the adequacy of the total stock but also the regional imbalances.

## **5. NORMS FOR ASSESSING REQUIREMENTS OF NON-TEACHING PERSONNEL**

- 5.1 With regard to supervisors/Inspectors, the usual norms are worked out either on the number of institutions supervised or the number of teachers.

Neither of them is a reliable measurement of the workload. The geographical area in which the schools are located, the nature of the terrain, the condition of roads and public transport system, the means of communication and the transport available to the officer, have all a significant impact on the validity of norms. Surveys, covering the entire country or a representative sample, diagnosis of adequacy and distribution would then process as in the case of teachers on the basis of such norms. Here again, the question of subject specialization would come up. What we have discussed about teachers would apply to them also.

- 5.2 Norms relating to other categories of educational personnel are usually based on administrative rules relating to the staffing of organizations. The educational planner has little opportunity to deal with them other than when he plans for the development of an institution. In such cases he is advised to follow the rules in operation.
- 5.3 The proportion between male and female personnel has to be a subject of diagnosis, particular in countries where girl's education is lagging behind. Disparities in the stock of teachers as well as among specialist teachers would indicate the magnitude of the problem. The geographical distribution of female teachers would similarly identify areas which demand attention.
- 5.4 Age pyramids of each category of personnel – if possible, showing the male-female composition – cold be very useful diagnostic tool. They would identify problems

which are going to be automatically solved with time (e.g. if the majority of the unqualified teachers are in the age-groups nearing retirement). They would also show critical situations which would arise with time (e.g. if the majority teachers qualified to teach a particular second language are nearing retirement). They would also indicate the patterns of in-service training that has to be planned to upgrade the professional competence of the teaching service. The method of constructing an age pyramid is quite simple and all one needs is a little practice.

The diagnosis of the current position relating to the educational personnel, carried in the manner discussed so far, would show:

- i) Overall shortages which have to be filled in addition to future needs – this means decisions relating to the intake of institutions which produce each category of educational manpower;
- ii) Shortage in specialized fields – for similar action as above as well as for decisions on incentives to attract personnel for categories which are in short supply;
- iii) Imbalances to be corrected transfers, incentives in recruitment of creation of new positions;
- iv) Shortfalls in competencies – to be remedied through in-service training programmes;
- v) Rate of wastage in each category – for action in terms of incentives etc. and planned pre-service training and recruitment for replacement;
- vi) Critical and urgent shortages and shortfalls in competencies – for decisions in terms of employing expatriate personnel, re-employing retired personnel or extending the age of retirement.

All these aspects have important implications in the preparation of an educational plan for a country.

## **6. TEACHER PLAN AND OVERALL EDUCATIONAL PLANS**

In mounting any new changed or expanded educational programme, we find that one of the highest priority concerns is securing the necessary teachers for it. Teacher supply has to be planned well ahead. Recruitment for teacher training courses may have to be undertaken as much as five or six years ahead of the time that trained teachers will be needed in the schools. If the teacher-training programmes themselves have not yet been established, it may require an additional two or three years to enable teacher training colleges recruit training staff and design and mount the training courses. This necessity to think well ahead about teacher requirements is one of the major impetus behind the development of educational planning which may be long term or short term depending on the condition of manpower available for different levels of education.

Careful planning of teacher supply is vital to qualitative change in education. New language policies, revised curricula involving changed approaches, new equipment and teacher aids all have implications for – and in turn may depend upon – adequate teachers supply and will make heavy demands upon a country's teacher training and teacher's retraining capacity. Realistic curriculum planning is intimately bound up with questions of teachers needs and teacher's availability. Particularly in periods of rapid educational expansion, the teacher training system may itself come to account for a significant part of educational effort and expenditure. It is not unknown for teacher training to absorb as much as 10 or 20 percent of Ministry of Education budget, and to account for a high proportion of enrolments at secondary or tertiary levels. Thus teacher's supply becomes an important consideration not just as a key input for expansion and improvement of primary, secondary and tertiary levels of education, but also itself a major competitor for the resources available to the education sector. Such resources being scarce, there may be conflict between the demands for spending on schools and for spending on the teacher training system. This may be seen as representing the classic economic problem of choosing between present benefits (teachers for the school now) and future benefits (more and better teachers for the school, but later); or, in economic terms of choosing between consumption and investment. Planning concerns choices for the future and in education some of the most difficult decisions concern the proportion of current resources to be invested in securing teacher supply.

A further reason why teacher demand and supply are so central to the concerns of educational planners is the cost of employing teachers. Their salaries account for an extremely high proportion of recurrent expenditure on education particularly at the primary level.

## **6.1 Necessity for long term teacher planning**

The planning of teacher demand and supply is a central concern of educational planners – because programmes of educational expansion or improvement require forward preparation, because the teacher – training system is itself competing with schools and other educational programmes for resources, because of the dominance of teacher salaries in educational finance. Since time sequence and phasing are of such cardinal importance in all educational planning, it may be useful to explore in a little more depth how they impinge on teacher demand and supply.

## **7. STANDARD AND DIAGNOSIS OF EDUCATIONAL FACILITIES**

- 7.1 In the introduction we highlighted the importance of conducting surveys to collect and analyse data – both quantitative and qualitative. With regard to educational facilities, this has already been done in Iran. Some data of varying quality collected

on a national scale are available in India, Malaysia and Sri Lanka. The material for Malaysia is available on computer tape and that for Sri Lanka in the annual returns of school principals. In Pakistan also NEMIS is continuously collecting qualitative as well as qualitative data from individual institutions, districts, provinces and consolidating at national level.

What is required is an accurate picture of the physical condition of the educational facilities in the country at all levels of education from primary to higher. The picture should show not only the quantity of building, (in terms of usable space) but also the condition which can be categorized simply as:

- Good condition
- Improvable condition
- To be replaced

Once this information is available, the amount of money needed for maintenance, upgrading and replacement can be determined in relation to standards for accommodation. At the same time the picture should show the condition of furniture categorized in the same way.

- 7.2 The first problem relating to data of this type concerns how much of it is to be collected. There appear to be two alternatives:

- Either
- (i) an exhaustive country-wide school inventory or
  - (ii) a sample survey, as the second best alternative

The stock of educational facilities in most countries of the region is so large that the alternative will usually be impracticable. Moreover, country-wide survey is also not always necessary. In survey sampling techniques can be used giving similar results after extrapolation.

- 7.3 Sampling is an extremely complex, statistical process. The size and nature of the sample drawn should thus be established in consultation with a statistician. In drawing the same it will first be necessary to categorize the facilities into similar or comparable groups such as:

Primary Schools  
Middle Schools  
High Schools

And to further classify these groups by location:

Metropolitan  
Big towns (with population from 50,001 – 1,000,000)  
Small towns (with population from 5,001 – 50,000)

Rural areas.

Where the topography or economy of the country shows marked difference as between one area and another then a further sub-division would be necessary.

It is of interest to examine, by way of example, the size of sample drawn in 1973 for Iran.

**TABLE I: Facilities Survey: Iran-Sample Size**

| Level           | Location     | Number of facilities | Sample Size |
|-----------------|--------------|----------------------|-------------|
| Primary         | Urban        | 3,119                | 49          |
|                 | Rural        | 21,605               | 242         |
| Lower Secondary | Urban        | 850                  | 10          |
|                 | Rural        | 711                  | 8           |
| Upper Secondary | Urban        | 1,146                | 14          |
|                 | Rural        | 696                  | 8           |
|                 | <b>Total</b> | <b>27,416</b>        | <b>331</b>  |

- 7.4 The distribution and location of schools for survey is next task and, again, the advice of a statistician should be sought to ensure random selection. In Iran, all villages were numbered and for each particular case in the table above, the sample was identified using a table of random numbers.

Once identified the physical facilities at each location can be surveyed.

- 7.5 If it is to be of value, a survey of physical facilities has to be made by surveyors having experience in the field of building. It will not be adequate to rely on returns submitted by school principals. For reliable information on qualitative matters it is important that the surveyors visit the facility. They should always work in a team of not less than two persons.
- 7.6 Quality is, indeed, the most difficult of all aspects for them to assess. Earlier in this Unit, it was suggested that facilities be assessed as good, improvable or requiring replacement. These ratings may be defined as below:-

|                       |                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Good                  | The building, room or sub-system is satisfactory as it stands. Normal maintenance will keep it in a satisfactory condition. |
| Improvable            | the facility is physically safe. However, varying amount of upgrading work is needed to bring it to the "good" level.       |
| Requiring replacement | Either unsafe or functionally unsuitable being in such condition as to require replacement.                                 |

- 7.7 There would be no point in comparing a rural mud school with an urban concrete school. There are excellent mud school buildings and also bad ones. There are good concrete buildings and bad ones. The term “good” is thus not absolute, except when used in its own, narrow context. Other qualities of building or furniture such as illumination levels or size of desks and chairs can be assessed in an absolute sense of all schools in all parts of the country.
- 7.8 The criterion used in Iran for defining the quality of educational facilities was: whether the building could perform its function, and whether it was acceptable within the context in which it was used. The surveyors in Iran were simply required to make a judgment at each facility visited and to assign to it one of the three categories mentioned above. Obviously if the various teams of surveyors are not carefully trained to make similar judgments about similar buildings, the value of the survey will depreciate. In Indonesia, this particular point was dealt with in a somewhat different manner, the surveyors being provided with a list of defects categorized in ranking order. Using the items in the list, an extract from which the Annexure II has been taken all surveyors are able to rank all buildings having similar defects in a similar way, thus increasing, confidence in the survey outcomes.
- 7.9 Aside from these important factors affecting assessment of the quality of facilities – to which, subsequently, it is possible to assign a cost – it is also important that the survey provides precise information on matters such as the farthest distance travelled by students attending the institution (this will indicate whether or not more schools are needed to avoid excessive student travel); the numbers of classes and finally, the numbers and sizes of each type of teaching and non-teaching accommodation units.
- 7.10 This then, in outline, is the sort of data that the survey would provide the educational planner. In itself, it is inadequate material for diagnosis of the situation because it is not matched by any criteria of adequacy. For example, the survey of 50 rural primary schools may show that the buildings and furniture are “good” but that the total area divided by the enrolment per shift is 0.3 square meters per place. This would suggest, as a preliminary diagnosis either that there is gross overcrowding in the classrooms or that many of the children are being taught outside, in the verandah, in the garden or some other open space as surrounding.
- 7.11 The educational planner is at this stage required to establish in his or her own mind what exactly is meant by “gross overcrowding”. At what point does the area per place in classrooms reach a level at which the planner feels conditions, while not luxurious, at least are such that students can learn in comfort? The answer to this question would be regarded as a “standard” for accommodation and the diagnosis of the physical facilities situation in any country involves setting the stock of facilities against the “standards” and deciding on the shortcomings.

- 7.12 As there are large number of educational institutions with different patterns of buildings and facilities, the collection of necessary information becomes very difficult for a planner. The easy approach to diagnosing the physical facilities is that there should be a uniform pattern of institutions at each level and in each situation – urban and rural. For example all rural primary schools in a country should have, say, 5 classes, 5 classrooms, one teachers' room, one store and one toilet. Each classroom should be spacious enough to accommodate 40 students at one square meter per place. Only by establishing such a norm, the results of the survey can be matched against the set standard.

Only in this way it is possible to have a clear picture of deficiencies in buildings and equipments for which the cost of remedial action can be calculated.

The couple with the qualitative assessment mentioned earlier good, improvable, requiring replacement to which costs can also be assigned, will give the total cost of the school surveyed. By extrapolation total cost for the country can be calculated.

## **8. CONCLUSION**

The planning of teacher demand and supply is central concern of educational planners. Teacher's requirements have no autonomy of their own; they are subject to decisions pertaining to aspects like educational structures, enrolment rates, pedagogical approaches and grouping of a student, school hours and teaching loads, teacher's remuneration and so on. In other words, teacher demand is not an independent force, but is as amenable to management as teacher supply. The ultimate concern and focus of educational administration and of educational planning should be learner and his learning. It is true that the achievement of certain limited instructional objectives through teacherless system has become technically more feasible as a result of the continuous development of self instructional methods and of the adaption of mass media. Nevertheless, even where modern gadgetry has been brought into improved effectiveness of learning, we still find that in every school system the direct personal contact between pupil and teacher remains the linchpin of the educational process. The effect of the new technical devices in education has thus been not to abolish the role of the teacher but rather to assist it to evolve in a creative way from that of authoritative instruction to one of the facilitation and guidance of the learning process. Indeed the teacher has a crucial role to play in organizing the use of the media and learning aids, to give the greatest educational benefits by promoting the cause of education. The Allama Iqbal Open University is the best example of explaining the new role of teacher in a media-based university.

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## 10. TEST AND APPLY YOUR KNOWLEDGE

- Question 1: What is the purpose of the diagnosis of situation in relation to the personnel and physical facilities for education in a country or part of a country?
- Question 2: Why is the diagnosis of the position of the teaching staff critical to the process of educational planning?
- Question 3: the purpose of a sample survey is to give a “picture” of the physical facilities for education. Discuss the statement with special focus on the detailed procedure you would adopt.
- Question 4: Diagnosis requires not only an account of the state of the facilities for education but also involves the application of standards. Why is this necessary?

## 11. ANSWERS TO QUESTIONS

1. Every new plan is constructed on the existing situation. The diagnosis of the existing educational personnel helps to know the need of new staff for different levels and aspects of education in the light of the targets set in the plan. Similarly, the diagnosis of buildings and other physical facilities will help to know the need of new buildings and facilities.
2. Diagnosis of the position of the teaching service is critical to educational planning because it is the largest single component which consumes anything from 80% to 95% of the total educational budget of a country. It is also the component in which a wide variety of academic and professional qualifications come into play on workloads, salary scales and expected outcomes of education. Most problems of shortages, shortfalls in competencies and regional imbalances in distribution are also associated with the teaching service.
3. The sample survey should show the total area of accommodation available in the facilities, by level of education and by type of space (e.g. classrooms, laboratories, etc.). It should also show the amount of furniture available (desks, chairs, etc.). The number of teachers and students should be shown too so that the planners can see how much space (per student) is available and whether there are enough laboratories, toilets and staff-rooms in relation to the population using the facilities that comprise the sample. Then the sample survey should show the condition of the buildings in a sufficiently clear way to enable a technician to advise the planner on the cost of maintaining the buildings that are in good condition, upgrading the building that are totally unsatisfactory. The survey provides data on the basis of

which the planner decides or makes choices for future action (this future action is discussed in lesson unit on – Projection Techniques – Facilities).

4. Diagnosis means identification of a problem resulting from study of a situation which is presumed to be unsatisfactory. So, when the planner finds out from the survey that, for example, the area per student place in classrooms is 0, 3 square meters, he or she has no idea, *prima facie* whether or not this is satisfactory. It is only when the 0.3 m<sup>2</sup> place is judged against an area or standard which is deemed to be satisfactory, that the planner is able to state that the situation is satisfactory or not.

Thus, if the standard area per place in classrooms is regulated (as it is, for example, in Sri Lanka) at 1.0 then and if the survey showed that only 0.6 was available, the planner would diagnose the difficulty and, like the medical doctor, suggest appropriate measures to bring about an improvement.

## **Unit – 5**

# **DIGNOSTIC TECHNIQUES (Financial Analysis) (UNESCO material)**

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## **1. INTRODUCTION**

Educational Planning is an activity which demands the deployment of many diverse skills. It calls for the services of administrative officials, academic educationists and practicing teachers, economists, sociologists and statisticians and many other kinds of specialists. The value, the feasibility and the ultimate success of any education plan will depend largely on the team spirit displayed by the educational planners. In the course of team discussions, arguments can be supported or challenged and conclusion accepted or rejected, only if the economists understands the language of the educationist and if the administrator can follow the reasoning of the economist.

Main objective of this unit is to clarify the basic ideas underlying the methods of costing and analysis and the projection techniques used by the costing expert, responsible for estimating expenditure and sources of financing education.

The definitions of cost used in economics are briefly surveyed, after which the special case of education is considered, leading to the clarification and discussion of the idea of cost to the community. In this connection certain distinctions are drawn especially between money cost and opportunity cost.

## **2. OBJECTIVES**

By the time you have worked through this unit you should be able to:

- understand the concept of cost in economics
- understand the three main concerns of financial analysis in education
- list the different possible sources of educational financing
- define the term ‘opportunity costs’
- indicate the chief categories of educational expenditure ‘by purpose’
- know and avoid the more common pitfalls in financial analysis.

### **3. CONCEPT OF COST IN ECONOMICS AND EDUCATION**

Before defining cost in education, it is essential to recall the meaning of cost in economics. In general, the concept of cost comes into play in the production of goods or services i.e. (a) a cost may be expressed in terms of money or in non monetary terms: (b) cost affects a specific economic transactor, producer seller, buyer, consumer, etc.

Marshall, for example, distinguishes the real cost which corresponds to the effort and sacrifice needed to produce the goods and services, on the one hand, and the outlay consisting in payments made to owners of the factors of production on the other.

In other words the real cost of a product corresponds to the opportunity cost; it is assumed that throughout the economic life of any good, there is always a choice of alternatives and that the cost of any choice is expressed in the terms of the 'opportunity foregone' to achieve the alternatives. The money cost to the consumer of the good or service is deemed to represent a certain equivalent, in financial terms, to the real cost to the seller. Because of the existence of 'chain' of economic transactors starting from the owner or first producer and ending with the final consumer, economic logic and the laws of behaviour ensure that the cost to any given transactor down the line. For example whole-saler's cost is higher than the production cost.

#### **3.1 Education Sector**

The education sector as the producer of the service of 'education' and like any other sector of activity brings into play the same concept of cost. A closer look at the application of the concept of cost to education reveals three types of difficulty inherent in the very nature of activity of education i.e.

1. The definition of the production of education
2. The identification of the economic transactors concerned with education
3. The fact that education has the character of public service

#### **3.2 The Product of Education**

The product of education may be preservation and enlargement of the sum of human knowledge. Another product of education measured by the creation and development of a civilization and the third product is measurable by the expansion of the reserves of human resources. In the first case, the product of education is measured by the number of enrolments and in the second by the number of successes of scholastic performance. The two different definitions of products of education imply two different measurements if the quality of education produced by the same system.

In contrast to what happens in every transaction relating to goods or services, the quantity of education supplied or 'sold' by the producer is not equal to the quantity acquired or 'bought' by the consumer. In estimating total or unit costs, it is

necessary to specify clearly whether the reference is to producer cost or consumer costs; though even this assumes that a distinction can be drawn between the producer and the consumer of education.

### **3.3 The Economic Transactors Concerned with Education**

The producer may be: the education establishment, the teacher, the public authority (Ministry of Education) a private agency (in the case of private education), families (who help to bring up children at home), or any other non-formal teaching institution. The consumers are the pupils and students and also families, which are in sense buyers of education for their children. One could thus speak of:

- a) The cost to the agencies producing education, essentially education establishment and administrative or supervisory authorities, and
- b) The cost to the consumers of education essentially families.

The cost for establishment or, more generally, for education authorities corresponds to the establishment budgets; salaries upkeep and maintenance charges, supplies, depreciation, etc.

### **3.4 Education as a Public Service**

One the macroeconomic scale at the level of family or education establishment, there is no close relation between the cost to the producer – the education establishment – and the cost to the consumer – the family. In the first place, the education establishment does not, in general bear the whole of its operating costs – since the teachers are often paid direct by the central authorities. Secondly, under a free education system, the direct cost – i.e., financing by taxation – depends less on the question whether or not the family is a ‘consumer’ of education than on other factors, such as the family income.

The difficulties at the micro economic level can be explained by the fact that the activity of education has the character of a public service.

It is, therefore, natural to treat families as a whole and to consider the education authorities as a single transactor. As the budgets of education authorities are financed by families (taxation and school fees), there is a broad equality between the money cost to the producer and consumer of education. For all these reasons, we can analyse that the cost of education means: ‘the cost to the community of the expansion and functioning of the education system. The producers, sellers and consumers of education are thus merged into one and the same economic transactor. The concept of cost means that the whole of the monetary and non monetary efforts which the community devotes to education must be inventoried and consolidated.

## 4. ANALYSIS OF EDUCATIONAL EXPENDITURE

Nobody can deny this fact that analysis of educational expenditures occupies a very significant place in the whole array of the processes of educational management. In this section we would discuss the same in a bit detail. The situation demands that a question as deceptively simple as the present rate of educational expenditures has to be considered with caution.

A thorough analysis of educational expenditure will serve three purposes;

- i) To discover imbalances in the allocation of educational resources to different branches of the educational system, or to different parts of the country
- ii) To identify the factors responsible for rapid expenditure increase
- iii) To see if there are potential sources not yet tapped to finance education.

There is, of course, a variety of ways in which educational expenditure may be broken down and examined. At the heart of the matter are three basic questions;

- i) What is the source or where have funds for education come from?
- ii) What is the outlet or on what purposes has the money been spent? and
- iii) Where in have the funds been allocated in the educational system?

In other words we want information on the sources of expenditure, the purpose of expenditure and the levels and types of education which have been financed.

In the following pages we would be discussing the above three basic questions about the analysis educational expenditure, one by one.

## 5. THE SOURCES OF EXPENDITURE

You would agree with the writer of these lines that the financing of education in the past is an essential pre-requisite, if we wish to forecast the resources available for the planning period ahead. We need to know where the main financing responsibility has been so far, and which other potential sources are yet relatively untapped.

In most of the countries including Pakistan, of course, education has been financed from the same types of sources over many years. So much so, that many planners tend to be stereo-typed and have given up thinking of other possible sources. But if we take a broad and unprejudiced outlook, revenues for education could be raised in a variety of ways. They are briefly described as under:

### **Public sources**

#### **A. General Taxes**

- 1. General Taxes
  - a. on income and wealth
  - b. business taxes

2. Custom duties
3. Fees, licences, etc.

In Pakistan, in the year 1985, the government imposed education tax called IQRA Education Tax on imports.

**B. Earmarked Revenue**

1. Earmarked taxes
2. Loans
3. State Lotteries
4. Commanded labour

**C. Private Sources**

1. School Fees
2. Donations (Private, corporate or from abroad)
3. Loans

**D. Voluntary Labour:**

May include volunteers to teach at different level

The above list of possible sources of educational finance suggests many highly unconventional ideas: but some of them are being quite seriously discussed by educational economists and planners:-

Since Pakistan as you know, is already facing an acute shortage of resources, there is a dire need to explore the possibility of some more resources in education. Could we not, for example, use the proceeds of state lottery to build new schools? Could we not relieve our teachers shortage by calling on qualified private individuals to volunteer as resource persons teaching special subjects? Could the government not introduce a special surcharge on top income earners, and earmark the revenues for education? Cannot we make university students pay for the costly services offered to them, by giving them interest-free loans payable after they have graduated?

Such questions are promoted by the recognition that one of the sources of educational finance on which most countries rely, i.e. the public budget, is frequently strained to the limit. School fees, private donations and foreign aid do contribute, but their role as additional sources of educational expenditure is very limited.

Could you have a pause and think as to what is the typical mix of sources utilized to finance education in Pakistan? How has the share of educational expenditure in the public budget developed over recent years? Are there any specific revenues e.g. special taxes, earmarked for education? What contribution, in cash or kinds, comes from private sources? Have industrial corporations been involved in the financing of education?

Public sources for education are not necessarily channeled through the Ministry of Education only. Other agencies may play an important, yet often overlooked role: the Ministries of Agriculture, health, Science and Technology, Labour of Social Welfare as well as public agencies like university councils, academies for public administration, etc., very frequently carry considerable educational institutions at all levels are being run by the Army Directorate of Education. You must have come across such schools in Cantonment and Garrison areas.

In countries where the system of financing education is decentralized, provincial or state Governments as well as municipalities form an additional source of public educational expenditure. A decentralized system of financing education may have a significant advantage. It may open up new sources of revenues e.g. through taxes levied at the state or provincial level only. Decentralization may also ensure more flexibility in responding to educational needs, compared to the delays and red tape which are a common weakness of centralized systems of financing.

In Pakistan, private institutions as in many other countries, are also playing a crucial role as important educational agents, which missions and religious organizations figuring most prominently. But systems of public subsidies to these institutions coupled with certain recognition and supervision requirements, have, more often than not, eroded their significance as independent sources of educational finance. Still, private profit making institutions, particularly in secondary and higher education continue to cater to large educational clienteles.

