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ABSTRACT

The intent of this document is to describe approximately 30 management science and organizational behavioral techniques with practical applications in school business management. Each technique is described by the mechanics of using the technique, specific applications of the technique, and requirements and constraints in the use of the technique. The use of technical language is avoided, and the document is focused for use by practitioners. The compendium is divided into five basic sections: (1) general management techniques, (2) data analysis techniques, (3) decision-making techniques, (4) planning techniques, and (5) management and organizational development techniques. The compendium contains suggested further readings for all topics. (Author/MLF)

School Business Management Techniques: A Compendium

A Project Sponsored by the
State University of New York at Albany
and the
New York State Association of School Business Officials

by

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January, 1980

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INTRODUCTION

At first glance, the business administrator or any other educational manager may find this publication heavy reading. It may also, at first, seem to some to be written in a foreign language.

One approach, which may make the transition from known to unknown easier, is to review first those techniques which are most familiar to the reviewer.

A second approach is to read all of the introductions to each part before reading the sub units. This will give the reader a quick overview.

A third approach is to read only the application sections for each technique before reading the other two parts of "description" and "problems of implementation of those techniques."

Keep in mind that this is a reference manual, and that it is a very concentrated extract of a body of theory and knowledge.

This paper hopes to offer a bridge between theory and practice which will enable the practioner to take a more objective look at the science of management and hopefully to weave together a list of terms which will be new to most school business officials.

Linear Programming
Operations Research
Modeling
Niteger Programming
Dynamic Programming
CPM
Gannt Charting
Decision Trees
Markov Analysis
Queing Theory
Game Theory
Probability Analysis
Boyesian Analysis
Inventory Models
Decision Theory
Regression Analysis
Ogive
Frequency Polygon
Multiple Regression
Cost/Benefit Analysis
Cost/Effectiveness Analysis
Least Squares Regression
Production Function Analysis
Mathematical Modeling
Non-linear Programming
Quadratic Programming
Cohort Survival Estimation
Team Building
Multiple Scenario
Monte Carlo Sensitivity Analysis
Quanitative Simulation
Process Consultation

A RANDOM LIST OF APPLICATION AREAS SUGGESTED IN THE PUBLICATION

1. Supervisory control of those not directly under the administrator's direct control
2. Inventory control
3. Forecasting energy use or savings
4. Evaluation of Instruction
5. Enrollment projection
6. Cost Control
7. Operational and Financial Planning
8. Making sense out of complex data
9. Budget defeats
10. Effective communication for credibility and to make the complex simple
11. Identification of trends
12. Identify cause of school bus accidents
13. Cash management
14. Optimal school size
15. Employee turn over
16. Absenteeism
17. Projecting outcomes or consequences
18. Bus scheduling
19. Student scheduling
20. Developing negotiation skills
21. Maximize number of students to be taught with given resources
22. Minimize bus stops
23. Minimize instructional expenses

PREFACE

This compendium of management techniques was developed as a response to a need expressed by the members of the New York State Association of School Business Officials. The basic format and content of this cocument was suggested by Dr. Richard J. McClements, Business Administrator for the Minisink Central Schools, and a NYSASBO member, in his doctoral dissertation. The project was encouraged by Dr. Bruce Brummitt, the Executive Director of NYSASBO and it has official NYSASBO endorsement. The authors wish to thank Drs. McClements and Brummitt, as well as NYSASBO, for their sustained cooperation and support.

This document was written using the male gender as a matter of editorial expediency, and no sexual discrimination was intended. It is hoped by the authors that these brief technique descriptions will serve as an impetus for further interest and research in the development of innovative and efficient school business management practices in New York State and nationwide. The authors may be contacted for additional information.

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MANAGEMENT TECHNIQUE DESCRIPTIONS

Introduction

These descriptions are intended to introduce school business officials and other district administrators to management techniques and help them choose the appropriate tools for the job at hand. Since school management involves a wide range of problems and tasks, the manager must have access to many techniques. However, an extensive in-depth search for tools appropriate to each task is seldom possible. By using these descriptions the manager should be able to scan a number of possible approaches quickly so as to choose the ones to receive more detailed attention. We have therefore constructed these descriptions to have enough basic material to allow for some judgment about the appropriateness of the technique for any particular management task. The manager can then decide, based on this preliminary overview, to pursue particular subjects in more detail, through further reading and research.