Industry is also emerging as potential sources of private educational expenditure, albeit to much lesser extent than in industrialized countries. In Pakistan, under the Workers Children Education Ordinance of 1972, establishments with more than 20 employees are required to pay an education cess at the rate of Rs. 100/- per worker per annum.

## **6. PRIVATE COSTS BORNE BY PARENTS AND STUDENTS**

One private source of educational expenditure which never appears in our financial statistics are the parents and students themselves.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parents contribute, firstly, by paying school fees, buying school books and uniforms, bearing the costs of school transport, etc. The total size of this contribution can at best be roughly estimated, but it is surely of great importance. But parents contribute in another manner as well. In rural areas particularly, it means a high sacrifice to them to send their children to a school in the harvesting season, rather than having them work in the farm. This sacrifice cannot perhaps be measured in pennies and pounds, but that does not lessen its significance in any way. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Similarly, the students themselves, once they are a little older ‘pay’ an indirect price for their education. Their sacrifice lies in the opportunity they forego to work and receive wages or salaries for doing some other job instead of going to school.

The concept of ‘opportunity costs’ borne by parents and students may sound quite abstract and of little relevance. But in reality, it certainly is a major factor in each student’s individual decision whether or not to continue schooling and postpone earning, just as it is a factor in the decision of parents whether to keep their children in school, or to withdraw them to the farm, at least for the harvesting season.

It may be clarified here that those who enroll with the Allama Iqbal Open University are not required to pay the opportunity cost because they are not required to leave the job. That is why costs of programmes offered by the AIOU are much less costly as compared to those of formal educational institutions.

Please pause for a moment and try to figure out the opportunity cost involved for a student? In our own country, who has just completed college education and demands to go for his M. A. from a formal university which means he won’t earn any income for at least another two years. What is the decision going to cost him and his parents?

## **7. THE PRUPOSES OF EXPENDITURE**

Analysing educational expenditure by purpose is at the heart of monitoring and controlling educational costs.

By purposes’ we mean the different educational goods, facilities and services on which money has to be spend and which in combination make effective teaching learning processes possible.

Just as the management of an industrial enterprise must keep a constant check in the costs of different factors of production in order to produce its goods with a minimum-cost combination of factors, the educational cost specialist should also try to strike an optimum balance between the different ‘purposes’ on which educational funds are being spent.

Wherever the data permit, educational expenditure should be broken down and analysed according to the following main ‘purposes’: Before you proceed to the next page, pause for a while and try to identify the major purposes of expenditures in education. Jot down the same in the following space.

### **Activity**

1. ....  
.....  
.....  
.....

|    |                                      |                                                              |
|----|--------------------------------------|--------------------------------------------------------------|
| a. | expenditure on capital item          | – purchase and development of land                           |
|    |                                      | – construction                                               |
|    |                                      | – furniture and none-expendable equipment                    |
| b. | expenditure on salaries              | – teaching staff                                             |
|    |                                      | – administration and supervision staff                       |
|    |                                      | – other employees                                            |
| c. | expenditure on other recurrent items | – administration and supervision                             |
|    |                                      | – operation and maintenance of buildings and facilities      |
|    |                                      | – instructional materials, expendable equipment and supplies |
|    |                                      | – text books                                                 |
|    |                                      | – school transport                                           |
|    |                                      | – auxiliary expenses (school meals, health care, etc)        |

The items enumerated under b. and c. above form total recurrent expenditure. They are required on a regular and continuous basis to keep the educational process going; one might say they are being ‘consumed’ in the process, just as the raw materials, electricity, supplies and the time of the workers are consumed in producing the respective goods or commodity in an industrial production process. By contrast, the items under a. above constitute total capital expenditure; they are investments made at irregular intervals and with a lifetime of several fiscal years before they have to be renovated or written off.

Roughly, the amount of recurrent expenditure needed is determined by the size of the system, that is, by the existing number of students and teachers. The amount of capital expenditure, on the other hand, is determined by the number of additional students which enter it every year provided that additional arrangements will have to be made for them in terms of extra physical facilities etc. In case additional enrolment is accommodated within the existing facilities, there will be no capital expenditure for them. Developing countries, with their rapidly expanding educational system have, therefore, a particularly big burden of costly capital expenditures to carry.

It may be noted that in Pakistan expenditure on item a. is called development or non-recurring expenditure, and on item b. and c. is called non-development or recurring.

|                                                                         |
|-------------------------------------------------------------------------|
| Get hold on recent data and update these tables and analyse the trends. |
|-------------------------------------------------------------------------|

## 8. EXPENDITURE BY LEVEL AND TYPE OF EDUCATION

A breakdown of educational expenditure by level and type of education helps the planner to see what parts of the system are costliest compared with the number of students they serve. Preferably, the planner should try to obtain data on expenditure by level and type of education for consecutive years. This will give him expenditure trends for each level and type of school. By comparing these trends, he can see which parts of the educational system expand fastest. What he observes, may not always be in line with educational policy objectives.

The analysis of educational expenditure by level and type of education can serve as an important check on whether the stated priorities of educational policy are actually adhered to.

The duration, designation and other specific features of particular levels and types of education will vary from country to country with the structure of their educational systems. However, a standard classification of educational levels is applied in the UNESCO Statistical Yearbook. It distinguishes between:-

- Pre-school education
- Primary education
- Secondary general education
- Secondary technical and vocational education
- Teacher training
- Higher education
- Other types of education

Certain types of educational expenditure cannot, or not easily, be allocated by level of education. They include most prominently, general administration expenditure incurred at the Ministry of Education or at provincial education departments. Expenditures incurred for educational research, statistics and last not the least, the services of educational planning bureaus or divisions, are equally 'overhead' in nature.

In Asian countries, primary education still claims the bulk of educational expenditure. But secondary and even more so, higher education have increased their share in educational budgets during recent years. Other types of education such as adult education, education for the handicapped or vocational training for the out of school youth are still relatively neglected areas in terms of financial support received. Often the priorities officially proclaimed and the money actually allocated are clearly incommensurate.

## 9. BUDGETING IN EDUCATION

The educational system of a country, if appropriately planned, operated and supported, can play a much more important part than any other agency or institution in creating an open society that can effectively utilize the feedback from its environment, and in improving the status and the condition of the citizens.

Pakistan inherited a very weak educational set up. The masses of people were illiterate and there were very few institutions at the time of independence. The British legacy in education was continued, but it proved much to be inadequate as it failed to shorten the gap between the output of the educational sector and the manpower needs of the country. This situation calls for a more efficient and affective education system.

Since budgeting is based on the education policy and plan some basic issues in education that should be kept in mind when formulating an education policy are:

1. What should be the purpose and goals of education? In other words, what do we want the masses to achieve given their social and religious beliefs?
2. What quantity and quality of educational do we need? This automatically involves a consideration of the cost of more or better education?
3. How should changes be made in educational provisions and opportunities for achieving the pre-determined goals of education?
4. How much should education cost?
5. How much of the country's resources should the government allocate to education?

In developing countries, where the educational levels are low, the government has to play a vital role in financing educational plans. However, because of meager resources their contribution to this sector is generally very low. This leads to the question of:

1. Public vs private finance for education:
  - a) Education as a semi-public good
  - b) Education as a consumption or an investment good
  - c) Implications for economics and financing of education
2. Redistributive effect of public subsidy to education:
3. Public versus private education finance, i.e. the equity efficiency costs of education: What do educational costs consists of or what are their major types:-  
Educational costs are divided into two distinct types:
  - a) Private costs
  - b) Social costsPrivate costs can be further divided into
  - a) Direct Private Costs (which include fees etc. incurred by a student)
  - b) Indirect Private Costs (i.e. earnings foregone of all things involved.) It is also known as opportunity cost of education.

These private costs can be further subdivided into two categories.

- a) Recurring costs (i.e. salaries of the staff, expenditure on materials etc.)  
Which can be (i) Direct Recurring Costs or (ii) Indirect Recurring cost.
- b) Non-recurring or Capital costs (i.e. costs of land, building fixtures, etc.)

Recurring costs are function of the average number of students per teacher and the teacher's remuneration. Educational costs can be measured in several ways, for example:-

- a) per student
- b) per graduate
- c) per institution
- d) per teacher

A comparison between the average cost per input and per output helps in evaluating the efficiency of the education system. Student enrolment is a good indicator of input while the number of students passed are outputs. Thus the larger the number of dropouts the greater will be educational cost of an institution per student. It is by and large held that about two-thirds to three-fourths of the average input takes the first annual examination, the reminder being dropouts or repeaters in intermediate and degree colleges of Pakistan. It may also be mentioned here that variations in student-teacher ratio also affect the total cost per student. The higher the ratio of teacher's salaries in the total cost, the greater the significance of student-teacher ratios and the average teacher remuneration in explaining cost variations.

## 10. CONCLUSION

Before concluding this unit, it may be useful to summarize major considerations about expenditure data which the educational planner must bear in mind when carrying out a financial analysis:

- i) Where educational expenditures are financed from different sources, it is usually difficult to get a consolidated figure of total educational expenditure.
- ii) Mostly the educational planner deals with public education expenditure only. For expenditure from private sources, he depends on crude estimates has been the case in Pakistan.
- iii) Within public expenditures on education, more often than not only those of the Ministry of Education are readily available.
- iv) Sometimes even the Ministry of Education and the public authority responsible for higher education publish their expenditure data separately which may contain contradictions.
- v) Educational budgets give intended, not actual expenditures. Information on actual expenditures incurred is on the other hand available only with great delay.
- vi) In the case of transfer payments from central level to provinces, districts, or to subsidized private schools double-counting of expenditures must be avoided.

Financial analysis as discussed looks at educational expenditure patterns with four questions in mind:-

- One which source of finance have we relied most heavily, and which others can we utilize better in future years?
- On what have we spent our educational money? On teachers pay, on buildings, equipment, textbooks, scholarships?
- How has our cost-structure changed in this respect?
- What branches (levels, types) of the educational system cost us most clearly.

All of these questions are restrospective and diagnostic. But their real purpose lies in future application:-

|                                                                              |
|------------------------------------------------------------------------------|
| Financial analysis as a diagnostic technique helps the educational planner:- |
|------------------------------------------------------------------------------|

- |                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>i) to project future costs as well as future resources available for education;</li><li>ii) to rationalize future patterns of educational spending.</li></ul> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## 12. TEST AND APPLY KNOWLEDGE

Four questions are given below to assist you in applying what you learnt in this unit to your work. Please find suggested answers on the page.

- Question 1:       What does the term ‘opportunity cost of education mean to you?
- Question 2:       In country W Education expenditures of the Ministry of Education in 2012 amounted to provincial education departments and Rs. 8 million payments to provincial education departments and Rs. 8 million subsidies to private schools. Provincial education departments incurred expenditures of Rs. 27 million. Educational expenditure of other government agencies were Rs. 5 million. How much was the total public expenditure on education in the year 2012.
- Question 3:       In 2013 country X purchased 20 schools buses from each of its provinces. 5percent purchase price was included as maintenance and operation costs in its educational budget. If you were to classify these expenditures ‘by purpose’, what categories would you use?
- Question 4:       Name some types of educational expenditures which are not easily classified by level.

### 13. SUGGESTED ANSWERS

- Question 1: To phrase 'opportunity costs of education' refers to the financial sacrifice (the 'income foregone') by a student who, instead of accepting a job and drawing a certain salary, chooses to continue his or her education for a given period of time.
- Question 2: The total public educational expenditure of the country in 2012 is Rs. 12 million from the Ministry of Education to the provincial education departments are not to be counted, as these are already contained in the Rs. 27 million expenditures shown by the provincial departments.
- Question 3: The purchase of school buses is to be included in the category of capital expenditure, whereas maintenance and operation costs are to be classified by level.
- Question 4: The following can be cited as examples of expenditures which are not easily classified by level:-
- Expenditure on gathering, analysing and publishing educational statistics;
  - General administration expenditures at the central level;
  - Funds for educational research in institutions attached to the Ministry such as curriculum development centers; and
  - Expenditure incurred by educational planning divisions.

## **Unit – 6**

# **DIAGNOSTIC TECHNIQUES (PUPIL FLOW)**

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**2012**

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## **A Word to the Student**

The phenomenon of the analysis of student flow has always been one of the corner stones of human considerations while planning for education at different levels. This concept entails the most judicious use of resources, which have always been limited vis-à-vis the human desires. This is because of the fact that education is primarily the major tool of agent used for preparing human resource in a country. Obviously, the need and importance of this type of the analysis of student flow cannot be over-emphasized for a developing country like Pakistan and the need and importance of this type of exercise becomes all the more greater in the realm of educational planning and management, wherein we are concerned with getting optimum output from minimum input required for that purpose.

The literature on the analysis of student flow is replete with discussion on different methods of analysis of student flow. In this unit, an attempt has been made to discuss different aspects of these methods in the light of different types of data required for that purpose.

Extensive use has been made of different sources mentioned in the bibliography. The same is gratefully acknowledged. I understand that there must be space for further improvement of the content and the format, which will be taken care of in due course of time during subsequent revisions of the course.

Dr. Allah Rakha Saghir

## 1. INTRODUCTION

Study of the fate of a group of pupils admitted in grade 1 of a system of education has always been a matter of interest for educational planners and managers. It tells us as to what happened to how many or how many dropped out, how many repeated in different grades and how many actually completed their cycle of education they entered. This process is known as cohort analysis. Let us further get into the phenomenon. Consider the hypothetical case of a newly established school opening with 100 pupils taking admission in grade I and then conceive the future of this group extended over a period of five years, some of them dropping out, some of them repeating the same grade and some of them moving on to the next grade. Also suppose that the school takes a policy decision of not admitting any other pupil in any class unless the entire group of 100 pupils leaves the school either through dropout, promotion or some of them repeatedly attending different grades till the last pupil is out of school from whatever grade. You will observe that those who complete the primary level examination will be doing so in different time periods, some of them completing the five-year study in five years, some of them six years or even seven years or so and some of them eventually leaving the school after repeated failures or so. Understood in this sense, when we study the fate of this group for the purpose of studying their movement in different directions from the same grade, we shall call it a cohort of 100 pupils. In this way, a cohort is a group of persons who jointly experience a series of specific events over a period of time.

One of the UNESCO publications defines a 'school cohort' as a 'group of pupils who join the first grade of a given cycle in the same school year, and subsequently experience the events of promotion, repetition, dropout or successful completion of the final grade, each in his/her own way'.

Boys/girls of school age group enter the school system through what we call 'admission' for which the government takes a policy decision and fixes the upper and the lower age-limits. For example, in Pakistan, the age limit for admission in grade I is 5 to 9 years. Admission rate i.e. number of new entrants as percentage of the total population of that age-group determines the in-school population of the group. Across the country, there is a possibility of gender and area variations regarding the admission of pupils in grade I. However, the fact remains that the target of universalization of primary education can only be achieved if the admission rate comes out to be 100 percent of the relevant age-group.

## **2. OBJECTIVES**

It is expected that after a thorough study of this unit, the students will be able to:

1. define cohort and describe the different methods of cohort analysis;
2. identify and use the most appropriate method/s of cohort analysis in the light of data available on different rates relevant to cohort analysis;
3. describe the assumptions of cohort analysis in general and those of the reconstructed cohort analysis, in particular;
4. calculate the ideal and actual input-output ratios for cohort analysis;
5. calculate the coefficient of efficiency and interpret it in the context of cohort analysis;
6. find out the wastage ratio and interpret it vis-à-vis the coefficient of efficiency.

### 3. SOME BASIC CONCEPTS IN COHORT ANALYSIS

Pakistan, a country characterized by a high population growth rate up to the recent past has still a huge number of children waiting for adequate educational facilities at their door-steps. In spite of having more than a dozen of education policies and a series of Five Year Plans, even in the year 2009, the literacy rate (10 plus population) just touches the figure of 54 percent. Increasing demand for schooling facilities is also coupled with an equally important phenomena of drop-out, repetition and progression which have got serious repercussions for the ultimate output of the system. Therefore, if we want to enhance the output of the system for increasing literacy rate and other important indicators of education, we must urgently address the above-mentioned rates at different levels of education, in general and those at primary level, in particular.

With the above concern in view, in this Unit, we will be looking into the phenomena of repetition, promotion and dropout and discuss certain methods and techniques used for determining their impact on the overall efficiency of the education system at primary level. We shall be doing this by studying the pupil flow over the years. But, before we proceed further, it is essential to understand the nature of these terms in the context of analysis of pupil flow. Some of these terms are described below:

1. Cohort: A group of persons who jointly experience a series of specific events over a period of time. Hence, a 'school cohort' is a group of pupils who join the first grade of a given cycle in the same school year, and subsequently experience the events of promotion, repetition, dropout or successful completion of the final grade.
2. Pupils of grade 1: Pupils of grade 1 consist of the following two categories: (i) New entrants, and (ii) Repeaters from the last year's grade 1.
3. Promotion rate: Percentage of pupils completing a particular grade and moving on to the next grade, for example, from grade 1 to grade 2.
4. Repetition rate: Percentage of pupils not completing the requirements for moving on to the next grade, and hence remaining in the same grade, for example, a pupil of grade I remains in grade 1.
5. Dropout rate: Percentage of pupils discontinuing their education and leaving the school without completing a particular grade or level of education.
6. Cohort analysis: A process of tracing the flow of a given cohort (group of pupils) through their promotion, repetition, drop out and completion of the final grade of the cycle.
7. Efficiency of the system: Relationship between the inputs (for example, boys enrolled in grade 1) of and the outputs from a system (e.g. number of boys completing primary education i.e. grade 5).

8. Wastage ratio: Reciprocal of the measure of efficiency or the input-output ratio used as a measure of the resources going waste.

While going through this unit, you should appreciate that the exercise on cohort analysis will have to include the calculation of all the above-mentioned rates and ratios etc. and ultimately end up with our discussion on the relationship between coefficient of efficiency and wastage ratio.

## 4. METHODS OF COHORT ANALYSIS

Analysis of educational internal efficiency is extremely essential in educational planning. One of the UNESCO sources<sup>1</sup>, describes three different ways to analyze educational internal efficiency by means of the cohort pupil flow method, depending on the type of data collected. You may also call them the three types of cohort or the three methods of cohort analysis. Based on the said source, these methods of cohort analysis have been described as follows:

### 4.1 The True Cohort Method:

The true cohort analysis may be used if we have data on promotion, repetition and dropout of the cohort. It derives its name from the very fact that we use the true or actual data in cohort analysis. However, this ideal way to undertake cohort analysis involves (i) either longitudinal study in monitoring the progress of a selected cohort of pupils through the educational cycle, or (ii) through retrospective study of school records in order to retrace the flows of pupils through the grades in past years. This method, however, is more costly and time-consuming and requires a good and reliable school-records system based on some sort of individualized pupil information. For this reason, this method is not yet generalized and is hence very rarely used.

It may be mentioned here that in the absence of individualized pupil information, internal efficiency in education can be determined on the bases of data on repeaters by grade together with enrolment by grade for at least two consecutive years using either the apparent or reconstructed cohort method, described in the following pages.

### 4.2 The Apparent Cohort Method:

The apparent cohort analysis is used when we have data on promotion, and dropout, but not on repetition. In that case, the enrolment in grade 1 in a particular year is compared with enrolment in successive grades during successive years and it is assumed that the decrease from each grade to the next one corresponds to the wastage occurring during the process. This method, the most commonly used so far, produces very approximate estimates of drop-out. However, its main weakness is its assumption that pupils are either promoted or else drop-out

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<sup>1</sup> [http://www.uis.unesco.org/i\\_pages/indspec/eff-box.html](http://www.uis.unesco.org/i_pages/indspec/eff-box.html)

of the school system and, therefore, repetition as a factor of paramount importance is overlooked. For this very reason, this method is considered quite appropriate for countries applying the policy automatic promotion at the given level.

#### **4.3 The Reconstructed Cohort Method:**

More pertinent and commonly used method for cohort analysis is the reconstructed cohort method which places less demand on the availability of detailed data over time. This method was for the first time used by UNESCO in the year 1969 in world-wide survey. This method of cohort analysis uses successive year class-wise data on enrollment and repeaters. This method stands out as the most widely used method for undertaking cohort analysis.

##### **4.3.1 Major assumptions behind the use of reconstructed cohort method:**

The methodology of reconstructed cohort flow model is based on the following assumptions regarding the pupils enrolled in a given grade in a certain year:

- i. There could be only three eventualities:
  - a. Some of them will be promoted to the next higher grade in the next school year;
  - b. Some of them will drop-out of school in the course of the year;
  - c. The remaining will repeat the same grade in the next school year.
- ii. There will be no additional new entrants in any of the subsequent years during the life-time of the cohort;
- iii. All calculations will be based on the original cohort of pupils. In our subsequent discussion on this method, we shall base it on the figure of 1000 pupils;
- iv. At any given grade, the same rates of repetition, promotion, and drop-out apply, regardless of whether a pupil has reached that grade directly or after one or more repetitions (hypothesis of homogenous behaviour);
- v. Flow rates for all grades remain unchanged so long as members of the cohort are still moving through the cycle.

To apply this method, data on enrolment by grade for two consecutive years and on repeaters by grade from the first to second year will be sufficient to enable the estimation of three main flow-rates: promotion, repetition and drop-out. Once obtained, these rates may be analyzed first of all by grade to study the patterns of repetition and drop-out. Then, they are used in a reconstructed pupil-cohort flow to derive other indicators of internal efficiency.

## **5. APPLICATION OF THE RECONSTRUCTED COHORT METHOD: A CASE-STUDY**

This section contains a brief account of the application of the reconstructed cohort method in the form of a case-study of Papua New Guinea, as mentioned by the above-quoted reference of UNESCO. You should know that there are two major phases that lead to the reconstruction of the cohort. Let us proceed further and see how we can apply

these two phases in the case of data on Papua New Guinea for illustrating the use of reconstructed cohort analysis.

### 5.1 Computation of flow-rates using data on enrolment and repeaters by grade:

One of the UNESCO sources illustrates the use of reconstructed cohort method using the Papua New Guinea data on primary education. Let us see how it was used.

| Grades         | 1       | 2       | 3       | 4      | 5      | 6      | Graduates |
|----------------|---------|---------|---------|--------|--------|--------|-----------|
| 1993 Enrolment | 123 702 | 111 058 | 95 690  | 69 630 | 56 478 | 41 311 | 19 735    |
| 1994 Enrolment | 129 700 | 113 882 | 112 433 | 78 758 | 62 692 | 45 429 |           |
| Repeaters      | 33 539  | 27 067  | 33 545  | 22 740 | 20 476 | 14 513 |           |

The methodology of the reconstructed cohort flow model is based on the fundamental concept that in a certain year, the pupils will either dropout, or repeat in the same grade or be promoted to the next grade. Based on this concept, the above data for Guinea permit the computation of the following three flow-rates:

For Grade 1:

- Promotion rate is 70.2%: Out of 123,702 pupils in grade 1, 86,815 i.e. 70.2% were promoted. Just understand that 113,882 were enrolled in grade 2 in 1994 and if we deduct 27,067 who repeated in that grade i.e. in grade 2 in 1994, we get 86,815 which is 70.2% of 123,702 initially enrolled in grade 1 in 1993.
- Repetition rate is 27.1%: Out of the 123,702 pupils enrolled in grade 1 in 1993, 33,539 of them i.e. 27.1% repeated in the same grade i.e. grade I.
- Dropout rate is 2.7%: Since the dropout rate is 27.1% and promotion rate is 70.2%, the residual of 100 is 2.7% which is obviously the dropout rate. Let us verify it; out of 123,702 pupils, 33,539 repeated, whereas 86,815 were promoted. Dropouts =  $123,702 - (33,539 + 86,815) = 3,348$  which is 2.7% of the initial enrolment of 123,702 in grade 1 in 1993.

The corresponding flow-rates for grade 1 are  $p = 0.702$ ;  $r = 0.271$ ; and  $d = 0.027$ , adding up to 1 or 100%.

For Grade 2:

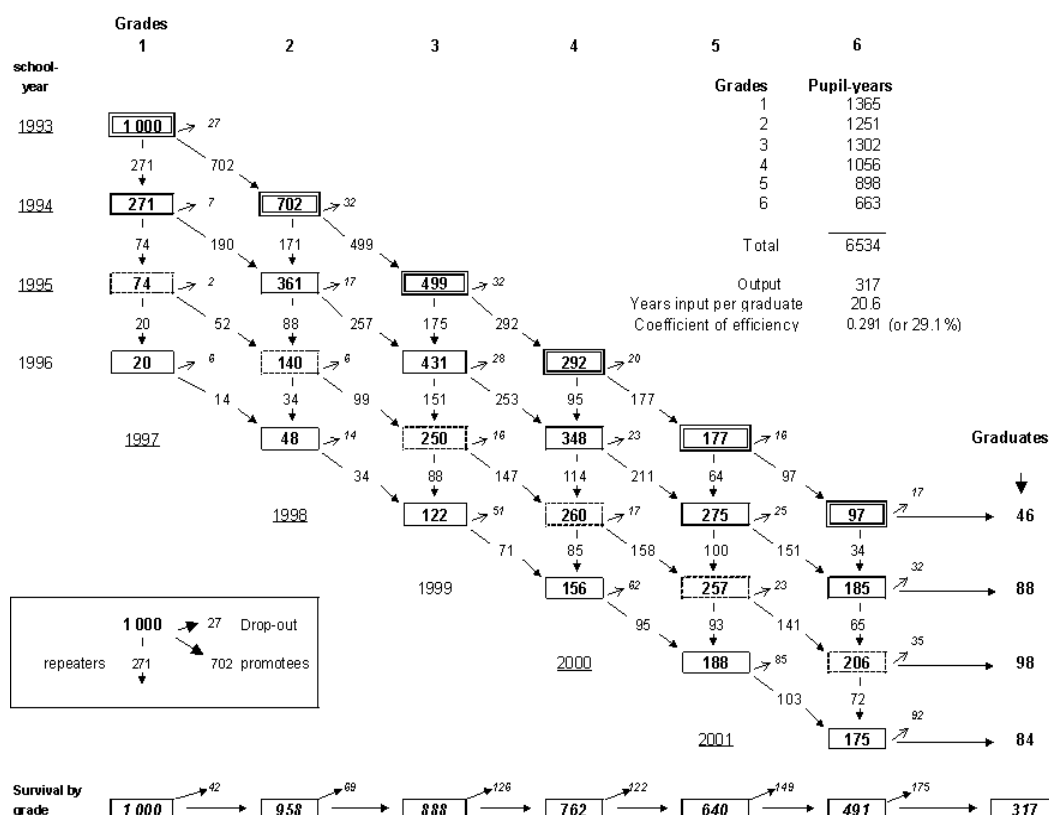
- Promotion rate is 71.0%: Out of the 111,058 pupils enrolled in grade 2 in 1993, 78,888 i.e. 71.0% repeated in the same grade i.e. grade 2 I 1994.
- Repetition rate is 24.4%: Out of the 111,058 pupils enrolled in grade 2 in 1993, 27,067 i.e. 24.4% repeated in the same grade i.e. grade 2.
- Dropout rate in 2.7%:  $100 - (71.0 + 24.4) = 4.6\%$ .

In this way, the corresponding flow-rates for grade 2 are  $p = 71.0$ ;  $r = 24.4$ ; and  $d = 4.6$ , adding up to 100%.

If we apply the same type of computation on a grade-by-grade basis, as we did for grades 1 and 2 above, we obtain the following flow-rates for all the grades i.e. from grade 1 to grade 6:

| Grades               | 1     | 2     | 3     | 4     | 5     | 6     |
|----------------------|-------|-------|-------|-------|-------|-------|
| Promotion rates (p)  | 0.702 | 0.710 | 0.585 | 0.606 | 0.547 | 0.478 |
| Repetition rates (r) | 0.271 | 0.244 | 0.351 | 0.327 | 0.363 | 0.351 |
| Drop-out rates (d)   | 0.027 | 0.046 | 0.064 | 0.067 | 0.090 | 0.171 |

In the case of reconstructed cohort flow model, these very flow rates are assumed to be followed in all grades in subsequent years as they are. Now based on the above-mentioned flow rates, we take up an assumed enrolment of 1000 in grade I in the year 1993 and go on applying them in subsequent years and grades. This gives us the reconstructed cohort as under:



REFERENCE: [http://www.uis.unesco.org/i\\_pages/indspec/eff-box.html](http://www.uis.unesco.org/i_pages/indspec/eff-box.html)

## 5.2 Application of Flow Rates in Cohort Analysis:

Let us now apply the flow-rates calculated in the previous section for the analysis of cohort. Since we are using the Reconstructed Cohort Method, as per the above-mentioned source, in case of grade 1, we take the cohort figure as 1,000 pupils (instead of the actual 123,702 pupils), and find that 271 pupils repeated grade I (27.1%); 27 dropped-out (2.7%), and 702 were promoted to grade 2 (70.2%). Likewise, we use the flow-rates for grade 2 on the 702 pupils reaching grade 2, we can easily discover that 171 repeated grade 2 (24.4%); 32 dropped-out (4.6%), and 499 were promoted to grade 3 (71%) and so on. You may appreciate one thing: “the first diagonal row in the diagram is obtained by multiplying the successive promotion rates for successive grades and successive years. The repetition and drop-out rates are then applied to obtain the second, the third and the fourth rows.” Since in the reconstructed cohort, we get the 100% of the cohort accounted for, there is no need to go for the fifth diagonal row.

For the purpose of an exercise, with the help of above diagram, try to find out answers to the following questions and write in the space given against each: Take help from the following example.

|                                                                                                 |    |
|-------------------------------------------------------------------------------------------------|----|
| For example: Out of 1000 pupils, how many graduated from the cycle without repeating any grade? | 46 |
|-------------------------------------------------------------------------------------------------|----|

Now proceed on to the following:

|                                                                    |     |
|--------------------------------------------------------------------|-----|
| How many graduated with a one year delay?                          |     |
| How many graduated with two years delay, i.e. they repeated twice? |     |
| How many graduated after repeating three times?                    |     |
| HINT: The total number of graduates comes to the tune of           | 317 |

## 6. EFFICIENCY IN EDUCATION

### 6.1 Meaning of Efficiency:

The concept of ‘efficiency’, as used by economists, refers to the relationship between the inputs into a system (such as seeds, number or pupils) and the outputs from that system (e.g. wheat, chairs or graduates). In education system, its efficiency is best measured by analyzing the student cohort. According to a UNESCO Bangkok publication<sup>2</sup>, however, measuring the efficiency of education systems is problematic due to difficulties in defining and measuring educational outputs, as well as in quantifying the relationship between inputs and outputs. An education system is considered to be efficient if it produces at a minimum cost the desired output in terms of a maximum number of young people who have acquired the necessary knowledge and skills prescribed by society. Stated differently, an education system is considered to be efficient if for a given input of

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<sup>2</sup> <http://unesdoc.unesco.org/images/0011/001139/113958e.pdf>

resources (human, financial and material), it maximizes the desired output, both in quantity and quality. While recognizing that education has various objectives, educational statisticians and planners measure the output of the school system in a simple way. They assume that the output of a given cycle of education is the number of pupils who complete the cycle, i.e. the graduates. Of course, this is a rather restricted definition since even the pupils who dropped out of school did acquire some of the knowledge and skills that the system intended to teach them. But, since there is no formal certification in such cases, such pupils dropping out of school are treated as dropouts.

This way of measuring output gives some useful insights into the functioning of an education system. Educational inputs comprise the buildings, teachers, books and other learning materials, which may be aggregated and expressed in terms of expenditure per pupil per year. One pupil who spends one year at school is said to have spent one pupil-year. The usual input indicator that corresponds to output measured in terms of graduates (or those who complete Grade 5, for example) is the number of pupil-years used by a given pupil cohort (i.e. a group of pupils that enters the first year of school together). To some extent, the amount of inputs expressed in monetary terms is related to the number of pupil years used to produce the output.

It has to be noted that any additional years spent to graduate pupils beyond the prescribed duration of a cycle of studies constitute an inefficient allocation of resources, yielding a coefficient of efficiency of less than 100 per cent (or unity).

## **6.2 Types of efficiency:**

We know that in the context of our present discussion, pupils entering the system form input in the system, whereas their number graduating from the system form out-put. This phenomenon is known as 'efficiency' of the system. As already mentioned in the foregoing pages, there are two types of efficiency: (i) Internal efficiency, and (ii) External efficiency. It may be put forth that the external efficiency refers to the expectations of the society in terms of the objectives of a particular level of education and hence its measurement poses lot many problems because of the fact that there are several gray concepts which are prone to so many interpretations. Moreover, it is not immediately relevant to our topic about cohort analysis which deals with multi-dimensional study student flow. **Hence, in the following pages, our focus will be on the concept of internal efficiency and its measurement.**

## **6.3 Basic concepts related to internal efficiency:**

The concept of internal efficiency has two main advantages (measurability and analytical clarity) as a tool of educational diagnosis. However, it can easily lend itself to over-interpretation. The limitations of the educational internal efficiency must, therefore, be recognized and respected. These limitations are related to the weaknesses of some of the key-concepts used to define efficiency in education, such as the following:

- i. Inputs:** In the context of cohort analysis, input refers to the number of pupils on roll in a starting year of the cycle which are subsequently destined to meet any of the three eventualities: either they are promoted and enrolled in the next grade, or

they are the dropouts or they repeat and remain in the same grade. While at school, each pupil has to be provided with the services of a teacher, necessary furniture, curriculum and other requisite facilities. In this way, longer the stay of a pupil in the system, higher the costs and hence the wastage. However, as pointed out earlier, for the purpose of cohort analysis, inputs consumed by a pupil are measured in terms of pupil-years.

- ii. **Outputs:** Following facts need consideration in connection with outputs. (a) the fact that the output is equated with number of graduates gives a very narrow view of the education process and its contribution to economy and society; (b) the fact that grade repetition is considered as wasteful (and automatic promotion accordingly as raising efficiency) is not entirely justified by insights into the positive and negative effects of repetition; (c) the fact that no output value whatsoever is accorded to the years spent by drop-outs in school, ignores research on threshold of literacy retention.
- iii. **Process:** the concept of internal efficiency in education is applicable only to those educational processes which follow the age/grade-pattern of conventional formal schooling.

Some more facts, such as the following, need to be considered with regard to the efficiency: (a) internal efficiency does not necessarily ensure external efficiency; in reality, the two concepts frequently militate against each other; (b) the reduction of educational wastage through higher internal efficiency will not necessarily, contrary to popular beliefs, entail any budgetary savings: if the elimination of grade repetition happens by decree, it will remain ineffective in terms of learning achievement; if it is backed up by remedial teaching, unit costs of education may be increased; (c) where drop-out is to be reduced through lowering drop-out rates, the accommodation capacity of school systems will have to be increased accordingly, particularly in the higher grades: educational budgets will rise as a consequence.

#### **6.4 Measurement of Internal Efficiency:**

Before we move on the method used for measuring the internal efficiency, it may be made clear that the target of perfect efficiency is neither achievable nor achieved in actual life. This is because of the fact that in actual practice, there do occur deviations from the standard of perfect efficiency. If for example, in a catchment area, 1000 students enter a system, neither all of them will dropout reducing the total output to zero, nor all of them will manage to complete the cycle within the minimum given time period. However, may be in very rare cases at micro level in a school, say all the 50 students taking admission in grade I manage to become graduate without any loss whatsoever, even, that may be very rare; but still it is till more likely to happen at local level more that at Union Council, Tehsil or District level. Larger the circle, lesser the chances of achieving 100 percent efficiency. In a 'perfectly efficient' system, this coefficient would equal 100%, and inefficiency arises when it is lesser than 100% (If the input-output ratio is used instead, the perfect state would be 1, and inefficiency arises from any point which is greater than 1.

#### 6.4.1 Concept of coefficient of efficiency:

Internal efficiency of a system is measured in terms of the Coefficient of Efficiency (CE). According to the technical guidelines given by the UNDP, UNESCO<sup>3</sup> in connection with the assessment of Education for All (1998), the concept of Coefficient of Efficiency refers to “the ideal (optimal) number of pupil-years required (i.e. in the absence of repetition and drop-out) to produce a number of graduates from a given school-cohort for a cycle or level of education expressed as a percentage of the actual number of pupil-years spent to produce the same number of graduates. Input-output ratio, which is the reciprocal of the coefficient of efficiency, is often used as an alternative.” According to the said source of UNDP-UNESCO, this is a “synthetic indicator of the internal efficiency of an educational system. It summarizes the consequences of repetition and drop-out on the efficiency of the educational process in producing graduates.” Now you are in a better position to understand the concept of Coefficient of Efficiency.

According to definition given by UNESCO<sup>4</sup>, Coefficient of Efficiency refers to the ideal (optimal) number of pupil-years required (i.e. in the absence of repetition and drop-out) to produce a number of graduates from a given school-cohort for a cycle or level of education expressed as a percentage of the actual number of pupil-years spent to produce the same number of graduates. Input-Output ratio, which is the reciprocal of the coefficient of efficiency, is often used as an alternative. It may be noted that one school-year spent in a grade by a pupil is counted as one pupil-year. Hence, to find out the CE, just divide the ideal number of pupil-years required to produce a number of graduates from a given school-cohort for the specified level of education, by the actual number of pupil-years spent to produce the same number of graduates, and multiply by 100.

The coefficient of efficiency is one synthetic indicator of educational efficiency. It summarizes the consequences of repetition and drop-out in the educational process leading to the ‘production’ of graduates. It is calculated as the ratio, expressed as a percentage, between:

- i. the optimal/ideal number of pupil-years that would be required to complete a cycle of education if no pupils repeated grades or dropped out, and
- ii. the actual number of pupil years spent by a pupil cohort to complete the cycle.

Hence, for finding out the CE, we divide the optimal/ ideal number of pupil-years required to produce a number of graduates from a given school-cohort for the specified level of education, by the actual number of pupil-years spent to produce the same number of graduates, and multiply the result by 100. So the calculation of the Coefficient of Efficiency requires the calculation of pupil years, both optimal/ideal and actual.

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<sup>3</sup> UNDP, UNESCO, Education for All: The Year 2000 Assessment Technical Guidelines, INTERNATIONAL CONSULTATIVE FORUM ON EDUCATION FOR ALL, Paris, August 1998.

<sup>4</sup> [http://www.uis.unesco.org/i\\_pages/indspec/tecspe\\_cefficiency.htm](http://www.uis.unesco.org/i_pages/indspec/tecspe_cefficiency.htm)

#### 6.4.1.1 Computation of Pupil Years:

As mentioned earlier, to find out CE, we have to compute two types of pupil years:

##### i. Optimal/ideal pupil years:

Continuing with the above data about Papua New Guinea, we can compute the optimal/ideal pupil years in the following manner. For grade 1, we obtain  $27+7+2+6 = 42$  drop-outs, which when subtracted from 1000 would give 958 survivals. Finally by summing the drop-outs from each grade ( $42+69+126+122+149+175$ ) we find a total of 683 pupils who dropped out without completing primary education (as graduates). Thus, out of the initial pupil-cohort of 1,000, only 317, or about 32 per cent, graduated from the primary cycle.

Multiplying this number of graduates by the number of grades ( $317 \times 6 = 1902$ ) would give the ideal number of pupil-years required to produce the graduates. It means that under the Papua New Guinea system of education, where primary education is of 6 years duration, the number of primary school graduates i.e. 317 multiplied by 6 gives us the **total number of ideal of years i.e. 1902**, which may be taken by them to complete their education without an wastage. The ratio between the ideal and then the actual number of pupil-years used by the cohort gives the coefficient of efficiency.

##### ii. Actual pupil years:

You may note that for finding out the actual pupil years at each grade level, we add up the number of students in a particular grade during different years. For example, pupil-years for grade I come to the tune of  $1000+271+74+20$  or 1365. Likewise, with the help of flow diagram given above, you may find out the actual pupil years as under:

| Grade                                     | Break-up of actual pupil years | Grade-wise actual pupil years |
|-------------------------------------------|--------------------------------|-------------------------------|
| 1                                         | $1000+271+74+20$               | 1365                          |
| 2                                         | $702+361+140+48$               | 1251                          |
| 3                                         | $499+431+250+122$              | 1302                          |
| 4                                         | $292+348+260+156$              | 1056                          |
| 5                                         | $177+275+257+188$              | 897                           |
| 6                                         | $97+185+206+175$               | 663                           |
| <b>Total number of actual pupil years</b> |                                | <b>6534</b>                   |

#### 6.4.2 Computation of coefficient of efficiency:

For computing the coefficient of efficiency, we may take up the data for Papua New Guinea as put forth in a UNESCO document<sup>5</sup> mentioned in the foregoing pages. Go through the data and find out the Coefficient of Efficiency using the ideal and the actual number of years.

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<sup>5</sup> [http://www.uis.unesco.org/i\\_pages/indspec/efficiency.htm](http://www.uis.unesco.org/i_pages/indspec/efficiency.htm)

| Measures                                                                                                                                                         | Values                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Ideal number of pupil-years required to produce graduate                                                                                                         | This is 6, because the duration of primary cycle is six. |
| The total ideal years for producing 317 graduates at the rate of 6 years per graduate                                                                            | 1902                                                     |
| The actual pupil-years spent to produce the same number of graduates i.e. 317.                                                                                   | 6534                                                     |
| Now find out the value of Coefficient of Efficiency as under:<br>Total number of ideal years ÷ Total number of actual years<br>$1902 \div 6534 = 0.291$ or 29.1% |                                                          |

## 7. WASTAGE RATIO

Having discussed the concept of coefficient of efficiency and its different aspects in detail, we now pass on to the next concept viz. the Wastage Ratio. Wastage ratio occurs in two forms: firstly, in the form of dropout and secondly in the form of repetitions of classes (stagnation). When a pupil leaves the school before completing the course it is termed as dropout whereas failing once or more before gaining promotion to the next higher class falls under the category of repetition of classes. As a matter of fact, it is the reciprocal of coefficient of efficiency and since the optimum input-output ratio is unity i.e. 1, inefficiency or wastage arises from any point which is greater than one. According to Ashrof (1999)<sup>6</sup>, as quoted by Lalit Kishore, “The total wastage in education is indicated by the number of repeaters and drop-outs. Generally, the indicators of educational wastage give a sense of internal efficiency of the system. The true cohort for wastage in primary education can also be calculated by five different methods. These being: (a) Input-output ratio; (b) Input per graduate; (c) Wastage ratio; (d) Wastage on account of repeaters and drop-outs; (e) Average duration of stay. As you can understand, each of these measures hints at different aspect of functioning of the system. For that reason, their values have to be different. Therefore, WR has universally been accepted as the true measure of wastage.

Wastage ratio is basically the reciprocal of the measure of efficiency which we have seen indicates as to what extent the system has been successful in producing the maximum number of graduates with minimum wastage at different grades in different years starting from grade I to grade 6, in the case of Papua New Guinea. In the case of data presented above, the coefficient of efficiency is 29.10%. Now let us proceed on to the process of calculating the Wastage Ratio based on the above data. The data required for calculating the Wastage Ratio include the following:

1. Actual input in the system in terms of pupil years:6534
2. Actual output of the system in terms of graduates:317
3. Ideal input of the system in terms of pupil years:1902

<sup>6</sup> Lalit Kishore, Wastage in Education as found on the site:  
<http://www.mynews.in/fullstory.aspx?storyid=9840>

4. Ideal output of the system in terms of graduates:317

The Wastage Ratio can be calculated with the help of following formula:

1. Find out the actual input-output ratio: This is nothing but the actual number of pupil years divided by the actual number of graduates produced by the system, which is (in the above example quoted from UNESCO) 6534 divided by 317 and it is 20.1

| <b>Actual Input-output Ratio</b>          | <b>÷</b> | <b>Ideal Input-output Ratio</b>                                                                                                                                                                                                                                                                                      |
|-------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6534 pupil years divided by 317 graduates | ÷        | This is 6. Why? because under an ideal situation, if all the pupils (1000) enrolled in a cohort complete graduation, without any dropout or repetition, in six years, the average number of years taken by the cohort for graduation will be six. Or we can say that $6000 \div 1000 = 6$ , or $1902 \div 317 = 6$ . |
| 20.61                                     | ÷        | 6                                                                                                                                                                                                                                                                                                                    |

2. Divide the actual input-output ratio by the ideal input-output ratio and find out the Wastage Ratio as under:

|                   |   |                        |
|-------------------|---|------------------------|
| The Wastage Ratio | = | $20.61 \div 6 = 3.435$ |
|-------------------|---|------------------------|

Likewise, we can also find out the WR by using the values used for calculating the CE ( $1902 \div 6534 = 0.291$ ), simply by inter-changing the places of these values. Then we get the WR as  $6534 \div 1902 = 3.435$ , which is exactly the same as calculated above. So, it is clear from the above calculations that the CE is 0.291 and the WR is 3.435.

As has already been spelled out above, under ideal situation the value of ratio between actual input-out ration and ideal input-output ratio will be equal to 1 and any increase in this value indicates the inefficiency of the system. Hence, according to our above calculated value, the system of Papua New Guinea was not functioning to the highest level of its efficiency. In this case, it is higher than 1. It means that the primary school graduates were being produced at more than thrice the ideal cost.

#### **LET US VERIFY IT:**

Had the system been functioning efficiently, the Coefficient of Efficiency or the ideal Input-output ÷ actual Input-output Ratio would have been  $6 \div 6$  or 1. In that case, all the 1000 pupils admitted in grade I in the year 1993 would have become graduates without any repetition or dropout, meaning thereby that there would not have been any wastage in the system.

## 8. COMPARISON BETWEEN COEFFICIENT OF EFFICIENCY AND WASTGE RATIO

Can you recall that in the very beginning of this study unit we defined the Wastage Ratio as a reciprocal of the measure of efficiency or the input-output ratio used as a measure of the resources going waste. Now before you understand and appreciate the relationship between the two, you must know that according to the Encyclopedia Encarta, 2005<sup>7</sup>, in mathematics by reciprocal we mean a number or quality that is related to another by the fact that when multiplied together the product is one or 1. Understood in this sense, you should appreciate that:

|      |                |          |                         |                       |                                             |
|------|----------------|----------|-------------------------|-----------------------|---------------------------------------------|
| CE = | $6 \div 20.61$ | $=0.291$ | Now see the next column | $1 \div 0.2911=3.435$ | Just see the reciprocity between CE and WR. |
| WR=  | $20.61 \div 6$ | $=3.44$  |                         | $1 \div 3.435=0.2911$ |                                             |

Since the values 6 and 20.61 have turn by turn appeared above as denominator and the numerator in both the calculations i.e. for the Coefficient of Efficiency and the Wastage Ratio, they are the reciprocals of each other. If you minutely go through the above table, you will appreciate that they are mutually inter-related with each other. They are actually the two sides of the same coin. That is why we can say that in case the CE is 1, the WR will also be 1 which indicates the fact that there is no repetition or dropout from the cohort. However, in case the value of CE is greater than 1, the value of WR starts decreasing or the vice versa.

Based on the information from the above-mentioned source of UNESCO, thus, in Pakistan, if it takes a cohort on average seven years to complete a five-year primary cycle, the coefficient of efficiency would be  $5 \div 7$  or 0.71 or 71.00 percent, indicating a system operating at only five-seventh efficiency and ‘wasting’ two-seventh (0.29) of its resources on repeaters and drop-outs.

Exercise:

You may take the case of a Pakistani primary school, and proceed to understand the whole thing as under: In a school cycle of five years, a successful completer would require at least five pupil-years to go through the education process; it would take at least 10 pupil-years to produce 2 successful completers, 15 to produce 3, etc. In other words, if all goes well and no pupil drops out or has to repeat, the ideal average number of pupil-years per successful completer should be equal to the duration of the school cycle. Now find out the actual years taken by the cohort for completing the cycle and find out the CE.

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<sup>7</sup> Microsoft® Encarta® Reference Library 2005. © 1993-2004 Microsoft Corporation.

## 9. SUMMING UP

Since it is often costly and difficult to generalize the school-record system based on reliable individualized pupil information, educational internal efficiency is assessed using the reconstructed cohort method. The indicators derived naturally are subject to the limitations and/or assumptions related to this cohort analysis method.

It may be mentioned here that the rates we have been dealing with in this Unit, represent just the technical aspects of the several technical functions the calculation of which lies within the domain of educational planners. The major objective in doing all that is to undertake an analysis of the dynamism of student cohort and the behaviour thereof in school during the cycle of education at a particular level.

It also needs to be clarified here that the calculation of different rates like repetition, dropout, promotion, coefficient of efficiency and wastage ratio in the context of a cohort analysis does, in no way, mean that the educational planner has got the necessary control over them in the actual field; absolutely that is not the case. The sole objective of doing all such academic exercises is just to foresee some of the possible aspects of pupil behaviour under the given circumstances. These circumstances pertain to several factors including the government policy, socio-cultural conditions, financial set-up, opportunities available to educated people etc. etc. For example, the government policy of automatic promotion at primary level will, to that extent, reduce the wastage ratio.

Likewise, strong monitoring by the school head and/or the class teacher is also likely to result in the identification of potential dropouts which can be duly taken care of, again reducing the potential wastage of the system. In spite of the fact that the planner does not have and cannot have any control over these rates as they occur in the field, the paper work on these calculations does go a long way in preparing the planners, and managers for making necessary allocations, providing for administrative things, and keeping track of the things as per plan.

In case, the planner finds out or smells some deviation in pupil behaviour from the projected course, he may take necessary steps or propose certain policy measures to the government so as to counter the same and thus ensure that the things go as per plan. We can conclude our discussion on the topic with Lalit Kishore's remarks<sup>8</sup> that "the wastage in education needs to be monitored and for this baseline, mid-line and end-line studies of wastage in education need to be carried out and made public to monitor the improvement in quality of primary education as well as elementary education subsequent to various interventions and projects."

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<sup>8</sup> Lalit Kishore's opinion on Wastage Ratio as available at the site:  
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## **Unit – 7**

# **PROJECTION TECHNIQUES ENROLMENT AND PERSONNEL**

**UNESCO Material**

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## **PART I ENROLMENTS**

### **OBJECTIVES**

By the time you have worked through Part I of this unit you should be able:

- to say what advantages projections based on students flow analysis hold over earlier techniques of enrolment projection;
- to name the policy variables which determine future students flows and the future size and distribution of enrolment;
- to enumerate the different working steps required in preparing an enrolment projection;
- to characterize the basic effects of changes in admission, repetition and drop-out rates on the future size of enrolment.

## **PART II PROJECTION TECHNIQUES PERSONNEL**

### **OBJECTIVES**

By the time you have gone through the second part of this unit, you should be able to:

- identify the information that should be derived from a diagnostic analysis to project teacher requirements;
- calculate overall teacher requirements;
- state the overall teacher requirements in terms of sex, qualification and specialization distribution;
- plan the supply of teachers and the expansion of teacher education programmes;
- determine norms for other grades of educational personnel and estimate needs; and
- analyse and estimate needs in personnel of non-formal education.

## **1. ROLE OF ENROLMENT PROJECTIONS IN EDUCATIONAL PLANNING**

- 1.1 Children's learning is the principal output of an educational system and estimating future school enrolment is one of the most important factors in quantitative educational planning.

The analysis of student flows is not just a 'diagnostic technique'. It also enables the educational planner to project school enrolment over the plan period. Enrolment projections are thus a logical extension of the analysis of student flow data. At the same time, they form the back-bone of practically each single task involved in educational planning.

- 1.2 It is on the basis of these enrolments that we can deduce all other future needs of the educational system.

Whether it is the assessment of future requirements in equipment and facilities the calculation of additional teachers needed, the estimation of budgetary allocations for education, or forecasts of shortage and surplus situations in the labour market-non of these tasks can be accomplished unless planners have an adequate idea of how many students will enter the systems, how they will proceed through the grades, and what number will graduate during the plan period. Thus, enrolment projection should indeed be considered as the core structure of any educational plan.

- 1.3 During the sixties, when educational planning as a discipline was still in its infancy, projection techniques of a relatively simple type were widely used. The least sophisticated approach consisted of extra-polating past time series of enrolment at each level of education. Obviously, this implied a very high degree of arbitrariness. Validity was enhanced when trends in the enrolment ratio for given educational levels were linked to population growth in the corresponding age groups.
- 1.4 Shortcomings of both techniques, however, are that no clues are provided on the future grade-wise distribution of enrolment, nor on the expected number of graduates during the plan period. Furthermore, no light is thrown on whether internal efficiency at given levels of education, measured through drop-out and repetition rates will improve or not.

Projecting enrolments on the basis of a student flow model does provide information on these essential items. It constitutes the most up-to-date and satisfactory technique of enrolment projection available to educational planners.

## **2. FACTORS DETERMINING THE STUDENT FLOW**

2.1 The flow of students into and through an educational cycle is determined by five factors:-

- i. The population of admission age.
- ii. The admission/participation rate to the first grade.
- iii. The promotion rate at different grades.
- iv. The repetition rates at different grades
- v. The drop-out rates at different grades.

These factors direct the in-flow of students into the cycle, determine the manner in which students proceed through the cycle during the plan period, and the number of graduates obtained in consecutive years.

Educational planners should look at rates of admission, drop-out and repetition not as extraneous factors which educational plans have to take for granted. The development of these rates should be influenced by educational policy and planning. They serve as steering valves which should be regulated and adjusted in accordance with the plan objectives.

Educational planners should look at rates of admission, drop-out and repetition not as extraneous factors which educational plans have to take for granted. The development of these rates should be influenced by educational policy and planning. They serve as steering valves which should be regulated and adjusted in accordance with the plan objectives.

The term objectives are often used in national development plans to announce a decision such as “By the year 1995 all those children having reached the admission age should be brought to school.” And it is on the basis of this wish that we can calculate what should be the capacity of the educational system.

Even the population of admission age, in itself a non-educational variable, may within certain limits be influenced by appropriate policy measures, such as family planning or improvements of child health care. Such policies will often be so designed as to facilitate the attainment of educational plan objectives.

### 3. WORKING STEPS IN PREPARING A STUDENT ENROLMENT PROJECTION

The first step in drawing up an enrolment projection is to ensure that the following minimum data are available:-

- i. A projection over the plan period of the age group corresponding to admission age,
- ii. Enrolment by grade in the year preceding the base year and
- iii. Enrolment and number of repeaters from the previous year, by grade, in the base year.

Let us try to prepare a projection chart of primary school enrolment on the basis of the above analysis. Let us take the year 1990 as the base year. For this exercise, we shall need the following data:-

- i. Projection of population aged 5 years over the plan period and exact number in 1989;
- ii. Admission rate to grade I in 1989 and the enrolment in the base year.
- iii. Repetition and drop-out rates at different levels in 1989 and the exact number of repeaters and drop-outs in the base year.

As a first step, we prepare the following table on the basis of hypothetical data:-

**Table I – First Step in Enrolment Projections**

| Year | population<br>Aged 5-years | Admission<br>rate | Grade I | Grade II | Grade III | Grade IV | Grade V | Total |
|------|----------------------------|-------------------|---------|----------|-----------|----------|---------|-------|
| 2000 | 1067                       |                   | E: 1235 | E: 1004  | E: 907    | E: 850   | E: 801  | 4797  |
| 2001 | 1097                       |                   | E: 1265 | E: 1024  | E: 946    | E: 867   | E: 845  | 4947  |
| 2002 | 1127                       |                   | R: 259  | R: 110   | R: 73     | R: 60    | R: 80   | 582   |
| 2003 | 1157                       |                   |         |          |           |          |         |       |
| 2004 | 1206                       |                   |         |          |           |          |         |       |
| 2005 | 1256                       |                   |         |          |           |          |         |       |
| 2006 | 1304                       |                   |         |          |           |          |         |       |
| 2007 | 1354                       |                   |         |          |           |          |         |       |
| 2008 | 1403                       |                   |         |          |           |          |         |       |

E: Total enrolment

R: No. of repeaters

Note: All figures in the above and the following frames are in thousands.

- 3.2 The second step of our projection exercise calls for computing the respective number of new entrants into grade I during the plan period. To accomplish this, we calculate first the admission rate for 2001. The figure found for 2001 is 92 percent.

$$\text{Admission rate} = \frac{\text{New entrants to grade I}}{\text{Population of 5 years olds}} = \frac{1006 \times 100}{1097}$$

In this case in 2001 enrolment minus repeaters = 1006

In estimating the likely trend in the rate during the plan period, the educational planner may base his judgment either on past trends in the admission rate, or on policy target, or on a combination of both. Amongst the more notable factors influencing the admission rate will be equalization of educational opportunities for girls and removal of rural/urban disparities of access to education.

For the purpose of our exercise, we assume that the admission rate which stood at 92 percent in the base year 2001 will increase by 1 percentage point annually over subsequent years. On this assumption, the perspective number of new entrants into grade I can be calculated as in the frame below:

**Table 2 – Determining New Admission on the Basis of Population and Admission Rate**

| Year | Population grade 5 years | Admission rate | New Entrants | Grade I | Grade II | Grade III |
|------|--------------------------|----------------|--------------|---------|----------|-----------|
| 2000 | 1067                     |                |              |         |          |           |
| 2001 | 1097                     | → 92 per cent  | → 1006       | →       |          |           |
| 2002 | 1127                     | → 93 per cent  | → 1048       | →       |          |           |
| 2003 | 1157                     | → 94 per cent  | → 1088       | →       |          |           |
| 2004 | 1206                     | → 95 per cent  | → 1146       | →       |          |           |
| 2005 | 1256                     | → 96 per cent  | → 1206       | →       |          |           |
| 2006 | 1304                     | → 97 per cent  | → 1265       | →       |          |           |
| 2007 | 1354                     | → 98 per cent  | → 1327       | →       |          |           |
| 2008 | 1403                     | → 99 per cent  | → 1389       | →       |          |           |

3.3 The next working step is central to the whole projection exercise. You have to determine the likely trend of repetition and drop-out rates at each grade of the cycle over the plan period. The most straightforward assumption may be that these rates shall remain constant over time. Alternatively, a political target might these rates shall remain constant over time. Alternatively, a political target might be set of reducing both repetition and drop-out rates to zero, either immediately or gradually over the years. Neither of these assumptions would seem to be in line with the exigencies of realistic educational planning. In order to avoid being either too mechanical or else over-optimistic the planner should bear in mind the following two points.

- i. First, in addition to knowing the figures for repetition and drop-out rates in the base year, some understanding of why they are, what they are, is essential. For example repetition rates at the terminal grade are often inflated because of limited intake capacity for the next higher educational cycle: or,

excessive dropout in primary grades III and IV may be due to rural parents recalling their children from school when they are old enough to provide effective help in farms work. Insight into these and other causes for high repetition and drop-out rates is imperative; if assumptions concerning future trends in these rates are to be realistic.

- ii. Secondly, whatever assumptions are chosen by the planner concerning drop-out and repetition rates, they should be reflected in specific educational programmes which, if successful, are to bring actual developments in line with out assumption. There is, for instance, no point in assuming a radical reduction of drop-out rates over the plan period, unless the educational plan also contains specifically designed action programmes which promise to make such an assumption real.

- 3.4 In the unit on analysis of student flows we have seen that, once repetition and drop-out rates are known, the promotion rate is determined simply as the residual:  $D = 100 - R - D$ . This may be generalized to say that with any two rates being fixed, the third one is automatically determined as well.

The number of successful completers of the terminal grade constitutes the output from this educational cycle.

- 3.5 Now we are equipped with all the base data and flow rates needed to actually carry out the enrolment projection exercise. The results are indicated in the frame below. They should be checked against the reader's own calculations.

**Table 3 – Projecting Enrolment in the System**

| Year | Population<br>Aged 5 years | Admission<br>Rate | Grade |      |      |      |      | Out<br>put | Total<br>enrolment |
|------|----------------------------|-------------------|-------|------|------|------|------|------------|--------------------|
|      |                            |                   | I     | II   | III  | IV   | V    |            |                    |
| 2000 | 1067                       |                   | 1235  | 1004 | 907  | 850  | 801  | 705        | 4797               |
| 2001 | 1097                       | 92%               | 1265  | 1024 | 946  | 867  | 845  | 752        | 4947               |
| 2002 | 1127                       | 93%               | 1301  | 1051 | 967  | 903  | 865  | 779        | 5087               |
| 2003 | 1157                       | 94%               | 1335  | 1084 | 993  | 925  | 901  | 822        | 5238               |
| 2004 | 1206                       | 95%               | 1386  | 1115 | 993  | 960  | 914  | 841        | 5368               |
| 2005 | 1256                       | 96%               | 1442  | 1159 | 1065 | 962  | 938  | 872        | 5568               |
| 2006 | 1304                       | 97%               | 1496  | 1209 | 1120 | 1028 | 932  | 867        | 5795               |
| 2007 | 1354                       | 98%               | 1551  | 1257 | 1180 | 1082 | 992  | 923        | 6062               |
| 2008 | 1403                       | 99%               | 1606  | 1319 | 1228 | 1140 | 1045 | 972        | 6338               |

In 2008 primary enrolment will amount to 6,33,000 students, as against 4,947,000 students in the base year 2001. This means an enrolment increase of 28 per cent over the eight year planning period.

The output from first-level education, i.e. the number of successful completers of grade-V will rise by about 29 per cent during the same period.

## **4. HOW SENSITIVE ARE ENROLMENT TRENDS TO CHANGE IN FLOW RATES**

4.1 Our projection exercise shows that both enrolment and output at primary education will increase during the plan period. Apparently this overall increase results from the interplay of the factors mentioned in para section 2 of this unit.

- The growing population of admission age,
- The increasing admission rate to grade I,
- The assumed changes in repetition rates at different grades,
- The assumed changes in drop-out rates at different grades.

What is important for the educational planner is to know how a separate change in any of one of these factors will affect future enrolment and output. Only when the particular effects of each factor are known, can the planner deliberately open or narrow the “steering values” so as to bring prospective trends of enrolment and output in line with the educational plan objectives.

4.2 A second argument is apt to underscore this point: enrolment projections should never aim at predicting only one future. What the planner should try to do is to design alternative possible courses of development, assess their implications, and identify political choices available to decision makers.

Of course, different combinations of the values of flow rates will yield an infinite range of possible developments. Any particular set of assumptions may be fed into our projection model of student flows, and the effects on enrolment and output can be easily calculated.

Three possible cases may be of particular interest, we shall briefly analyse each of them:-

Case 1: The population of admission age and the admission participation rate to grade I increase, but repetition and drop-out rates remain constant.

Case 2: Population and admission rate, and also the repetition rate, remain constant; only the drop-out rates are to be reduced drastically at all grades.

Case 3: Population and admission rate and also the drop-out, remain constant; only the repetition rates are to be reduced drastically at all grades.

For each case, the three frames below indicate the effect on primary enrolment and output (successful completers of grade V) by 1998.

### **CASE 1**

|                       |                                                                                                                                                                                                                                                                           |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assumption:           | Between 1990 and 1998, the population of admission age and the admission rate will increase as given in table 2 above. However, repetition and drop-out rates remain at their 1990 level.                                                                                 |
| Result of Projection: | Primary enrolment increases by 31 percent from 1990 to 1998. Out-put from primary education also increases, but only about 25 percent.                                                                                                                                    |
| Interpretation:       | Increase of population and admission rate tend to expand both enrolments and output. However, with repetition and drop-out rates not being improved, the efficiency of primary education does not rise and enrolments grow in fact faster than the corresponding out-put. |

### **CASE 2**

|                       |                                                                                                                                                                                                                                                                                                                                 |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assumption:           | Between 1990 and 1998 the population admission age, the admission rate and the repetition rates at grade I-V will remain at their 1990 level. The drop-out rates at all grades will be zero from 1991 onwards.                                                                                                                  |
| Result of projection: | Primary enrolment increases by 19 percent from 1990 to 1998. Output from primary education increases drastically by about 44 percent.                                                                                                                                                                                           |
| Interpretation:       | Although the same number of new entrants will be admitted every year, the total enrolment increases measurably. This is due only to the reduction of drop-out rates. At the same time the efficiency of first level education will be markedly improved, with prospective output growing much in excess of enrolment increases. |

### **CASE 3**

|                       |                                                                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assumption:           | Between 1990 and 1998 the population of admission age, the admission rate, and the drop-out rates at grades I to V will remain at their 1990 level. However, repetition rates at all grades will be zero from 1991 onwards. |
| Result of Projection: | First-level enrolment decreases by 3 per cent from 1990 to 1998. Output from primary education increases by 22 percent.                                                                                                     |

Interpretation: While a constant number of new entrants will enter the cycle every year, total enrolment decreased slightly, owing to the abolition of grade repetition from 1991 onwards. Along with the enrolment decrease, outputs will increase considerably, this making for a noticeable improvements of the efficiency of primary education.

## 5. CONCLUDING REMARKS

- 5.1 Enrolment projections based on student flow analysis are the best technique available to educational planners. Their advantage is that they lay open the five factors on which enrolment increases depend; population growth, higher admission rates, and changes in repetition, drop-out and promotion rates.
- 5.2 More important, the projection technique you have learnt in this unit allows you to build strategic options and choices of educational policy into the projection. You can now project future enrolments in the form of alternatives, each one based on specific policy assumptions.
- 5.3 The figure-work involved is smaller and easy than it seems at first. All computations can be handled manually. But the future lies in computer programming of student flow models adapted to the educational features of each country. Some Asian countries already have started to work on this task.

What you have learnt in this unit will provide the cornerstone of all subsequent units in this book. Neither teacher, nor facilities, costs and resources can be projected unless enrolment projections have been carried out first.

## 6. TEST AND APPLY YOUR KNOWLEDGE

Six questions are given below to assist you in applying what you learnt in this unit to your work the correct answer are given on the following page.

- Question 1: What advantages has an enrolment projection, based on a student flow model, over less sophisticated projection techniques.
- Question 2: What minimum data are required to draw up an enrolment projection based on a student flow model?
- Question 3: For what reasons should educational planners, in preparing an education plan, draw up alternative enrolment projections?
- Question 4: What is the net effect on enrolment, if repetition rates are lowered at all grades, while the population of admission age, the admission rate and drop-out rates at all grades remain constant?
- Question 5: what is the net effect on efficiency of education and the output from education, if drop-out and repetition rates are sharply reduced, but the number of new entrants remains the same over the years?
- Question 6: What is the effect on enrolment, if drop-out rates at each grade are lowered while repetition rates, rate of admission, and the population of admission age remain unaltered?

## 7. SUGGESTED ANSWERS

- To question 1: An enrolment projection based on a student flow model contains information on:-
- i. the future grade-wise distribution of enrolment,
  - ii. future numbers of graduates,
  - iii. the future degree of efficiency in education simpler projection techniques, e.g. extrapolations of past enrolment trends, do not offer information on any of these items.
- To question 2: Minimum data required are:-
- i. a projection over the plan period of the age group corresponding to admission age,
  - ii. enrolment by grade in the year preceding the base year,
  - iii. enrolment and number of repeaters from the previous year, for each grade, in the base year.
- To question 3: Alternative enrolment projections show how enrolment trends would react to different assumptions concerning the flow rates. They also help to make the political choices available to decision makers more explicit.
- To question 4: Enrolment will decrease.
- To question 5: both the efficiency of education and the output from education will increase considerably.
- To question 6: Enrolment will increase.

## **PART II**

### **PROJECTION TECHNIQUES (PERSONNEL)**

#### **OBJECTIVES**

By the time you have gone through the second part of this unit, you should be able to:-

- Identify the information that should be derived from a diagnostic analysis to project teacher requirements;
- Calculate overall teacher requirements;
- State the overall teacher requirements in terms of sex, qualification and specialization distribution;
- Plan the supply of teachers and the expansion of teacher education programmes;
- Determine norms for other grades of educational personnel and estimate needs; and
- Analyse and estimate needs in personnel of non-formal education.

#### **1. INTRODUCTION**

The projections of enrolment show us the growth in size of the different levels and types of education. To serve this clientele we need various categories of educational personnel. In planning for future, it is necessary for us to know how many persons of what qualifications we need. As teachers constitute the largest component of the educational personnel, we shall first deal with methods for projecting teacher requirements. We shall then proceed to projection methods relevant to other categories.

## **2. DEMAND AND SUPPLY OF TEACHER FOR THE FORMAL SYSTEM**

- 2.1 In estimating the future demand for teachers the following steps are taken:-
- i. the present stock of teachers is measured, distributed by sex, age and qualifications;
  - ii. the number of teachers in each category who will leave their profession each year is estimated;
  - iii. the number of teachers of each category that will be needed each year in the future is estimated; other factors that influence the demand for teachers, apart from the future school enrolment, should also be considered;
  - iv. On the basis of all data, including the desired replacement of unqualified teachers, the number of new teachers needed each year can be projected and thus the number of students who should graduate from teachers training institutions can be found.
- 2.2 Information about the present teaching staff is needed and it is important to make sure that teachers serving in more than one school are not double-counted. Information on the stock of teachers has to be given for different groups of teachers, because in some countries like Pakistan female teachers serve only in girls' schools and they marry and have children and leave their jobs. Unqualified teachers might be forced to either leave their jobs or acquire the necessary qualifications. Old teachers retire or die. Young qualified teachers may leave their teaching jobs for better-paid ones. A certain number of teachers is promoted every year or transferred to other positions in the educational system (e.g. supervisors or instructors, curriculum developers, text-book writers). All these factors relating to the existing stock of teachers would be covered if a diagnostic analysis is conducted.
- 2.3 The number of teachers who have their jobs has to be estimated. If the age distribution of the teachers are known, one can use a life table to estimate number of deaths. If there is a fixed retirement age, the number of teachers who will retire each year can be computed. Gradual replacement of these teachers who lack sufficient qualifications should be planned. The most difficult part is the estimation of the number of teachers who leave voluntarily to take other jobs or to continue their education. A study of previous trends in one way of estimating this loss.
- 2.4 Estimation of the loss of teachers (or wastage in the teaching profession) in one year is shown in table I. the estimation should be done separately for each sex and for each category of qualification. The example refers to the teachers qualified for teaching in primary school.

**Table I: Distribution of Loss of Teachers by Reason**

| Age Groups | Teachers | Death Rate | No. of Deaths | Retired | Others Leaving Teaching |         |       |
|------------|----------|------------|---------------|---------|-------------------------|---------|-------|
|            |          |            |               |         | Rate                    | Net No. | Total |
| 19         | 720      | .0020      | 1             |         | .061                    | 44      | 45    |
| 20 - 24    | 1,760    | .0021      | 4             |         | 0.50                    | 88      | 92    |
| 25- 29     | 4,912    | .0024      | 12            |         | .031                    | 152     | 164   |
| 30 - 34    | 3,916    | .0028      | 11            |         | 0.30                    | 117     | 128   |
| 35 - 39    | 1,823    | .0035      | 6             |         | .026                    | 47      | 53    |
| 40 - 44    | 912      | .0044      | 4             |         | .019                    | 17      | 21    |
| 45 - 49    | 532      | .0055      | 3             |         | .005                    | 3       | 6     |
| 50 - 54    | 425      | .0075      | 3             |         | .000                    | 0       | 3     |
| 55 - 59    | 317      | .0105      | 3             |         | .000                    | 0       | 3     |
| 60 - 64    | 236      | .0136      | 3             |         | .000                    | 0       | 3     |
| 65 - 69    | 199      | .0200      | 4             | 40      | .000                    | 0       | 4     |
| Total      | 15,752   |            | 54            | 40      |                         | 468     | 562   |

- 2.5 The rate of teachers who leave their profession has been computed in the following way: the number of teachers who leave the profession minus the number of teachers who re-enter it divided by the total number of teachers in the age group. A proper estimation would call for information for a series of years, but this is rarely available and one may assume that the rates are constant. On the above data the overall wastage rate for this teaching service is 3.6 per cent i.e.

$$\frac{54 + 40 + 468}{15752} \times 100.$$

It would be quite adequate if in our projections we make provision for the replacement this number.

- 2.6 The following data for each part of the school system each year are needed to estimate the demand for teacher.
- The number of students (which is what enrolment estimates would give us);
  - The average number of hours per week for a student (this is usually prescribed in the school curricula);
  - The average number of students taught at the same time by one teacher (this is equal to the average class size); and
  - The average number of hours per week taught by the teacher (which is prescribed by rules relating to conditions of service of teachers. Usually a teacher works for a lesser number of hours than students, because he is given a few free periods to prepare for lessons, correct written exercises, etc. e.g. in Sri Lanka. Teacher is required to work 20 hours a week whereas the schools are conducted for 25-27-1/2 hours). In Pakistan a secondary school teachers works for 24 hours per week, where the school week is of 30 hours.

- 2.7 When estimating the demand for teachers, it is necessary to do so for each part of the school system according to the qualifications needed by the teachers. The number of teachers needed can be computed by using the following formula;

$$n = \frac{E \times ht}{Et \times hs}$$

Where:

- n the number of teachers needed,
- E the total number of students = enrolments,
- Et the average number of students per teacher (= class size),
- hs the average number of weekly hours per student, and
- ht the average number of weekly hours per teacher.

The question can be simplified, if the number of hours taught per week by the teacher is equal to the number of hours of teaching received by the students as is, often, the case in primary schools, where the one teacher / one class system is found. The simplified formula i.e:

$$n = \frac{E}{Et}$$

Where:

- n is the number of teachers;
- E is the total number of student and
- Et is the average class size

- 2.8 The application of these formulas will not be necessary where the teacher / pupil ratio is either prescribed by rules and regulations for each level or type of education or determined by authorities. Where authorities determine the pupil / teacher ratio from time to time, several factors would affect their decisions:-

- they may decide to adhere to ratios evident from past trends,
- they may decide on a policy of improving the ratio on the assumption that small classes learn more effectively,
- they may vary the ratio to meet financial difficulties as a means of stretching the educational rupee to the utmost.

In whatever way and for whatever reason the pupil / teacher ratios are determined they could be conveniently used by the planner to compute his needs for new teachers;

$$n = \frac{E}{r}$$

Where r = pupil / teacher ratio or the average number of pupils per teacher.

In all these methods, the filling of vacancies or shortages in the teaching service are automatically taken care of.

- 2.9 The methods, so far dealt with, are applicable, with slight modifications, to projecting the overall teacher requirements in the national system of education or any part thereof; that is, they are applicable to a state, province, region, district or institution as well as to any level or type of education. The modifications needed in each case are in the variables of the formula, thus,

E will vary according to whether students of the whole country or a part thereof or of any level or type of education are considered.

Et hs, ht and r will vary according to average class size of each level or type of education.

- 2.10 The figure was computed as overall teacher requirements (= n in our formulae) has to be further refined to arrive at what an educational planner has to know very specifically; that is, how many new teachers should the system recruit? Let us work out a simple example;

In year  $Y_0$  (which is the base year in planning symbols) a country has 18,506 teachers. On projections worked for year  $Y + 1$  (which is the first year of the plan), the overall teacher requirements are calculated to be 21,610. How many new teachers should the system recruit in  $Y + 1$ ? One would give the answer as  $21,610 - 18,506 = 3,104$ . But is it correct? One important factor has not been taken care of. Out of 18,506 teachers some will retire or die and some would change jobs. So we have to find out the wastage rate. Let us assume that the wastage rate for this country is 4 percent. This means that it would lose 40 teachers between  $Y_0$  and  $Y + 1$ . Therefore, the total number of new teachers the system would recruit is  $3,104 + 740 = 3,844$ .

Here again, what we get is the overall number of new teachers to be recruited. But an educational planner needs more than that.

- 2.11 There are three aspects with which an educational planner is particularly concerned:-
- The proportion of male and female teachers;
  - Distribution of qualified teachers; and
  - Requirements of specialist teachers.

Based on diagnosis, the planner has to determine a target towards which the current situation has to be progressively improved. Let us work out a simple exercise:-

Exercise: In country x, the female teachers in primary schools form only 18 percent of the teaching service. This is regarded as seriously hindering the expansion of girls' education. It is decided that the proportion be increased to 50 percent as fast as possible. How will the educational planner calculate the number of female teachers to be recruited every year assuming that qualified females are available for appointment? The position in the base year ( $Y_0$ ) and projected overall requirements for five year plan period Y/5 are given:-

| Year    | No. of teachers | No. of Female Teachers | Wastage Rate for Male Teachers | Wastage Rate for Female Teachers |
|---------|-----------------|------------------------|--------------------------------|----------------------------------|
| $Y_0$   | 24,500          | 4,415                  | 3.2 percent                    | 4.5 percent                      |
| $Y + 1$ | 26,300          |                        |                                |                                  |
| $Y + 2$ | 26,600          |                        |                                |                                  |
| $Y + 3$ | 31,200          |                        |                                |                                  |
| $Y + 4$ | 33,800          |                        |                                |                                  |
| $Y + 5$ | 36,100          |                        |                                |                                  |

(The learner may wish to work this out and compare his results with solution see Annexure 1).

The same approach is applicable to the recruitment of qualified and special teachers.

### 3. PLANNING THE SUPPLY OF TEACHERS

- 3.1 Projecting the need for new teachers of various categories, qualifications and gender and age distribution amounts to an exercise in manpower planning for the teaching service. Once the required manpower is determined, it is the responsibility of the national system of education to ensure that its institutions and programmes produce them in the numbers and characteristics needed and at the appropriate time. For this purpose, the educational planner has to gear the output and programmes of teacher training institutions to these needs. The institutions and programmes to be considered in this exercise include departments for faculties of education in universities and teacher's college of various descriptions (primary or elementary teacher training colleges, secondary teacher training colleges, science or technical teacher training colleges. In-service training course through distance teaching etc. etc.). For this purpose, the pattern of student flow in these institutions and programmes have to be analysed carefully to establish the input-output ratio. The question we ask ourselves, here, is: how many students should we enroll in order to produce the required number of new teachers assuming that all graduates do not usually join the teaching service and some of the enrolled students repeat and drop-out. Let us examine the nature of this exercise with a concrete example:-

Example: The projections for new science teachers show that a country should have the following number of teachers with B.Sc. and B.Ed. as minimum qualifications:-

Y + 1      60  
Y + 2      65  
Y + 3      72  
Y + 4      80  
Y + 5      90

Note: Y is the base year and the years Y + 1 etc. are the years following the base year.

Let us assume that the University has a combined course of four year to produce such graduates. Our diagnostic analysis shows that 20 percent of graduates of this course take up other jobs or proceed to higher studies or leave the country. We now examine the flow of students in the course:-

| Year  | 1st Year | 2nd Year | 3rd Year | 4th Year | Graduates | No. Joining as Teachers |
|-------|----------|----------|----------|----------|-----------|-------------------------|
| Y - 5 | 50       | 32       | 31       | 35       | 28        | 22                      |
| Y - 4 | 55       | 42       | 30       | 38       | 30        | 25                      |
| Y - 3 | 60       | 48       | 42       | 40       | 34        | 27                      |
| Y - 2 | 65       | 54       | 47       | 48       | 42        | 34                      |
| Y - 1 | 70       | 60       | 53       | 54       | 48        | 39                      |
| Y0    | 75       | 64       | 58       | 59       | 54        | 45                      |

Note: The years Y-5, Y-4 etc. show 5 years and 4 years preceding the base year. With these data we have three cohorts whose progress can be analysed:

- Year Y-5 admissions 50 producing 42 graduates or 34 teachers in Y-2,
- Year Y-4 admissions 55 producing 48 graduates or 30 teachers in Y-1,
- Year Y-3 admissions 60 producing 54 graduates or 45 teachers in Y0.

The average annual input-output ratio of this course could be worked out as an indicator of past trends:-

50 + 55 + 60 ----- 164 admissions (55 annual mean)  
42 + 48 + 54 ----- 144 graduates (48 annual mean)  
34 + 39 + 45 ----- 118 teachers (39 annual mean)

- $\frac{\text{graduate}}{\text{admissions}} = \frac{48}{55}$       87 percent
- $\frac{\text{teachers}}{\text{admissions}} = \frac{39}{66}$       71 percent

With these indicators we could assume that the cohorts beginning in Y-2, Y-1, and Y0 would produce the following number of graduates and teachers:-

| <b>Years</b> | <b>Graduates</b> | <b>Teachers</b> |
|--------------|------------------|-----------------|
| Y-2 to Y +1  | 57               | 46              |
| Y-1 to Y + 2 | 61               | 53              |
| Y0 to Y + 3  | 65               | 53              |

But these are short of the numbers we need according to our projections:-

| <b>Year</b> | <b>Needed No.</b> | <b>Likely to be available</b> | <b>Shortfall</b> |
|-------------|-------------------|-------------------------------|------------------|
| Y 1         | 60                | 46                            | 14               |
| Y 2         | 65                | 50                            | 15               |
| Y 3         | 72                | 53                            | 19               |
| Y 4         | 80                | –                             | –                |
| Y 5         | 90                | –                             | –                |

The above table shows us that the position up to Y+3 is already determined by the intake to the course. The educational planner has, of course, a few remedies which he could recommend to the policy-makers: e.g. (A) improve the internal efficiency of the course by reducing drop-outs and repeaters (B) enforce every graduate to serve for a minimum period as a teacher. If (A) is adopted and the input-output ratio is increased to at least 95 percent the shortfalls could be reduced to:

From 14 in Y+1 to 10;  
From 15 in Y+2 to 12; and  
From 19 in Y+3 to 14.

This is barely effective. If recommendations (b) is accepted, the problem would be immediately solved. But, if the policy-makers do not uphold such a recommendations, the planner has to wait until Y+4 to start producing enough teachers to meet both the backlog of shortfalls and the projected needs. To achieve this he has to determine the intake to the course from Y+1 onwards. First of all, he has to determine how the shortfalls are to be met all in Y=4 or to be spread on to both Y+4 and Y+5. Let use assume that the decision is to spread the shortfalls into the two years. The shortfall for year+1, Y+2 and Y+3 amounts to 48, which is to be spread over two years. This means that the projected number of required new teachers for Y+4 and Y+5 has to be increased.

Not they become:-

$$Y+4----- 80 + 24 = 104$$

$$Y+5----- 90 + 24 = 114$$

To produce the required number of new teachers, the intake or admissions to the course have to be regulated as follows:-

$$Y+1 = 146$$

$$Y+2 = 161$$

The planner cannot stop here. He must ask himself whether these are realistic targets. The growth rate of this course has been gradual, increasing by only 5 each year. Can it now suddenly expand from possible 80 places in Y+1 to 126 places? What is position with regard to teaching staff, classroom laboratory space, other facilities etc.? If the targets are found to be unfeasible then other solutions have to be pursued: may be expatriate teachers could be a solution.

The process described through this example, has to be followed in determining the intake to the institutions and programmes which produce each category of teachers.

- 3.2 In our example, we found that we could project the intake to the course only up to Y+2. There are still three years in the plan period for which the intake has to be indicated. If we had our requirements of new teachers projected for a period longer than five year, we would have had no difficulty. So it is important that our projections should be for a much longer period than the plan period. If we had projections of new teacher requirements from Y+1 to Y+10, we would have been in a better position to plan the expansion of our teacher education programme.
- 3.3 It is interesting to note that our exercise in projection does not end here. Once we have projected the intake to teacher training institutions and programmes, we have to work out their total enrolments. On the basis of their total enrolments, we have to project the requirements in new teacher education. If teacher educators are also produced by any national institution like a college or academy for teacher educations, a similar exercise would be necessary to determine its intake and consequently of its personnel requirements.

## 4. DEMAND AND SUPPLY OF EDUCATIONAL PERSONNEL

- 4.1 The projection of requirements of other educational personnel is much less complex. Once the norms are established, the needs could be arithmetically computed for example, each school is expected to have a headmaster. With a norm like that the needs in headmasters would be calculated on the following basis:-

|                        |                                                             |
|------------------------|-------------------------------------------------------------|
| New headmasters needed | number of schools minus<br>Number of headmasters in service |
|------------------------|-------------------------------------------------------------|

The same procedure is applicable to clerical and other staff of educational institutions for whom norms are administratively prescribed.

- 4.2 A grade of personnel regarding whom, a more careful scrutiny is needed, is the supervisor inspector superintendent. This grade could have at least two main divisions:-

- i. General supervisors;
- ii. Specialist or subject supervisors.

The cadre of general supervisors is usually fixed in terms of a workload, expressed in terms of a number of institutions or a geographical area. On this basis, the number required could be calculated quite easily. But with regard to specialist or subject supervisors, norms are expressed in various ways. In some instances, it is the geographical area (e.g. a home economics supervisor in each district). In others it is number schools, offering the particular subject at a particular level (e.g. a technical education supervisor for 10 senior secondary schools having programmes of technical education). In yet others, the norm is spelled out in terms of the number of teachers teaching the subject. These norms require the planner to examine in detail the growth pattern relating to the relevant subjects. It is possible that this has already been done at the diagnostic stage. If so, what is needed to apply the norms systematically and derive the number needed for each subject specialization.

- 4.3 In projecting the needs of headmasters, principals and supervisors, inspectors, superintendents, we have to bear in mind an important point. The usual source of personnel for these grades is the teaching service. If there is a large-scale increase in recruitments to these grades they will affect the teaching service and cause critical shortfalls. So, as soon as we have established our projections for these grades, we should look into their impact on the projections made for teachers. The projections will need revision. It is also important to take notice of quite a prevalent practice in most countries of deploying teachers and supervisors to work in education offices and special organizations like curriculum development or text-books centres. Allowance for such development must be made in the projections. The same applies if teachers and supervisors are given long-term in service training in training college or universities in the country or abroad). Most countries maintain, for these purposes. What is called a “Supernumerary cadre” over and above the numbers required according to norms? This has proved to be a very useful provision. Personnel at the executive level of the educational management machinery and in specialized institutions have to be calculated on the basis of existing administrative rules and regulations.
- 4.4 As in the case of teacher projections, the exercise must continue to include enrolments of any institutions or programmes where each category of personnel is trained or oriented. Then on the basis of their enrolments, their staff needs have also to be projected.

## 5. PROJECTION OF NEEDS IN PERSONNEL FOR NON-FORMAL EDUCATION

- 5.1 By the very nature of non-formal educational programmes the task of projecting their needs in personnel is rendered quite complex. Each programme is expected to be tailor-made to suit certain felt needs of a community or a clientele. As such each programme could be unique in its organization, mode of operation and number o nature of personnel. There are no established patterns of work or personnel distribution as in the formal system of education. Yet, the educational planner is required to allocate resources for the expansion and improvement of non-formal education. We must, therefore, evolve some methodology for estimating, with a fair degree of accuracy, the personnel requirements of these programmes.
- 5.2 Among non-formal educational programmes of a country, there are a few which rely on the delivery mechanism of a teacher teaching in a classroom situation. Adult literacy and adult education programmes fall into this category. The functional literacy programmes, where in the literacy training of adult is combined with improving their vocational skills, also adopt a similar mechanism for at least half of the time. As the emphasis shifts from literacy and knowledge to skills, the time spent in classroom situation becomes less. Instead, learning is designed to take place in actual working situations. We could thus divide these programmes into two categories:-
- i. Those which adopt a classroom situation; and
  - ii. Those which rely on actual working situations.
- 5.3 For estimating personnel requirements we need to establish certain norms. A norm, as we have seen, has to be expressed in terms of the target we aim at. In an education plan, the target for non-formal education is most conveniently expressed in terms of the size and characteristics of the clientele. We could either deal with a unspecified global target (e.g. non-formal educational programmes to reach 120,000 adults) or elaborate a bread-down according to kinds of programmes or clienteles, e.g.

|                                            |        |
|--------------------------------------------|--------|
| Functional literacy programmes             | 60,000 |
| Agricultural extension programmes          | 40,000 |
| Programmes for upgrading mechanical skills | 15,000 |
| Rural leadership courses                   |        |

or

|                        |        |
|------------------------|--------|
| Urban illiterates      | 40,000 |
| Small farms holders    | 50,000 |
| Out-of-school youth    | 10,000 |
| New migrants to cities | 20,000 |

The kind of details into which programmes and clientele are elaborated depends on the degree of organizational complexity which non-formal education has reached in the country. We have, therefore, first to take note of the manner in which the target is specified. How do we evolve some working norms in relation to these targets?

- 5.4 A survey of existing programmes from the point of view of their staffing pattern would be the most desirable. If programmes for each target group is separately analysed, we would arrive at a working ratio between the number of clienteles and the number of personnel needed to conduct the programme. Results like the following could be derived from such an analysis.

Say existing programmes of adult literacy for small farm holders show that 2 instructors could complete a full course in literacy and skill training for 50 farmers need 12 man-months of staff time. The norm could then be established as one farmer needs 1250 or 0.24 man months. For a functional literacy programmes for 50,000 small farm holders, the personnel needed for the purpose could be estimated at 12,000.

It is usually not possible to conduct a survey of all existing programmes. For purpose of projecting staff or even costs such an extensive survey is not necessary. A carefully prepared sample surely would give equally valid norms.

Here again, the planner has to consider the sources from which the personnel are drawn and the implications relating to the staffing of relevant training institutions and programmes.

## **6. CONCLUSION**

Projection techniques relating to educational personnel according to each category. As regards teachers and teacher education there are fairly well-established methods which could be conveniently adopted. As regards other personnel, the norms have to be worked out on the basis of systematic diagnostic analysis. Much of the staffing pattern in a country is determined by the existing administrative rules and regulations. They usually specify workloads and ratios among different grades. A planner has to take note of them. It does not mean that a planner is bound by them. An important contribution which a planner could make is to assess the relevance and validity of these rules and regulations as related to planned development of education and set in motion the process of having them modified according to changing needs.

## 7. RECOMMENDED READING

- Ingvar Wordelin: *Quantitative methods and Techniques of Educational Planning*, Regional Centre for Educational Planning and Administration in the Arab countries, Beirut, 1972 (chapter 6).
- J. D. Chesswas: *Methodologies of Functional Planning for Developing Countries*, Unesco-IIEP, Paris, 1969 (stage III, section D).
- Unesco: *Educational Simulation Model (ESII)*, Method and Analysis Division, Department of Social Sciences (report No. 29), Paris, 1974 (chapter II).

### Annexure – I

## SOLUTION TO EXERCISE IN PARA 2.11

A policy could be adopted that from Y 1 only female teachers would be appointed to fill vacancies arising from wastage of both male and female teachers and also to fill the additional posts provided. Year by year, the proportion of female teachers would increase by the number of new places. By year Y 5 the proportion of 50:50 would be reached. The following table shows the results of the calculations:-

| Year | Total Teachers Projected | Male   | Female | Projected increased | Replacements |     | New Appointments |     |
|------|--------------------------|--------|--------|---------------------|--------------|-----|------------------|-----|
| Y0   | 24,500                   | 20,085 | 4,415  | –                   | –            | –   | –                | –   |
| Y 1  | 26,300                   | 19,442 | 6,858  | 1,800               | 643          | 199 | 2,642            | –   |
| Y 2  | 28,000                   | 18,820 | 9,780  | 2,300               | 622          | 309 | 3,231            | –   |
| Y 3  | 31,300                   | 18,218 | 12,982 | 2,600               | 602          | 440 | 3,642            | –   |
| Y 4  | 33,800                   | 17,635 | 16,165 | 2,600               | 583          | 584 | 3,767            | –   |
| Y 5  | 36,100                   | 18,050 | 18,050 | 2,300               | 564          | 727 | 2,612            | 979 |

This only illustrates the method. It may not be practicable if male teachers in training institutes are to be given appointments at least in Y 1 and A2 (assuming the course is of two year duration). A slower pace could be adopted by distributing the vacancies between male and female teachers appropriately.

## 8. TEST AND APPLY YOUR KNOWLEDGE

Question 1: A teaching service lost the following during the last three years through retirement, resignation and death.

|     | No. of Teachers | Retirement | Resignation | Death |
|-----|-----------------|------------|-------------|-------|
| Y-3 | 28,750          | 78         | 1,035       | 112   |
| Y-2 | 29,970          | 85         | 970         | 125   |
| Y-1 | 31,318          | 94         | 958         | 130   |

Question 2: What is its wastage rate?  
In a school system, projected enrolments for Y+1 are 14,750. The average class-size is 50. The students work for 30 hours a week. Regulations require teachers to work for 22 hours a week: sciences and mathematics are made compulsory subjects from Y+1.

- What is the number of teachers required in Y+1?
- How many more are needed if class-size is to be reduced to 40.

Question 3: In the school system, referred to in Q.2, science and mathematics are made compulsory subject from Y+1. According to the curriculum each is to be given 4 hours per week (total hours for all subjects being 30 hours). How many science and mathematics teachers should the school system have in X+1?

Question 4: In the example given in Para 13, to what extent will this country meet its requirements of science teachers in years Y+1 to Y+3 if the following conditions prevail from Y+1:-

- No repeaters or drop-outs;
- 95 percent of 4<sup>th</sup> year students in the B.Sc / B.Ed. course;
- All graduates are compelled to serve as teachers for the first years of graduation?

Question 5: The following information is derived from a sample survey of non-formal educational programmes of a country:-

| Programme                             | Average No. of learners per centre | No. of staff members | Length of course |
|---------------------------------------|------------------------------------|----------------------|------------------|
| Adult Literacy                        | 120                                | 3                    | 4 months         |
| Functional Literacy                   | 88                                 | 3                    | 6 months         |
| Rural Leadership                      | 36                                 | 4                    | 2 months         |
| Motor Mechanics and Electrical Wiring | 12                                 | 1                    | 6 months         |
| Building Construction                 | 24                                 | 2                    | 8 months         |

The country plans to launch a programme to provide adult literacy to 38,500; functional literacy to 61,500; Rural Leadership training to

2,000; Motor Mechanics Electrical Wiring training to 8,000 and training in Building Construction to 20,000. On the basis that a staff member conducts 8 months of courses per year, what is the number of staff members needed for this programme?

## 9. ANSWERS

- Question 1: Wastage rate 3.85 percent
- Question 2: a. 402  
c. 101
- Question 3: Science Teachers: 54  
Mathematics Teachers: 54
- Question 4: Y+1 ----- meet the target of 60  
Y+2 ----- short by 4  
Y+3 ----- short by 1  
If your answer to 4+1 is different, check whether you have provided  
for the repeaters from you to remain in the fourth year class in Y+1.
- Question 5:
- |                       |              |
|-----------------------|--------------|
| Adult Literacy        | 481          |
| Functional Literacy   | 1,538        |
| Rural Leadership      | 55           |
| Motor Mechanics etc.  | 500          |
| Building Construction | 1,675        |
| Total                 | <u>4,249</u> |

## **Unit – 8**

# **PROJECTION TECHNIQUES (Costs and Resources)**

**UNESCO Material**

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## **1. INTRODUCTION**

Matching resource requirements with resources available is at the heart of planning. Both steps involved in this exercise require projections – a projection of how much it will cost to reach the educational plan target and projection of the total resources which the education sector can hope to receive.

We shall present in this unit the principal projection techniques used to undertake this two-fold task; you will soon note that these techniques are meant primarily for the federal or provincial level educational planner. They deal with cost and resource aggregates, not with the costs and budget details of particular projects and programmes.

As a general rule, the projection of resources should be done before the projection of costs, because we tend to adjust our cost estimates to the resource ceiling, rather than other way round. The resource projection, in other words, provides the constraint within which feasible and realistic cost projections can be worked out. Let us, therefore, deal with techniques of resource projection first.

## **2. OBJECTIVES**

By the time you have gone through this unit you should be able to explain and apply three principal methods of projecting educational resources:

1. Enumerate the concept of “capital cost per student place”;
2. Project recurrent cost for different levels of education assuming alternative trends of “unit costs”;
3. Project recurrent costs for different levels of education, using the projection formula presented in section I of this unit.

### **3. THE “CEILING PROVISION” FOR EDUCATION**

Most national development plans will somewhere indicate what resources have been earmarked for education over the plan period of 4, 5 or 6 years. This “ceiling provision” for education may be given in either of three ways:-

- a. The anticipated outlay on education may be specifically given in terms of the amount to be expended annually over the plan period.
- b. the anticipated outlay on education may also be indicated as percentage of the annual government budget over the plan period.
- c. the anticipated outlay on education may also be presented as percentage of the Gross national or Domestic Product or the National Income of the country over the plan period.

In whatever form the resource availability for education is indicated, the educational planner is not spared of the necessity of doing the calculations himself. The educational planner cannot accept a figure given to him without adequate checking. This means that he should calculate the resource availability all over again by himself.

If the educational planner finds, on re-examination; that the estimate of resource availability given to him by the economic planner is open to question, what alternatives does he have? This depends entirely on the planning philosophy of the country concerned. In some, the educational planner would have the freedom to make his own estimate and even differ widely from the economic plan. In others, the economic planner may revise his targets according to the findings of the educational planner. But in yet other, the economic planner would insist that his estimates should supersede those of the educational planner.

Whatever the outcome, the educational planner to consult the economic planner. Both must go through each other’s assumptions and calculations. A joint decision, which made by them after such consultations, would have much merit.

### **4. METHODS FOR PROJECTING EDUCATIONAL RESOURCES**

To forecast resources availability for education, the educational planner depends on a available data on educational expenditure. The more data he has, the more accurate will his forecast be. The data must not only be comprehensive in their coverage of levels and types of education but must also extend over a fairly long time horizon.

The data he needs for this purpose are as follows:-

- i. The total public educational expenditure (recurring and non recurring) of the country incurred not only by the Ministry of Education but also other Ministries

and by provincial and local governments which handle various types of educational programmes.

- ii. The total government budget of the country. A comparison of data on total public educational expenditure with the total government budget indicates the ratio the government budget made available to education.
- iii. The Gross National or domestic product or national income of the country. These data enable the planner to find out what proportion of the GNP or NI the country had devoted to education.
- iv. The private investment in education. In most Asian countries an important segment of the educational services, particularly at the second and third level for education, is provided by private institutions. In some cases these private schools and colleges are fully subsidized by the Government: in other cases, they are only partly subsidized or are self-supporting.

Another private source of funds for education are parents: they pay school fees and purchase textbooks, uniforms, etc. In some cases they present donations to the school or assist with voluntary services. A knowledge of the total private investment in education enables the planners to refine his assumptions on resource availability.

- v. the total amount of foreign aid to the educational sector, received from multi-lateral and bi-lateral sources.

With the above data, the educational planner proceeds to derive the following formation:-

#### **4.1 The trend of growth in public educational expenditure**

Example: In country X, the following had been the total educational expenditure:

| <b>Year</b> | <b>Total Educational Expenditure (dollars)</b> |
|-------------|------------------------------------------------|
| 1959-1997   | 2.350,000                                      |
| 1964-2002   | 2.640,000                                      |
| 1969-2007   | 3.140,000                                      |
| 2012        | 3.950,000                                      |

Using logarithmic tables, the annual rate of growth can be calculated as follows:-

| <b>Year</b> | <b>Average Annual Growth Rate</b> |
|-------------|-----------------------------------|
| 1997-2002   | 2.4 per cent                      |
| 2002-2007   | 3.5 per cent                      |
| 2007-2012   | 4.7 per cent                      |
| 1997-2012   | 3.5 per cent                      |

The planner can now make several alternative assumptions as to how these past trends would continue in the future (say, over the plan period 2013 – 2017). By way of example let us illustrate three of them:

- a. In the first five-year period 1997-2002 the average annual increase in expenditure was 2.4 per cent, in the second period 3.5 per cent, and in the third period 4.7 per cent. An extrapolation of this trend would bring the yearly increase during the plan period, 2013-2017 to 6.0 per cent (Assumption a.).
- b. the growth rate of expenditures over the period, 2007-2012, 4.7 per year, will be maintained (assumption b.).
- c. The growth rate over the last 15 years, being 3.5% per year,  $(2.4+3.5+4.7 \text{ over } 3)$  is used for projection (Assumption c.). The result of this exercise will be as follows:-

| <b>I. Projections of total public resources for education during plan period according to assumptions a,b,c (in thousands of rupees).</b> |             |             |             |             |             |                          |
|-------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|                                                                                                                                           | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>Total plan period</b> |
| Assumption a.                                                                                                                             | 4187        | 4438        | 4705        | 4987        | 5286        | 23603                    |
| Assumption b.                                                                                                                             | 4136        | 4330        | 4534        | 4747        | 4970        | 22717                    |
| Assumption c.                                                                                                                             | 4088        | 4231        | 4379        | 4533        | 4691        | 21922                    |

#### **4.2 The trend of growth in education's share of the Government Budget.**

An alternative approach to estimating total public resources likely to be available for education is based on the share of educational expenditures in the total Government budget.

Example: In country x, the total educational expenditure as a share of the Government budget has been as follows:-

|      |               |
|------|---------------|
| 1997 | 15 per cent   |
| 2002 | 15.5 per cent |
| 2007 | 16.0 per cent |
| 2012 | 16.5 per cent |

The Government Budget for the plan period is estimated by the economic planner to be as follows:-

|      |                  |
|------|------------------|
| 2013 | Rs. 26.2 Million |
| 2014 | Rs. 29.0 Million |
| 2015 | Rs. 31.5 Million |
| 2016 | Rs. 34.0 Million |
| 2017 | Rs. 37.2 Million |

Here, the assumptions which the educational planner can make include the following:-

- a. As the growth rate has been rather low, assume a constant share of 16.5 per cent for the next five years (Assumption d.).

- b. However slow the increase; it has been a steady one; so assume a continued linear growth in the share of education in the Government Budget (Assumption e.).

Each assumption will, as in the previous cases, give a set of projections, as follow:

| <b>II. Projections of total public resources for education during plan period according to assumptions d and e. (in thousands of rupees).</b> |             |             |             |             |             |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|                                                                                                                                               | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>Total plan period</b> |
| Assumption d.                                                                                                                                 | 4323        | 4785        | 5198        | 5610        | 6138        | 26054                    |
| Assumption e.                                                                                                                                 | 4375        | 4901        | 5355        | 5848        | 6473        | 26952                    |

### **3.3 The trend of growth in education's share of the Gross National or domestic product or national income.**

Another approach to estimate and check resource availability is to base it on the share of educational expenditures in GNP.

Example: In country x, the total educational expenditure as a share of the GNP had been as follows:-

|      |              |
|------|--------------|
| 1997 | 3.1 per cent |
| 2002 | 3.2 per cent |
| 2007 | 3.8 per cent |
| 2012 | 3.9 per cent |

The economic planner has estimated the GNP for the plan period to be as follows:

|      |                 |
|------|-----------------|
| 2013 | Rs. 112 Million |
| 2014 | Rs. 119 Million |
| 2015 | Rs. 129 Million |
| 2016 | Rs. 136 Million |
| 2017 | Rs. 149 Million |

Here the same kind of assumptions as in the case of education share in the government budget can be made. Each assumption gives a set of projections.

Again formulating two alternative assumptions, we have the following:-

- During the plan period 3.9 percent of GNP, which is the rate for 2013, will be available for education (assumption f.).
- The trend is the share of education in GNP will continue as follows (Assumption g.)

|    |      |                                   |
|----|------|-----------------------------------|
| in | 2013 | 3.9 per cent of GNP for education |
|    | 2014 | 4.0 per cent of GNP for education |
|    | 2015 | 4.0 per cent of GNP for education |
|    | 2016 | 4.1 per cent of GNP for education |
|    | 2017 | 4.2 per cent of GNP for education |

As in the previous cases assumption will give a set of projections as follows:-

| <b>II. Projections of total public resources for education during plan period according to assumptions f and g. (in thousands of rupees).</b> |             |             |             |             |             |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
|                                                                                                                                               | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>Total plan period</b> |
| Assumption f.                                                                                                                                 | 4368        | 4641        | 5031        | 5304        | 5811        | 25155                    |
| Assumption g.                                                                                                                                 | 4368        | 4760        | 5160        | 5576        | 6258        | 26122                    |

The educational planner now has as many as seven projections of public educational resourced during the plan period. These are recapitulated as follows:-

| <b>Projection of total public resources available for education during the plan period according to different assumptions.</b> |                                         |                |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------|
| <b>Total resources over planed period 2013-2017</b>                                                                            |                                         |                |
| Assumption a.                                                                                                                  | Past trends in public exp. on education | Rs. 23,603,000 |
| Assumption b.                                                                                                                  |                                         | Rs. 22,717,000 |
| Assumption c.                                                                                                                  |                                         | Rs. 21,922,000 |
| Assumption d.                                                                                                                  | Education's share of the Gove. Budget   | Rs. 26,054,000 |
| Assumption e.                                                                                                                  |                                         | Rs. 26,952,000 |
| Assumption f.                                                                                                                  | Education's share of GNP                | Rs. 25,155,000 |
| Assumption g.                                                                                                                  |                                         | RS. 26,122,000 |

When the seven projected figures are carefully examined, one can come to two conclusions:-

- The three different approaches give widely divergent results. Estimates based on the share of education in the budget are highest, followed by those based on the projected share in GNP. The estimated future resources according to past trends in educational expenditures are however, the lowest and this raises the question whether the forecasts of GNP and total Government budget are not too optimistic.
- The differences between the different assumptions within the same approaches are not so wide. Assumptions c.d. and f. can be termed conservative and a, e and g are optimistic assumptions.

The most likely estimate of resource availability will be somewhere in between. The arithmetical mean of the seven projections (i.e. 25,000,000 is quite a reliable estimate. It is this estimate which the educational planner would use as a working basis for target-setting.

What the educational planner has so far done is to estimate the resources which would be available from government sources. But these are not all. There are contributions which parents and private organizations make to education in the form of fees, donations and voluntary services. It is also reasonable to expect a certain amount for foreign aid, even though the continuance of such ad is directly related to government policy. A set of

projections for these sources has to be worked out on the same lines as for public sources of funds. These amounts will give a fair though not totally accurate estimate of what could be expected from private and foreign sources during the plan period. They, too, should be taken into consideration as additional resources in setting the educational plan targets.

## **5. COST PROJECTIONS AS AN INTERACTIVE PROCESS**

Educational cost projections translate quantitative and qualitative plan targets into expenditure which will be needed to put the plan into practice. Only when an educational plan has been translated into an educational budget, can it be submitted to the Ministry of Finance, or the equivalent authority for approval.

Quite often also, the very step of ‘costing’ the educational plan makes planners realize that the plan targets would be too costly to achieve, that the projected costs exceed the ceiling provision for education, and that, therefore, a plan revision is called for. The costing exercise will then have to be redone either partly or for the plan as a whole. In reality, planners may have to go re-costing it several times.

As a rule, educational cost projections are done not in a single step, but in a series of steps as an iterative process.

Analytically, the first step of the costing exercise is to project capital costs and recurrent costs separately, and then to combine the two resulting estimates. Let us see first how the costing with regard to capital items is done.

## **6. PROJECTING CAPITAL COSTS**

The costs of additional schools to be built, furnished and equipped during the plan period depend on the planned increase of the number of students at different levels of education, and different areas of the country. Exactly what additional number of students we anticipate, and at which levels this is planned however, is a question which a well-conceived educational plan can answer. But, in order to calculate the capital costs required to accommodate these new students, we need a technique which links up the increase in students numbers with that in capital costs. The standard, used by educational planners to accomplish this, is the concept of ‘capital cost per student place.’

To obtain figures on capital costs per student place, the planner depends on the advice of the school architect and building cost expert. They will tell him how much space is required for each student in terms of classrooms, labs, library, administrative offices, toilets, etc., and how much it will cost to provide this standard space per student. To this

they will add the cost of utilities (electricity, water), site works, as well as furniture and non-expendable equipment per student place.

Capital cost per student place is thus a normative figures decided upon after consultation with experts. It is not an empirical figure which one might obtain by dividing the capital expenditure of recent years by the number of students in these same years. The time-trend one might find, if this were done, would probably be much too erratic and unstable to provide a useful basis for planning. We have to realize that trends in capital cost are much less predictable than, for instance, trends in recurrent costs.

Once this is clarified, how does the planner proceed to calculate the capital cost required, say, in first year of the new plan period? Suppose the plan stipulates 40,000 additional students in that year; a decision will then have to be made on the desirable average school size that is, on the number of students places to be provided in each new school: let us assume that the desirable school size were to be fixed at 400 student places per school. We would then have to build 100 such schools to accommodate the 40,000 new students, and each school would cost us 400 times the capital cost per student place which had been determined in consultation with the school architect and building cost expert.

Of course, one global standard cost figure per student place, to be applied to all types of schools in all parts of the country, would make little sense. Usually, planners use and combine different standards as follows:-

| Capital costs per student place differ for: |                                                                     |
|---------------------------------------------|---------------------------------------------------------------------|
| Primary schools                             |                                                                     |
| ▪                                           | Secondary general and vocational schools                            |
| ▪                                           | Colleges and universities                                           |
| ▪                                           | Schools located in rural areas                                      |
| ▪                                           | Schools located in urban areas                                      |
| ▪                                           | Schools constructed in simple type with local materials             |
| ▪                                           | Schools constructed in modern type with costly, improved materials. |

The planner also has to bear in mind that construction costs will rise during the plan period. In fact, they frequently rise faster than the general price level. Whether a particular school is built in the first or last year of the plan period can make a surprisingly big difference in price. A carefully timed building programme is therefore necessary to keep capital costs at reasonable levels.

## 6.1 Underutilized Schools, Replacement and Improvement

The procedure applied in the costing of capital items may, in reality, have to be modified on account of two considerations:-

Firstly, to the extent that existing school building are underutilized, part of the new enrolment can be accommodated by utilizing hitherto underutilized schools to full

capacity. That means that the number of new schools to be built may be less than one would expect from the straight forward formula offered in para above. Care must be taken, however, to check if it is really feasible to fully utilize presently underutilized school buildings. A remote underutilized rural school building, for instance, cannot readily accommodate students from a neighbouring town with overcrowded schools, unless a bus service is provided. In this case, the advantages (financial and otherwise), of adding the needed additional space to the existing school building (s) in the town should be carefully considered.

|                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Planners should carry out a survey to identify the degree of underutilization of existing schools before calculating the total number of new schools required. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|

Secondly, new schools may have to be built over and above those justified by the planned increase in student numbers, because many schools may use buildings which are badly in need of replacement or improvement.

|                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Planner should identify the needs for replacement and quality improvement of existing schools before calculating the total number of new schools required. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|

Ordinary educational statistics hardly ever provide the information needed to assess replacement and quality improvement needs. Special surveys may have to be undertaken.

Such a survey might come up with the following kinds of results; 10 per cent of urban and 20 per cent of rural schools will have to be replaced with new buildings within the next five years; 90 per cent of all rural schools should get electricity and water supply within the next five years; only 70 per cent of urban secondary schools, and 20 per cent of rural schools, have science labs and workshops; etc. it is this type of information which is to be used by the planner as the basis for an accurate costing of replacement and improvement needs.

## **7. PROJECTING RECURRENT COSTS**

The most important requirement for the educational planner attempting to project the recurrent costs implied by the educational plan is that he understands and works with the tool of 'unit costs'.

|                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The concept of 'unit costs' denotes the amount of recurrent expenditure spent per student in a given year. Unit costs are calculated either for the educational system as a whole, or, preferably, for certain levels of education, or even for particular school. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Unit costs figures thus provide an aggregate expression of the value of educational goods services which the educational system, or particular levels and branches of the system, spends on its average client (the single student) every year on a recurrent basis.

Unit cost figures are used to x-ray the cost structure of the educational system in various ways: comparisons of unit costs at different levels of education may indicate that too much or too little is spent per student at one particular level. Time series of unit costs, in actual or constant prices, may throw some light on factors responsible for the cost explosion in education. Comparison of unit costs for urban vs. rural, or for private vs. public schools help to pinpoint inequalities in educational provision which might otherwise go un-noticed.

When using unit costs in the manner indicate above, i.e. as a tool of retrospective expenditure analysis, we should always remember that the computation of unit costs in itself does not tell us much. It is only through comparisons that unit cost become significant. The more thorough, detailed and comprehensive these retrospective comparisons of unit costs are, the better will out chances be that we obtain at the same time valid clues for planning and predicting future recurrent costs of education.

### 7.1 How are educational cost projections commonly done?

Having used unit costs as a total for retrospective analysis, the planner will then turn to project the recurrent costs implied by the new educational plan. The rationale he applies is a very simple one; when future student numbers as foreseen by the plan, are multiplied with unit costs (either the present or some projected future figure), the planner obtains a crude estimate of future recurrent costs.

|                                                                                                       |
|-------------------------------------------------------------------------------------------------------|
| $\frac{\text{Future recurrent costs}}{\text{Future student numbers}} \times \text{Future unit costs}$ |
|-------------------------------------------------------------------------------------------------------|

This basic exercise can be done in a more or less sophisticated manner. As a minimum requirement, it should be carried out separately for primary, secondary and higher education, because both the amount of unit costs and their developments over time differ widely between these three levels of education. There are many countries where unit costs of higher education are about 20 times, and those of secondary education about 5 times higher than in primary education. And these differences seem to widen rather than narrow down, as the educational systems expand.

If data constraints allow only a very crude costing exercise, the planner will take the unit cost figures found for primary secondary and higher education in the base year, assuming that somehow these figures will not undergo any major change in the plan period ahead. He will then multiply these unit cost figures with the student number implied by the plan targets for year 1,2,3 etc, of the plan period.

The simple method is shown as “Alternative 2” in the table below.

However, unit costs will presumably not remain constant, due to general price increases and also due to improvements in the quality of educational services and facilities provided per student. The planner will take these factors into account by either

extrapolating the trend of unit costs over the past few years, or, if he fails to have such data, by assuming some future growth rate which he reopens to be realistic. For an illustration of this method, see “Alternative” in the table below:-

A simple example: Projecting unit costs in primary education for the period 2014-2018, according to two assumptions (Alternative 1 and Alternative 2)

|             | <b>Planned enrolment in primary education</b> | <b>Unit Cost (in rupees)</b> | <b>Total recurrent costs in primary education (thousands of rupees)</b> |                      |                      |
|-------------|-----------------------------------------------|------------------------------|-------------------------------------------------------------------------|----------------------|----------------------|
| <b>Year</b> |                                               | <b>1 Alternative</b>         | <b>2 Alternative</b>                                                    | <b>1 Alternative</b> | <b>1 Alternative</b> |
| 2013        | 55,000                                        | 70                           | 70                                                                      | 3,850                | 3,850                |
| 2014        | 62,300                                        | 70                           | 72                                                                      | 4,361                | 4,486                |
| 2015        | 68,100                                        | 70                           | 75                                                                      | 4,767                | 5,107                |
| 2016        | 74,500                                        | 70                           | 79                                                                      | 5,215                | 5,885                |
| 2017        | 76,200                                        | 70                           | 85                                                                      | 5,334                | 6,477                |
| 2018        | 82,200                                        | 70                           | 90                                                                      | 5,747                | 7,390                |

You will note that the recurrent costs of primary education, as projected for 2018 differ considerably, depending on which method is used. Both results look somewhat arbitrary; both, of course, contain a very strong element of guess. Still, this is how the costing exercise is commonly done. Behind the imposing cost calculations being presented as part of many educational plans, a critical mind will frequently discover very crude assumptions concerning the future trend of unit costs.

## 7.2 A more refined projections technique

Obviously, the ‘unit costs’ by themselves are too aggregate a concept to give us very accurate and reliable cost projections. Behind them lies a variety of factors, each of which contributes to the growth of recurrent educational expenditure. Such factors are the level of teacher’s salaries, the teacher student ratio, population growth trends, social demand as reflected in rising enrolment ratios, and others.

For a more refined cost projection which takes these factors into account you may work with the following formula:-

$$E_{wrr} = \frac{P \times r \times (s - c)}{S/T}$$

This is what the symbols in this formula mean:

- $E_{wrr}$  Recurrent expenditure at a particular level of education;  
 $P$  Population of age group which corresponds to a particular level of education;  
 $r$ , Gross enrolment ratio at a particular level of education;

- s,      Average teacher salary at a particular level of education;
- c,      Average amount of non-salary recurrent cost items spent per teacher at a particular level of education;
- S/T     Pupil teacher ratio at a particular level of education.

In any given year, and at any level of education, the recurrent expenditure is equal to the size of the corresponding population age-group, multiplied by the enrolment ratio for that level, multiplied further with the sum of average salary and other recurrent costs per teacher, and divided by the student / teacher ratio.

Let us test this formula on the expenditure data, using primary education in a country in 2010 as an example. In that year, the country spends Rs. 1,837,000 as recurrent expenditure on its primary school system; the population aged 6.13 and 70.9 percent of these attended schools; the average annual salary of a primary school teacher came to Rs: 10,855,000, with another 1,483. Rs. Per teacher spend on non-salary recurrent items such as textbooks, teaching materials, maintenance, auxiliary expenses, etc. The student/teacher ratio stood at 35.4:1.

Now multiply p,r, and (s+c) as in the formula above and you get a figure of 1,837,000,000 exactly the recurrent expenditure on primary education in 2000.

We can now venture a projection of recurrent expenditure on primary education in the country in 2020 on much safer grounds than if we had information on unit costs and enrolment only. Suppose the population factor were to grow by 3 percent annually; the target enrolment ratio for 2000 were 90 percent; teachers were expected to get pay hike of 5 percent each year and the very modes provision of non-salary recurrent items were to be raised by 10 percent each year essential the student teacher ratio, finally, might be lowered to 30:1 by 2020.

The combined effect of all these changes would lead to a projected figure of Rs. 6,452,297,000 as recurrent expenditure on primary education in 2020 some 250 per cent above the amount spent in 2000.

The projection technique presented just now is still a rather crude one. But at least it enables the planner to judge the relative influence of various factors at work, to vary his assumption with regard to each of them, and thus to embark on the 'iterative' process of drawing up cost-projections to which we referred in Para 5 of this unit.

You can study the actual public allocation and expenditure on various sectors of education during 2011-2012 in appendix I, II, III, IV for further projections.

## Appendix I

### SECTION ---

#### MINISTRY OF EDUCATION

2011-2012  
Budget  
Estimate

(Rupees in Thousands)

Demands Presented on behalf of the Ministry of Education

Current Expenditure on Revenue Account

|     |                                                                                 |       |
|-----|---------------------------------------------------------------------------------|-------|
| --- | Education Division                                                              | -     |
| --- | Higher Education Commission                                                     | -     |
| --- | Education                                                                       | -     |
| --- | Federal Government Educational Institutions in<br>the Capital and Federal Areas | -     |
|     |                                                                                 | <hr/> |
|     | Total                                                                           | -     |
|     |                                                                                 | <hr/> |

## NO. ---\_EDUCATION DIVISION

## DEMANDS FOR GRANTS

DEMAND NO. ---  
(FC21M05)  
EDUCATION DIVISION

I. ESTIMATES of the Amount required in the year ending 30 June, 2012 to defray the Salaries and Other Expenses of the **EDUCATION DIVISION.**

**Voted** **Rs.** **..**

II. FUNCTION-cum-OBJECT Classification under which this Grant will be accounted for on behalf of the **MINISTRY OF EDUCATION.**

|                                  |                                             | <b>2010-2011<br/>Budget<br/>Estimate</b> | <b>2010-2011<br/>Revised<br/>Estimate</b> | <b>2011-2012<br/>Budget<br/>Estimate</b> |
|----------------------------------|---------------------------------------------|------------------------------------------|-------------------------------------------|------------------------------------------|
|                                  |                                             | <b>Rs</b>                                | <b>Rs</b>                                 | <b>Rs</b>                                |
| <b>FUNCTIONAL CLASSIFICATION</b> |                                             |                                          |                                           |                                          |
| 095                              | Subsidiary Services to Education            | 107,000                                  | 107,000                                   | ..                                       |
| 096                              | Administration                              | 1,014,950,000                            | 640,053,000                               | ..                                       |
| <b>Total</b>                     |                                             | <b>1,015,057,000</b>                     | <b>640,160,000</b>                        | <b>..</b>                                |
| <b>OBJECT CLASSIFICATION</b>     |                                             |                                          |                                           |                                          |
| A01                              | <b>Employees Related Expenses</b>           | <b>241,817,000</b>                       | <b>232,565,000</b>                        | <b>..</b>                                |
| A011                             | Pay                                         | 118,101,000                              | 108,154,000                               | ..                                       |
| A011-1                           | Pay of Officers                             | (48,868,000)                             | (38,720,000)                              | ..                                       |
| A011-2                           | Pay of Other Staff                          | (69,233,000)                             | (69,434,000)                              | ..                                       |
| A012                             | Allowances                                  | 123,716,000                              | 124,411,000                               | ..                                       |
| A012-1                           | Regular Allowances                          | (109,131,000)                            | (109,273,000)                             | ..                                       |
| A012-2                           | Other Allowances (Excluding TA)             | (14,585,000)                             | (15,138,000)                              | ..                                       |
| A02                              | <b>Project Pre-Investment Analysis</b>      | <b>75,000</b>                            | <b>75,000</b>                             | <b>..</b>                                |
| A03                              | <b>Operating Expenses</b>                   | <b>697,329,000</b>                       | <b>378,395,000</b>                        | <b>..</b>                                |
| A04                              | <b>Employees Retirement Benefits</b>        | <b>9,001,000</b>                         | <b>5,701,000</b>                          | <b>..</b>                                |
| A05                              | <b>Grants Subsidies and Write off Loans</b> | <b>5,000,000</b>                         | <b>5,000,000</b>                          | <b>..</b>                                |
| A06                              | <b>Transfers</b>                            | <b>5,462,000</b>                         | <b>5,458,000</b>                          | <b>..</b>                                |
| A09                              | <b>Physical Assets</b>                      | <b>27,432,000</b>                        | <b>7,188,000</b>                          | <b>..</b>                                |
| A13                              | <b>Repairs and Maintenance</b>              | <b>28,941,000</b>                        | <b>5,778,000</b>                          | <b>..</b>                                |
| <b>Total</b>                     |                                             | <b>1,015,057,000</b>                     | <b>640,160,000</b>                        | <b>..</b>                                |

## Appendix II

**NO. ----\_ FEDERAL GOVERNMENT EDUCATIONAL  
INSTITUTIONS IN THE CAPITAL AND FEDERAL AREAS**

**DEMANDS FOR GRANTS**

**DEMAND NO. ----  
(FC21F03)**

**FEDERAL GOVERNMENT EDUCATIONAL INSTITUTIONS IN THE  
CAPITAL AND FEDERAL AREAS**

I. ESTIMATES of the Amount required in the year ending 30 June, 2012 to defray the Salaries and Other Expenses of the **FEDERAL GOVERNMENT EDUCATIONAL INSTITUTIONS IN THE CAPITAL AND FEDERAL AREAS.**

**Voted Rs. ..**

II. **FUNCTION-cum-OBJECT Classification under which this Grant will be accounted for on behalf of the MINISTRY OF EDUCATION.**

|        |                                                        | <b>2010-2011<br/>Budget<br/>Estimate</b> | <b>2010-2011<br/>Revised<br/>Estimate</b> | <b>2011-2012<br/>Budget<br/>Estimate</b> |
|--------|--------------------------------------------------------|------------------------------------------|-------------------------------------------|------------------------------------------|
|        |                                                        | <b>Rs</b>                                | <b>Rs</b>                                 | <b>Rs</b>                                |
|        | <b>FUNCTIONAL CLASSIFICATION</b>                       |                                          |                                           |                                          |
| 091    | Pre-Primary and Primary Education Affairs and Services | 623,311,000                              | 623,311,000                               | ..                                       |
| 092    | Secondary Education Affairs and Services               | 975,459,000                              | 975,459,000                               | ..                                       |
| 093    | Tertiary Education Affairs and Services                | 898,858,000                              | 898,860,000                               | ..                                       |
| 096    | Administration                                         | 5,230,000                                | 5,230,000                                 | ..                                       |
|        | <b>Total</b>                                           | <b>2,502,858,000</b>                     | <b>2,502,860,000</b>                      | <b>..</b>                                |
|        | <b>OBJECT CLASSIFICATION</b>                           |                                          |                                           |                                          |
| A01    | <b>Employees Related Expenses</b>                      | <b>2,255,819,000</b>                     | <b>2,255,819,000</b>                      | <b>..</b>                                |
| A011   | Pay                                                    | 1,310,530,000                            | 1,308,105,000                             |                                          |
| A011-1 | Pay of Officers                                        | (543,895,000)                            | (542,287,000)                             |                                          |
| A011-2 | Pay of Other Staff                                     | (766,635,000)                            | (765,818,000)                             |                                          |
| A012   | Allowances                                             | 945,289,000                              | 947,714,000                               |                                          |
| A012-1 | Regular Allowances                                     | (866,456,000)                            | (869,181,000)                             |                                          |
| A012-2 | Other Allowances (Excluding TA)                        | (78,833,000)                             | (78,533,000)                              |                                          |
| A03    | <b>Operating Expenses</b>                              | <b>148,372,000</b>                       | <b>148,343,000</b>                        | <b>..</b>                                |
| A04    | <b>Employees Retirement Benefits</b>                   | <b>20,000</b>                            | <b>20,000</b>                             | <b>..</b>                                |
| A06    | <b>Transfers</b>                                       | <b>6,486,000</b>                         | <b>6,486,000</b>                          | <b>..</b>                                |
| A09    | <b>Physical Assets</b>                                 | <b>47,400,000</b>                        | <b>47,400,000</b>                         | <b>..</b>                                |
| A13    | <b>Repairs and Maintenance</b>                         | <b>44,761,000</b>                        | <b>44,792,000</b>                         | <b>..</b>                                |
|        | <b>Total</b>                                           | <b>2,502,858,000</b>                     | <b>2,502,860,000</b>                      | <b>..</b>                                |

## Appendix III

NO. ---\_EDUCATION

DEMANDS FOR GRANTS

DEMAND NO. ---  
(FC21E04)  
EDUCATION

I. ESTIMATES of the Amount required in the year ending 30 June, 2012 to defray the Salaries and Other Expenses of the **EDUCATION**.

Voted                      Rs.                      ..

II. FUNCTION-cum-OBJECT Classification under which this Grant will be accounted for on behalf of the **MINISTRY OF EDUCATION**.

|                                  |                                                         | 2010-2011<br>Budget<br>Estimate | 2010-2011<br>Revised<br>Estimate | 2011-2012<br>Budget<br>Estimate |
|----------------------------------|---------------------------------------------------------|---------------------------------|----------------------------------|---------------------------------|
|                                  |                                                         | Rs                              | Rs                               | Rs                              |
| <b>FUNCTIONAL CLASSIFICATION</b> |                                                         |                                 |                                  |                                 |
| 092                              | Secondary Education Affairs and Services                | 43,177,000                      | 40,077,000                       | ..                              |
| 093                              | Tertiary Education Affairs and Services                 | 416,813,000                     | 398,193,000                      | ..                              |
| 095                              | Subsidiary Services to Education                        | 4,000,000                       | 4,000,000                        | ..                              |
| 097                              | Education Affairs and Services not elsewhere classified | 334,253,000                     | 321,805,000                      | ..                              |
|                                  | <b>Total</b>                                            | <b>798,243,000</b>              | <b>764,075,000</b>               | <b>..</b>                       |
| <b>OBJECT CLASSIFICATION</b>     |                                                         |                                 |                                  |                                 |
| A01                              | <b>Employees Related Expenses</b>                       | <b>152,302,000</b>              | <b>144,472,000</b>               | <b>..</b>                       |
| A011                             | Pay                                                     | 90,043,000                      | 82,563,000                       |                                 |
| A011-1                           | Pay of Officers                                         | (50,889,000)                    | (44,562,000)                     |                                 |
| A011-2                           | Pay of Other Staff                                      | (39,154,000)                    | (38,001,000)                     |                                 |
| A012                             | Allowances                                              | 62,259,000                      | 61,909,000                       |                                 |
| A012-1                           | Regular Allowances                                      | (56,630,000)                    | (56,430,000)                     |                                 |
| A012-2                           | Other Allowances (Excluding TA)                         | (5,629,000)                     | (5,479,000)                      |                                 |
| A02                              | <b>Project- Pre-Investment Analysis</b>                 | <b>1,040,000</b>                | <b>1,040,000</b>                 | <b>..</b>                       |
| A03                              | <b>Operating Expenses</b>                               | <b>56,150,000</b>               | <b>54,036,000</b>                | <b>..</b>                       |
| A04                              | <b>Employees' Retirement Benefits</b>                   | <b>394,000</b>                  | <b>394,000</b>                   | <b>..</b>                       |
| A05                              | <b>Grants Subsidies and Write off Loans</b>             | <b>573,429,000</b>              | <b>552,305,000</b>               | <b>..</b>                       |
| A06                              | <b>Transfers</b>                                        | <b>6,812,000</b>                | <b>3,712,000</b>                 | <b>..</b>                       |
| A09                              | <b>Physical Assets</b>                                  | <b>2,975,000</b>                | <b>2,975,000</b>                 | <b>..</b>                       |
| A13                              | <b>Repairs and Maintenance</b>                          | <b>5,141,000</b>                | <b>5,141,000</b>                 | <b>..</b>                       |
|                                  | <b>Total</b>                                            | <b>798,243,000</b>              | <b>764,075,000</b>               | <b>..</b>                       |

## Appendix IV

NO. ----\_ HIGHER EDUCATION COMMISSION

DEMANDS FOR GRANTS

DEMAND NO. ----  
(FC21H03)  
HIGHER EDUCATION COMMISSION

I. ESTIMATES of the Amount required in the year ending 30 June, 2012 for HIGHER EDUCATION COMMISSION.

Voted Rs. ..

II. FUNCTION-cum-OBJECT Classification under which this Grant will be accounted for on behalf of the MINISTRY OF EDUCATION.

|                                  |                                         | 2010-2011<br>Budget<br>Estimate | 2010-2011<br>Revised<br>Estimate | 2011-2012<br>Budget<br>Estimate |
|----------------------------------|-----------------------------------------|---------------------------------|----------------------------------|---------------------------------|
|                                  |                                         | Rs                              | Rs                               | Rs                              |
| <b>FUNCTIONAL CLASSIFICATION</b> |                                         |                                 |                                  |                                 |
| 093                              | Tertiary Education Affairs and Services | 23,220,000,000                  | 29,057,000,000                   | ..                              |
| <b>Total</b>                     |                                         | <b>23,220,000,000</b>           | <b>29,057,000,000</b>            | <b>..</b>                       |
| <b>OBJECT CLASSIFICATION</b>     |                                         |                                 |                                  |                                 |
| A03                              | Operating Expenses                      | 3,693,422,000                   | 3,816,154,000                    | ..                              |
| A05                              | Grants Subsidies and Write off Loans    | 19,526,578,000                  | 25,240,846,000                   | ..                              |
| <b>Total</b>                     |                                         | <b>23,220,000,000</b>           | <b>29,057,000,000</b>            | <b>..</b>                       |

NOTE: Budget for 2011 - 2012 has been reflected under Demand No. 35.

## **8. CONCLUSION**

As we have seen the costing of an educational plan requires first a distinction between capital and recurrent costs; for each of these, cost projections are carried out separately. The projection of recurrent costs is, in turn, done separately for the different levels of education, i.e. primary, secondary and higher education. When, at each level, we can employ a projection formula which expresses recurrent costs in terms of such factors as population enrolment ratio, teacher salaries, etc. and permits specific assumptions for each of them.

After all this disaggregating and separating, the final step of costing the educational plan involves reassembling the partial cost projections to yield an estimate of the total costs implied by the plan in year 1,2,3 ... etc. of the plan period. It is this total cost estimate which will then be gauged against the project resources available for education.

## **9. RECOMMENDED READING**

1. Peter Williams. Planning Teacher demand and supply, UNESCO IIEP 1979 Paris.
2. Lyons, Raymond F. Requirement and Supply of Teachers (25) Paris IIEP 1968.
3. Joh Vaizey and John Shahan, Resources for Education, London, 1968.
4. R.A. Freeman, school needs in the decade ahead. Washington, D.C. 1968.
5. [www.finance.gov.pk/fb\\_2011\\_12\\_summary\\_whitebook.html](http://www.finance.gov.pk/fb_2011_12_summary_whitebook.html).  
Government of Pakistan, Ministry of Finance.

## 10. TEST AND APPLY YOUR KNOWLEDGE

- Question 1:
- a. In what ways can the economic planner indicate the resource availability for education?
  - b. Should his estimates be accepted without question?
  - c. In what cases is a check of the estimates provided by the economic planner?
  - d. Should the educational planner act by himself if he has to revise the estimate of resource availability for education?
- Question 2: What data are required to forecast resource availability?
- Question 3: What steps are required to determine the number of schools to be built during a new plan period?
- Question 4: Why do we place so much emphasis on a retrospective analysis of unit costs? What can the planner expect from it?
- Question 5: In country x between year 1 and 2 the population of primary school age increases by 5 percent, the primary level enrolment ratio by 2 percent, salaries and other recurrent costs per teacher by 10 percent while the student, teacher ratio in primary schools decreases by 3 percent. What will be the percentage increase of recurrent costs of primary education from year 1 to year 2?

## 11. SUGGESTED ANSWERS

- To question 1: a. As “ceiling provision”, expressed as
- i. Global outlay on education, with or without details as regards its breakdown according to forms, levels or types of education or
  - ii. Percentage of annual Government Budget, or
  - iii. Percentage of GNP, GDP, NO.
- b. No.
- c. When a marked increase or decrease is seen over the previous years, when a drastic redistribution of budgetary provisions for various government activities is indicated, when an over ambitious rate of economic growth is assumed.
- To question 2: See Para 2 of this unit.
- To question 3: The following steps are usually required at each level of education.
- a. Determine the expected increase of enrolment over the plan period.
  - b. Determine that part of the additional enrolment which can be accommodated in existing, under-utilized schools.
  - c. Decide on the average school size.
  - d. From a, b and c derive the number of new school buildings to be constructed.
  - e. Add the number of old school buildings which need replacement of the number of new buildings to be constructed during the plan period.
- To question 4: See Paragraph 7 of this unit.
- To question 5: Recurrent costs of primary education will increase by 21 percent. You can compute this by using the formal given in Para 8.5.

## **Unit – 9**

# **COLLECTION, PROCESSING, STORAGE AND RETRIEVAL OF EDUCATIONAL STATISTICAL DATA**

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**2012**

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## 1. INTRODUCTION

This unit is devoted to the processes and techniques used in handling the data from the collection stage to the final processing stage. The processing may be manual or by the help of machine.

As the process of planning can be meaningful only if we have all the necessary information is properly prepared from ready for use. This step is also essential in other methods of processing. The information in our case is the educational data that we collect. Every organization was considered to make the planning process means full and accurate.

At this stage, you will ask, “What is a sound data base”? You might have come across several publications on educational statistics. These publications contain all possible information that you require in educational planning. Do these publications give us “sound data base”? The answer is a big No-Reason? These data are collected through very long channels of communication and these have never been checked for validity. If you projections and deriving other conclusions, you will certainly come out with contradictory results. There are wide variations in the information tabulated by our Planning Division and the statistical year books of the Ministry of Education. The sources of collection in both the cases are the same, i.e. the provincial governments. This one single factor constitutes the adequate evidence for its lack of validity. It is easy to conclude that if this type of data is fed into the computer or processed manually, the results will not be of any use.

## **2. OBJECTIVES**

By the time you have gone through this unit, you should be able to understand:

- i. Different ways in which statistical data are obtained for educational planning.
- ii. Important factors to be considered in preparing a statistical questionnaire
- iii. The four phases of processing educational data.
- iv. Different kinds of equipment used for processing, storage and retrieval of data

### 3. COLLECTION OF DATA

Collection of data is thus the first important step. In Pakistan Central Bureau of Education at the Federal level and the Bureau of Statistics at the provincial level collect the educational data. These data are based on the information received from the District Education Officers. The District Education Officers get the data from the schools.

In most countries of the world, different techniques for the collection of data are in vogue:

- i. Regular censuses of students, teachers etc. in all educational institutions.
- ii. Regular sample survey of students, teachers etc. in all educational institutions or a sample of educational institutions.
- iii. Adhoc surveys at irregular intervals.
- iv. Population censuses
- v. Sample surveys drawn from the total population, probably in conjunction with population censuses.
- vi. Routine reporting of data obtained as a by-product of educational administration.

#### 3.1 Census:

A census is a study that obtains data from every member of a population. In most studies, a census is not practical, because of the cost and/or time required.

Most countries of the world collect the educational statistics by means of annual school census. A certain date in the year is chosen as the school census day. On this day the headmasters, the teachers and the students are involved in providing the necessary data. Questionnaires are distributed before hand, which are filled in and returned to District Education Office.

#### 3.2 Sample Survey:

A sample survey is a study that obtains data from a subset of a population, in order to the estimate population attributes. The information received as a result of the annual school census does not include the entire information needed for educational planning. It is normally a report on the school population and the strength of teachers. The condition of school building, the situation of an accommodation, etc. which an educational planner needs cannot be included in the above exercise. In order to get information on these aspects, the sample survey is used. For this purpose a number of schools is selected and information on all aspects of the system is collected.

Sample surveys are also used for getting information on questions like the social background of the students or reasons for leaving teaching profession. The procedure adopted is similar to the one described above. On the basis of this information the results are generalized for the entire country or the region.

### **3.3 Adhoc Surveys:**

Adhoc surveys are another method of collecting data. This method is applied when data are needed for some specific project or a number of projects. This method may also be used for checking the validity of the data already collected. Information on any number of items or aspects of the educational system can be collected in this way.

### **3.4 Population Censuses:**

Population censuses are conducted regularly at 10 years' intervals in many countries of the world. The reports of census contain the age distribution of the population. It clearly gives the population of ten years old, twenty years' old etc. This information or data are useful for an educational planner and can give him the information on school age population. Based on this information the educational planner can work out different educational requirements. Population censuses are therefore, one of the important mean of collecting data about education.

An educational planner does not always rely on the census reports. He may undertake his own sample surveys and make his own generalizations. He selects a sample out of the total population and checks on those characteristics of that population which he requires.

### **3.5 Experiment:**

An experiment is a controlled study in which the researcher attempts to understand cause and affect relationships. The study is "controlled" in the sense that the researcher controls:

1. How subjects are assigned to groups and
2. Which treatments each group receives.

In the analysis phase, the researcher compares group scores on some dependent variable. Based on the analysis, the researcher draws a conclusion about whether the treatment (independent variable) had a casual effect on the dependent variable.

### **3.6 Observational Study:**

Like experiments observational studies attempts to understand cause and effect relationships. However, unlike experiments, the researcher is not able to control

- i. How subjects are assigned to groups and
- ii. Which treatments each group receives.

### **3.7 By-product of the conduct of institution:**

Data are also collected as by-product of the conduct of institution. Schools are inspected regularly by the school inspectors. The results of inspection are reported to the district office. These reports can be utilized for creating data on the enrolment; promotion rate and dropout rate. During a year the education departments at federal and provincial levels may ask for reports which may contain data on some aspects of education. This is one way of collecting data.

### 3.8 Data Collection pros and Cons

The most commonly used tools of data collection for planning include questionnaires and checklists. Each method of data collection has advantages and disadvantage.

#### 3.8.1 Resources:

When the population is large, a sample survey has a big resource advantage over a census. A well designed sample survey can provide very precise estimates of population parameters – quicker, cheaper and with less manpower than a census.

#### 3.8.2 Generalizability

Generalizability refers to the appropriateness of applying findings from a study to a large population. Generalizability requires random selection. If participants in a study are randomly selected from a large population it is appropriate to generalize.

Observational studies do not feature random selection, so it is not appropriate to generalize from the results of an observational study to a large population.

#### 3.8.3 Causal Inference:

Cause and effect relationship can be teased out when subjects are randomly assigned to groups. Therefore, experiments, which allow the researcher to control assignment of subjects to treatment groups are the best method for investigating causal relationships.

## 4. TOOLS FOR DATA COLLECTION

### 4.1 Questionnaire

A questionnaire is a set of carefully selected and ordered questions prepared by an investigator to seek factual information from respondents or to find their opinion, attitude or interest. Some authors restrict the use of the word questionnaire to a set of questions seeking factual information whereas those seeking opinion are called *opinionnaire* and those dealing with attitude of the respondent are called *attitude scale*. However, it is generally agreed that isolating specific questions for the consideration of respondents tends to objectify, intensify and standardized their observations.

#### 4.1.1 Framing of Questions:

Have you thoroughly explored your hypothesis, experience, literature and other questionnaires so as to frame questions stated in crystal clear, simple language and sharply focused in meaning? Are subordinate questions asked or is an exhaustive list of alternative choices provided so as to explore various aspects of decisive answers? Are the questions framed to elicit specific answers. These are the questions, the answers of which help you decide what information is needed, which questions are to be selected and then draft and review them.

#### **4.1.2 Ordering of Questions:**

An item placed in psychologically or logically sound sequence sample, interesting, neutral questions proceeding more difficult, crucial or personal ones and those that establish a frame of reference or provide keys to recall before those asking for detail is a smooth transition made from one group of questions to the next? Positive answers to these questions will help you order the questions on technically sound basis.

#### **4.1.3 Designing the Directions and Format:**

Are clear and complete directions given concerning the type and scope of information that is wanted? Are the categories, format and directions designed to elicit accurate and unambiguous answers to require minimum of respondent's time? These are the questions which help in designing directions and format for the questionnaire.

#### **4.1.4 Forms of Questionnaire:**

You can construct questions in the form of closed open, pictorial and scale item you can utilize one type of questionnaire exclusively or a combination of them when structuring your questionnaire. The nature of the problem and the character of the respondents determine which form or forms will most likely supply the desired data. For statistical data closed form questionnaire are used:

##### **a. Closed form:**

Closed form of questionnaire usually consists of a prepared list of concern questions and a choice of possible answers. To indicate his answer, the respondent simply marks 'yes' or 'no' or check one or more items from the list of answers. Often an alternative "Do not know" is provided in items seeking opinion on highly controversial matters. Sometimes, respondents are asked to rank a series of statements / reasons / factors etc, in the order of their importance of interest.

Closed form questionnaires are easy to fill out and help in keeping the respondents mind focused on the subject. However, they often fail to reveal the respondent's motives (why the answers as he does), and do not always get information of sufficient scope and depth, and may not discriminate between finer shades of meaning. Fixed alternative responses may make respondents take a stand on issues about which they have not crystallized opinion or may force them give answers that do not accurately express their ideas.

Questionnaires are distributed among the data providers. The timing and format of the questionnaires is another important factor affecting the validity of data. This is so important an aspect that it needs to be discussed separately.

The work of the educational statistics office involves the construction of questionnaires. Only a few points of introduction to the construction of the questionnaires will be given:

- a. The quality of the data we get from the questionnaires depends to a very large extent on the quality of the instrument. Therefore, much attention must be paid to

the construction of the questionnaires and specialists in the field should be consulted.

- b. The suitable shape of the questionnaire depends on a series of factors: costs, ease of communication, type of data providers, mode of data processing, etc. It must provide adequate space for the answers and allow quick and safe reading by clerks and punched card operators. The use of different colours to separate the different forms is recommendable.
- c. Like other instruments used in research in the behavioural sciences, questionnaires have to be tried out in trial runs or preliminary investigations before they can be used in a major study. It is also often necessary to complement them by other methods of data collection e.g. interviews with a number of “critical” or typical certain answers and to check the data.
- d. The timing of the distribution of the questionnaires is also of great importance and should be determined during try-outs. The questionnaire should not arrive when headmasters are too busy to give them proper attention.
- e. The questions in a questionnaire should be clear, short and simple. Their meaning should be easily understood and it is preferable that they are self-explanatory as instructions are usually not read. Every question should be relevant.

#### **4.2 Observation**

Observation is concerned with the overt behaviour of persons under conditions of normal living. Many important aspects of human observation are concerned with the overt behaviour of persons under conditions of normal living. Many important aspects of human behaviour cannot be profitably observed under the artificially arranged laboratory conditions. Observation as a research technique must be directed by a specific purpose; systematic, carefully focused and thoroughly recorded. Like other research procedures, it must be subjected to the usual checks for accuracy, validity and reliability. The observer must know just what to observe and what to look for. Both reliability and validity of observation are improved when observations are made at frequent intervals by the same observer. Observation may be direct or indirect, scheduled or unscheduled and known or unknown.

##### **Methods of Recording Observations:**

To aid in the recording of information gained through observation, a number of devices have come to be extensively used. These instruments help the researcher focus his attention on specific phenomena, make objective and accurate observation and systematize the collection of data.

#### 4.2.1 Check-list

The check-list is the simplest of the devices, consisting of a prepared list of items. The presence or absence of the items may be indicated by checking “Yes or No” or the type and number of items may be indicated by inserting the appropriate word or number. This simple “laundry list” type of devices systematizes and facilitates the recording of observation and helps to assure the consideration of important aspects of the object or act observed.

Suppose you want to use observation for gathering data to study project implementation. Before you actually visit the project office, you must have a complete list of things that you want to observe. For this purpose you prepare a checklist some of whose items may be the following”

|                                                                      |     |    |
|----------------------------------------------------------------------|-----|----|
| Is a copy of the approval of PC-1 available?                         | Yes | No |
| Has a time schedule been prepared to start various major activities? | Yes | No |
| Have responsibilities for each major activity been assigned?         | Yes | No |
| Has detailed drawing of the building been prepared?                  | Yes | No |
| Has the building plan been approved?                                 | Yes | No |

The data collected through check list would be as exhaustive and complete as the checklist.

The Educational Statistics Office depends on a staff of non-statisticians for the filing-out of the statistical questionnaires. Particularly in countries on an early stage of statistical development, it is necessary to teach data providers how to fill out forms. It is also important to explain reasons for and results of the data collection so that the data providers understand that their help is useful and necessary.

The creation of statistical consciousness also includes on explanations of the role of statistics in educational planning illustrated by examples of how the data are used.

Teach how to fill out forms explain reasons for the data collection give a feedback of the results of the data collection. Give examples of how data are used.

We have discussed almost all possible methods for collecting educational statistics. The statistics thus collected are not in useable form. Two steps are essential before it can be used effectively. The first step is to ensure that as far as possible, the data are valid. The second step is to analyze the information and to break it down into different forms. Let us consider the first step.

#### 4.2.2 Rating Scale:

A rating scale is used for qualitative description of a limited number of aspects of a thing or traits of a person. In this device the aspects of the thing or the traits of a person are rated on a five or a seven point scale from the highest to the lowest. In other words we can say that a rating scale is a method that requires the rater to assign a value, some time numeric to the related object, as a measure of some rated attribute.

**Classification of Rating Scales:**

There are four main types of rating scales:

**a. Ordinal Scale:**

Rating scale in which numbers indicate the relative position of items, but not the magnitude of difference. Liker scale is example of it e.g.

Does computer effect on office work efficiency?

1. Strongly disagree
2. Disagree
3. Agree
4. Strongly agree
5. Not sure

**b. Interval Scale:**

When members indicate the importance of difference between items, but there is no absolute zero point. Attitude scales and opinion scales are examples.

**c. Ratio Scale:**

Where numbers indicate importance of difference and there is a fixed zero point. Ratio can be calculated e.g. costs, scales, revenue, age, income, price etc.

**4.2.3 Importance of Observational Techniques:**

Following are some of the merits of observational techniques in the collection of data:

- a. Observational techniques supply information which supplements the information obtained by other method.
- b. Observation supplies information which cannot be gathered by other available techniques.
- c. Observation provides a sample of individuals real behaviour.
- d. Observations are selective.
- e. Observation promotes the growth of person doing the observation

**4.3 Interviews:**

In quantitative research (survey research) interviews are more structured than in qualitative research. In structured interviews, the researcher asks a standard set of questions and nothing more (Leady and Ormrod 2001).

**4.3.1 Face-to-Face Interviews:**

Face-to-Face interviews have a distinct advantage of enabling the researcher to establish rapport with potential participants and therefore, gain their cooperation/ These interviews yield highest response rates in survey research. They also allow the researcher to clarify ambiguous answers and when appropriate, seek follow-up information. Disadvantages include impractical when large samples are involved time consuming and expensive (Leady and Ormrod, 2001).

#### **4.3.2 Telephone Interviews:**

Telephone Interviews are less time consuming and less expensive and the researcher has ready access to anyone on the planet who has a telephone. Disadvantages are that the response rate is not as high as they face-to-face interview but considerably higher than the mailed questionnaire. The sample may be biased to the extent that people without phones are part of the population about whom the researcher wants to draw inferences.

#### **4.3.3 Computer Assisted Personal Interviewing (CAPI)**

This is a form of personal interviewing, but instead of completing a questionnaire the interviewer brings along a laptop or hand held computer to enter the information directly into the database. This method saves time involved in processing the data, as well as saving the interviewer from carrying around hundreds of questionnaires. However, this type of data collection method can be expensive to set up and requires that interviewers have computer and typing skills.

## **5. VALIDITY CHECKING**

There can be several ways of checking the validity of the data collected. The decision on what way to be used depends upon the individual using the data. He may compare with the data collected during previous three to five years. The criteria in this case will be the trends of growth or decline. If these trends are consistent, it can be safely assumed that the data are valid. If there are inconsistencies, the validity becomes doubtful. For example, if the rate of growth in enrolment over the years has been 5% and the present data, compared with the previous information shows this rate to be 15%, the need for further checking is established. The educational planner in this case may have to look at the policies of the government, the increase in educational expenditure or the other measures that might have been taken. He may also resort to “sample checking”.

The sample checking technique is to be used in two cases. One case has been described in the previous paragraph. This technique is also applied (second case) if the validity of the previous years' data is doubtful. The educational planner may draw a “representative sample” of the population that he is investigating. The size of the sample depends upon his resource and convenience. It can be as large as to cover 30% of the entire population or as small as giving coverage only to less than 5%. There is one important criterion for effectiveness of this technique which should not be missed. The criterion is that the “sample must have all the characteristics that the original population has”. This qualification alone can give it a representative character.

## 6. ANALYSIS OF DATA

### **Data analysis:**

According to Mosby's Medical dictionary, 8<sup>th</sup> edition 2009, the phase of study that includes classifying, coding and tabulating information needed to perform quantitative or qualitative analyses according to research design and appropriate to the data. Data analysis follows collection of information and precedes its interpretation or application.

Analysis of data is a process of inspecting, clearing, transforming and modeling data with the goal of highlighting useful information, suggesting conclusions and supporting decision making. Data analysis has multiple facts and approaches, encompassing diverse techniques under a variety of names, in different business, science and social science domains.

### **Type of data:**

Data can be of several types.

### **Quantitative data:**

- Data is a number, often this is a continuous decimal number to a specified number of significant digits.
- Sometimes is a whole counting number.

### **Categorical data:**

Data one of several categories.

### **Qualitative data:**

Data is a pass/fail or the presence or lack of a characteristic.

### **The process of data analysis:**

Data cleaning is an important procedure during which the data are inspected and erroneous data are – if necessary, preferable and possible corrected data cleaning can be done during the stage of data entry. If this is done, it is important that no subjective decisions are made. The guiding principle provided by Ader (ref) is: during subsequent manipulations of the data. Information should always be cumulatively retrievable. In other words, it should always be possible to undo any data set alterations. Therefore, it is important not to throw information away at any stage in the data cleaning phase. All information should be saved i.e. when altering variables, both the original values and the new values should be kept, either in a duplicate data set or under a different variable name), and all alternations to the data set should carefully and clearly documented, for instance in a syntax or a log.

### **Initial data analysis:**

The most important distinction between the initial data analysis phase and the main analysis phases, is that during initial data analysis one refrains from any analysis that are

aimed at answering the original research question. The initial data analysis phase is guided by the following four questions.

### **Quality of data:**

The quality of the data should be checked as early as possible data quality can be assessed in several ways, using different types of analyses, frequency counts, descriptive statistics (means, standard deviation, median), normality (skewness, kurtosis, frequency histograms, normal probability plots) associations (correlations, scatter plots).

Other initial quality checks are:

- Checks on data cleaning, have decisions influenced the distribution of the variables? The distribution of the variables before data cleaning is compared to the distribution of the variables after data cleaning to see whether data cleaning has had unwanted effects on the data.
- Analysis of missing observations: are there many missing values, and are the values missing at random? The missing observation in the data are analyzed to see whether more than 25% of the values are missing where they are missing at random (MAR) and whether some form of imputation needed.

**Analysis of extreme observations:** Outlying observations as the data are analyzed to see if they seem to disturb the distribution.

**Comparison and correction of differences in coding schemes:** Variables are compared with coding schemes of variables external to the data set, and possibly corrected if coding schemes are not comparable.

### **Test for common-method variance:**

The choice of analyses to assess the data quality during the initial data analysis phase depends on the analyses that will be conducted in the main analysis phase.

### **Quality of measurements:**

The quality of the measurement instruments should only be checked during the initial data analysis phase when this is not the focus or research question of the study. One should check whether structure of measurement instruments corresponds to structure reported in the literature.

There are two ways to assess measurement quality:

### **Confirmatory factor analysis:**

Analysis of homogeneity (internal consistency, which gives an indication of the reliability of a measurement instrument. During this analysis, one inspects the variances of the items and scales, the Cronbach's  $\alpha$  of scales and the change in the Cronbach's  $\alpha$  when an item would be deleted from a scale.

**Initial transformations:**

After assessing the quality of the data and of the measurements, one might decide to impute missing data, or to perform initial transformation of one or more variables, although this can also be done during the main analysis phase.

Possible transformations of variables are:

**Square root transformation:** (If the distribution differs moderately from normal)

**Log-transformation:** (If the distribution differs substantially from normal)

**Inverse transformation:** (If the distribution differs severely from normal)

**Make categorical:** (Ordinal/dichotomous) (If the distribution differs severely from normal and no transformation help)

**Did the implementation of the study fulfill the intentions of the research design?**

One should check the success of the randomization procedure, for instance by checking whether background and substantive variables are equally distributed within and across groups.

If the study did not need and / or use a randomization procedure, one should check the success of the non-random sampling, for instance by checking whether all subgroups of the population of interest are represented in sample.

Other possible data distortions that should be checked are:

**Dropout** (this should be identified during the initial data analysis phase).

**Item non-response** (whether this is random or not should be assured during the initial data analysis phase).

**Treatment quality** (using manipulation checks).

**Characteristics of data sample:**

In any report or article, the structure of the sample must be accurately described. It is especially important to exactly determine the structure of the sample (and specifically the size of the subgroups) when subgroups analyses will be performed during the main analysis phase.

The characteristics of the data sample can be assessed by looking at:

- Basic statistics of important variables
- Scatter plots
- Correlations
- Cross-tabulations

**Final stage of the initial data analysis:**

During the final stage, the findings of the initial data analysis are documented and necessary, preferable and possible corrective actions are taken.

Also, the original plan for the main data analyses can and should be specified in more detail and/or rewritten.

In order to do this, several decisions about the main data analyses can and should be made”

- In the case of non-normal's: should one transform variables; make variables categorical (ordinal/dichotomous) adapt the analysis method?
- In the case of missing data: should one neglect or impute the missing data; which imputation technique should be used?
- In case items do not fit the scale: should one adopt the measurement instrument by omitting items, or rather ensure comparability with other (uses of the) measurement instrument (s)?
- In the case of (too) small subgroups should one drop the hypothesis about inter-group differences, or use small sample to changes, like exact tests or bootstrapping?
- In case the randomization procedure seems to be defective: can and should one calculate propensity scores and include them as covariates in the main analyses.
- In the case of outliers: should one use best analysis techniques?

**Analysis:**

Several analyses can be used during the initial data analysis phase;

- Univariate statistics
- Bivariate associations (correlations)
- Graphical techniques (scatter plots)

It is important to take the measurement levels of the variables into account for the analyses, as special statistical techniques are available for each level.

**Nominal and ordinal variables:**

- Frequency counts (numbers and percentages)
- Associations
- Circumambulations (cross-tabulations)
- Hierarchical loglinear analysis (restricted to a maximum of 08 variables)
- Loglinear analysis (to identify relevant/important variables and possible confounders)
- Exact tests or bootstrapping (in case subgroups are small)
- Computation of new variables.

- **Continuous variables**
  - Distribution
  - Statistics (M, SD, variance, skewness, kurtosis)
  - Stem-and-leaf displays
  - Box plots

### **Main data analysis:**

In the main analysis phase analyses aimed at answering the research question are performed as well as any other relevant analysis needed to write the first draft of the research report.

### **Exploratory and confirmatory approaches:**

In the main analysis phase either an exploratory or confirmatory approach can be adopted. Usually the approach is decided before data is collected. In an exploratory analysis no clear hypothesis is stated before analysing the data, and the data is searched for models that describe the data well. In a confirmatory analysis clear hypotheses about the data are tested.

### **Exploratory data analysis:**

Should be interpreted carefully when testing multiple models at once there is a high chance on finding at least one of them to be significant, but (a technical term used in statistic to describe particular flaws in a testing process, where a true null hypothesis was incorrectly rejected (type I error)) this can be due to a type I error. It is important to always adjust the significance level when testing multiple models with, for example, a bonferroni correction.

(Bonferroni correction is a method used to counteract the problem of multiple comparisons.)

Also, one should not follow up an exploratory analysis with a confirmatory analysis in the same dataset. An exploratory analysis is used to find ideas for a theory, but not to test that theory as well when a model is found exploratory in a data set, then following up that analysis with a confirmatory analysis in the same datasheet could simply mean that the results of the confirmatory analysis are due to the same type I error that resulted in the exploratory model in the first place the confirmatory analysis therefore will not be more informative than the original exploratory analysis.

### **Stability of results:**

It is important to obtain some indication about how generalizable the results are while this is hard check, one can look at the stability of the results. Are the results reliable and reproducible? There are two main ways of doing this.

### **Cross-validation:**

By splitting the data in multiple parts we can check if analyzes (like a fitted model) based on one part of the data generalize to another part of the data as well.

**Sensitivity analysis:**

A procedure to study the behaviour of a system or model when global parameters are (systematically) varied. One way to do this is with bootstrapping.

**Statistical methods:**

A lot of statistical methods have been used for statistical analyses. A very brief list of four of the more popular methods is:

- **General linear model:**  
A widely used model on which various statistical methods are based (e.g. t test, ANOVA, ANCOVA, MANOVA). Usable for assessing the effect of several predictors on one or more continuous dependent variable.
- **Generalized linear model:**  
An extension of the general linear model for discrete dependent variables.
- **Structural equation modeling:**  
Usable for assessing latent structures from measured manifest variables.
- **Item response theory:**  
Models for (mostly) assessing one latent variable from several binary measured variables (e.g. an exam)
- **Free software for data analysis:**
  - Root** – C++ data analysis framework developed at CERN.
  - PAW** – FORTRAN/C data analysis framework developed at CERN.
  - JHep work** – Java (Multi – platform) data analysis framework developed at ANL.
  - KNIME** – the Konstanz information miner, a user friendly and comprehensive data analytics framework.
  - Data Applied:** an online data mining and data visualization solution.
  - R** – a programming language and software environment for statistical computing and graphics.
  - Devinfo** – a database system endorsed by the United Nations Development Group for monitoring and analyzing human development.
  - Zeptoscope Basic** – Interactive Java-based plotter developed at Nanomix.

## 7. STORAGE OF DATA

After the data are collected and properly analyzed, these are ready for manual and machine processing. The next important step is its storage. For storing data, you need to generate “data files”. Each unit of data will be recorded on a separate file. If the processing is manual the data will be kept in shelves. The order in which the organization will use the data will have to be kept in view. The totality of all these files maintained in a proper sequential form will make your “data library”.

If the organization has a computer the data will be stored into the machine. This idea is not so simple as it obviously looks. The sequence in which the data are to be processed and managed is to be conceived beforehand. All possible applications of data are to be listed. On the basis of the exercise and the entire file records are to be intergraded in to a single file. The repetitions and duplications are to be identified and removed.

With the above cautions exercises, the data will be stored into the computer. This single interacted data file will be known as “data base file” or the “data bank”.

This is not the end of the exercise. The information in the society is continuously changing. The data file shall therefore need updating from time to time. This updating may involve the internal adjustment or incorporation of the fresh information received from external sources. The internal changes may be easily adjusted, but the incorporation of fresh information received from external sources is a challenging task for the “system analyses”.

So far we have discussed the techniques of data collection and suggested a few measures for ensuring its validity. This part of the discussion was related to the persons sitting in a central office and having the responsibility of managing and maintaining the data. The data are provided by the sources lying outside the central office and there is hardly any control over the data providers. Despite all the caution at the central level the data providers may be unaware of importance of data and may provide totally bogus information. This element of risk exists, especially, in countries like Pakistan. The staff at the Education office or the headmasters and the working teachers, who are the main source of data, are normally not much aware of the importance of the information that is being provided.

In countries like ours some additional safeguards are necessary. Two steps, which appear to be unavoidable, are (i) training of the staff at the District Education office level in compiling data, and (ii) proper familiarization of the teachers, and headmasters with the nature of the importance of the information that is to be provided by them.

## 8. THE MINIMUM DATA REQUIREMENTS

Another important requirement related to the collection of statistics is to decide on the minimum data that must be collected. Many countries in addition to having an inadequate reporting system require far too much to be reported. This is why the system does not work. It is much easier to add new data to be collected than to decide to drop certain data and the body of statistics collected just grows.

The content of the essential minimum will vary from country to country. It should take the form of at least an annual questionnaire. The data not provided by the annual school census should be obtained by special surveys based on sampling.

The non-formal education including adult education, certain vocational training, training programmes in other Ministries, etc. requires a different procedure due to the dispersed nature of its administrative control. The importance of non-formal education is increasing rapidly and a different kind of questionnaire will be required for it, incorporating some of the elements of the regular questionnaire but adding other elements reflecting the special nature of this type of education.

The minimum essential data most often missing are on repeaters, on students in higher education by year of study and age, on teachers by qualification, age and subject taught, on expenditure by purpose and unit costs.

However, poor the data of the school and university system are, they are always worse in the non-formal educational system which is particularly unfortunate as this is a new area. Hence deliberate attempts shall have to be made to collect relevant data for this purpose. Such data would for example include education administered by other Ministries than the Ministry of Education, courses for adults, courses for early school leavers in agriculture, fishery and handicraft etc.

## 9. A SYSTEM OF SAMPLE CHECKING

The need to develop greater use of sampling techniques is a consequence of a reduced annual questionnaire. There is also a need to devise a system of sample checking. One of the major weaknesses in educational statistics is the variable quality of the statistics. The data are often inaccurate at the reporting stage. Some of the errors will escape through the first check-point. The use of sampling techniques for special surveys offers an opportunity for sample checks on the basic annual data to be carried out at the same time. The purpose of a regular programme of sample checks is not only to reduce the number of errors but also to ascertain the quality of the data and be in a position to improve it.

### **Basic Data and “Derived” Data**

A useful distinction may be made here between basic data obtained from schools, from headmasters, teachers, students, from original sources and data that are “derived” after

classifying, tabulating and analyzing, etc, such basic data. The basic data are sometimes called the “raw” data. At the decision-making level one required “digested” data based on the raw data. For example, at the central ministry level we may not require to know the salary and allowances of each teachers or a particular teacher, but we would like to know how many teachers are earning a certain scale, or the total expenditure on teacher salaries etc.

For most of these decision-making purposes, raw data are available in difference files, but it is not tabulated and put in a form required by the decision-maker. It may also happen that the raw data are scattered in many different files and the temptation would be to send another circular to call for raw data again, relevant to the particular decision to be taken. Many such delays in decision-making and unnecessary work of answering circulars can be avoided if there is a proper system of processing, storing and retrieving the data.

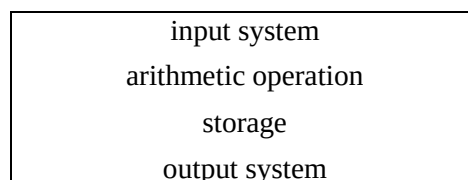
## **10. DATA PROCESSING, STORAGE AND RETRIVAL**

The question of data processing, storage and retrieval is related to the level of development of the statistical office. In some countries, the office has only about ten persons working in others there are several hundreds. The resources are consequently different and so are the needs. The needs for educational statistics are related to the development of the educational planning machinery. Where planning has reached a rather sophisticated level, the demand on the statistical office are much greater, both as to the amount of information needed and the flexibility of, and the access to, such information. All this influences the methods of processing, storage and retrieval of data.

### **10.1 The Data Processing**

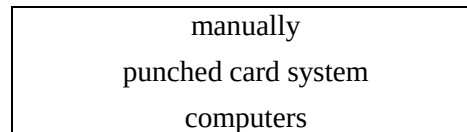
How can we process our data, manually or by means of machines so that this is done in the most efficient way and with the consideration given to the reduction of errors? We have read the organization of the computer. The data processing follows the same path.

The process has four phases. We must have an input system: the original data are transferred to a form, which is suitable for processing. There is an arithmetic operation performed on the data with the help of desk calculators, punched-card operated machines or computers. There is a system which permits storage of all the original information as well as intermediate data which appear while we process the original ones. Finally there must be an output system which permits us to present processed data in a form which can be used.



Let us look at each of these phases one by one and see how they work in offices equipped in various ways.

The processing of data can be handled manually with the use of calculating machine (mechanical or electronic), by a punched card system or by computers. A combination of these three systems is also possible.



### 10.1.1 The Input System

One important question in relation to the processing of data is the quality of the final product. Modern computer technique offers good possibilities for the rapid controlling of data. After a more general manual control, questionnaires are transferred to magnetic tape and the main control is made in the computer. There are always possibilities of checking sums, logical connections between different variables, etc. in a computer check programme, where only the errors are taken out on error lists and checked manually. The amount of work in the procedure is of course much smaller than if every questionnaire including – the correct ones is checked manually. What the computer can do in a few minutes may take months in a manual procedure.

If we are not using computers for data processing, but use punched card technique or manual processing with calculating machines, we have to formulate our checking instructions as rigidly as possible. Test checking in advance is necessary here as well as before establishing a computer check programme in order to foresee the various types of errors that will occur. It is necessary not only to identify the possible errors but also to give exact instructions of how the errors should be handled and corrected.

The most important point at the input stage is to convert the data into a form which is acceptable to the computer. Data may be presented to a computer in a number of ways, each using a unique coding system for the representation of data. Examples are punched cards, punched paper tape, magnetic tape and optical character reading methods.

The punched card system uses rectangular pieces of cardboard where the information is punched into different fields of the cards. The data have to be represented by a code number.

In the manual system, tables and master sheets are prepared to the filed in including systems of cross-classification.

### 10.1.2 The Arithmetic Operations

In the computerized system the arithmetic unit processes the data to the final form required. It has an in-built control unit to ascertain correct computation.

In the punched card system, the tabulator is equipped with adding machines so that we can get totals of the information punched on sub-groups of cards and larger totals for groups of cards. The tables can be parented in several forms. We can get the original

numerical information printed in the table together with sub-totals, or we can arrange so that we only get certain information common to groups of cards and the totals.

In the manual system we have to add the figures given in the questionnaires, cross-tabulate them and, of course, check all the calculations.

## **10.2 The Storage**

The storage capacity in the computerized system is almost unlimited. Data can be stored on, for instance, magnetic tapes, magnetic discs or magnetic drums. The capacity of and access data storage are different in three cases, but all have a very high capacity and a very high degree of access.

In the punched card system, data are stored on punch cards. A filing system can be devised and the content of different groups of cards can be written on the first card storage.

## **10.3 The Output System**

In the two machine system, the output unit is a printer that prints out the results of the processed data, either in the form of tables ready to be printed and published, or in an intermediate form which needs further editing. The number of these machine lists can be considerable and a system of filing is necessary.

In the manual system the output consists of summary tables that need to be typed and printed.

## 11. CONCLUSIONS

Before a country decides on its programme of educational statistics, it is important to investigate the needs for which a system and the possibilities of developing it, in the light of the educational system in the country and the planning methods.

The choice of data processing method must depend on the amount and type of data that need to be collected and the organization of the Educational Statistics Office. At an early stage of statistical development, where data are collected from the headmasters using a simple questionnaire, the country may chose to use desk calculators. This call for a minimum of technically educated personnel, and the work can be done by a staff of technically unqualified clerks.

As the amount of data increases, the use of punched card systems might be preferred. The office should then be provided with a complete set of such machines; key punchers, verifiers, sorters and tabulators. We need personnel who are qualified these machines. In addition, desk calculators are needed, as data processed by the machines have to be treated further.

In the processing of data, computerized system might be useful only at a very developed stage of the statistical office. It might be as much a hindrance as a help when considering the administrative structure and the lack of skilled personnel. One of the great advantages of computers is that they save time in the actual calculation state. However, computers require very careful preparation of data before they are fed in to the exchange. What is needed in developing countries is a process using mainly national resources that is labour intensive.

There is a considerable amount of statistical data published by international agencies such as United National UNESCO, ILO. The information might be relevant to decision making at the national level. Many times decision-makers require data from other countries, in order to see the situation in their own country in a new light, form a different perspective. For this purpose an educational planner should be fully acquainted with documents which publish such data. Examples of these publications are:

- i. UNESCO Statistical yearbook, Paris, UNESCO.
- ii. Progress of Education in the Asian Region. Statistical Supplement, Bangkok, UNESCO Regional Office for Education in Asia, 1972 and 1975.
- iii. United Nations Demographic Yearbook, New York, United Nations.
- iv. United Nations Demographic Yearbook for Asia and the Far West, Bangkok, ESCAP (Economic and Social Commission for Asia and the Pacific).
- v. Pakistan Education Statistics, Ministry of Education, Islamabad, 1979.

## **12. TEST AND APPLY YOUR KNOWLEDGE**

Five questions are given bellow to test your understanding of the unit. The answers to the questions are to be found in the paragraphs indicated.

1. What are the ways in which the basic statistical data for educational planning can be obtained?
2. What are the most important factors to consider in relation to statistical questionnaires?
3. What is the difference between “raw” and “derived” data?
4. The processing of data has four phases. Which are they?
5. Processing, storage and retrieval of data can be organized with different types of equipment. Give examples.

## **13. BIBLIOGRAPHY**

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