Each description has three main parts. First the purpose of the technique is outlined along with its main components and terms. Second, possible applications for schools are discussed. Third, we discuss some general problems and concerns for implementation.

The descriptions are necessarily brief. There is no attempt to be comprehensive or to exhaust the possible applications for school management problems. In addition, some of the sections are in fact groups of related techniques, no one of which receives much detailed attention. Therefore, we have included references for further reading in each of the main subjects.

The group of techniques chosen for description covers much of the important content in management. But there has been no attempt to cover all possible topics. We believe that this format for introducing techniques will be useful. Therefore the list was chosen to reflect techniques already in some common use or with substantial potential for applications. If this approach is in fact successful in helping managers apply the most appropriate techniques to their problems, it will be possible to expand the topics covered and be more comprehensive in scope.

The descriptions are grouped by general management functions. On examining the range of topics, we found that they fell into five sections representing major management responsibilities: (1) General Information Management and Analysis, (2) Data Analysis and Information Processing, (3) Decisionmaking, (4) Planning and Forecasting, and (5) Organizational Development and Change. The data analysis methods discussed in (1) and (2) are the most general and are applicable to all areas of management. Decisionmaking includes specific methods for making choices, such as in allocation of resources, as well as more general methods for analysis of decision situations. Organization development includes basic approaches to adding, maintaining, and supporting organizational activities, techniques for managing change and problem intervention. The planning section includes several basic methods for qualitative and quantitative projection of data along with analysis of complex project planning. Because in practice, these areas often overlap, attention is given where possible to connections among the techniques and basic concepts.

Section I

GENERAL INFORMATION MANAGEMENT AND ANALYSIS

Introduction

Some techniques which have found successful application in management are quite general and can be used in many situations. In this section we describe four types of these techniques: systems analysis, computer programming, operations research and mathematical modeling, and simulation. Three of these - systems analysis, operations research, and simulation - have no standard definition or universally used procedures. They are, rather, ways of thinking about management and organizational phenomena. They require abstracting and selecting from a complex process and building an image or representation of that process. The image is then used to analyze how to better manage the process, or how to change it to achieve more or different objectives. For example, a systems analysis of maintenance operations would require identifying what goes into the operation, the internal mechanisms of how jobs are controlled and performed, and measures of what results. In each case, the technique helps identify and organize ideas about a complex process into a framework that aids understanding and control.

Computer programming is more general yet. It contains many of the characteristics of the techniques described above, but it is directed specifically at using computers to do management tasks. Thus programming must fit the needs of management and the requirements of the machine which is to do the work. Since computers are general purpose information processing machines, the possible applications cut across the entire field of management.

SYSTEMS ANALYSIS

I. Description

The application of the systems concept to the planning and operation of an effective organization is known as systems analysis. Systems analysis is concerned with identifying the most reasonable and appropriate means for accomplishing organizational purposes. Such an approach uses systematic procedures for the development and management of the operating systems, such as manpower systems, resource flows, and technical systems and to design management information systems for planning and decision making. The information system permits a systematic examination and comparison of alternative courses of action which are related to the attainment of desired objectives and allows a cost and benefit analysis with each alternative. A systems systems approach leads to ways of thinking about an organization that are different from traditional conceptions. The approach provides the manager with a way of handling the vast amount of information which enters the organization, relating one specialty to another, and understanding the relationship of the organization to its environment.

The fundamental aspect of the systems approach to organizations and management is the interrelationships of the subunits to each other and to the total system, and of the subunits and total system to their environment. Often organizations do not achieve effectiveness and efficiency to the extent possible because of the failure of persons to relate the parts or functions (subunits) to each other, the total organization, and the environment.

A system is an orderly, purposeful interrelationship of components designed to carry out predetermined functions or objectives. The system may be open or closed. An open system is affected by its external environment; a closed system is not. Educational institutions are open systems, strongly affected by their external environment. Such a system, to be effective, must be sensitive and adaptive to changes in its social, political, legal and economic external environment, as well as in its internal environment. Regardless of the complexity of the system, the basic elements are the same. The first element is that of input. Inputs include the manpower, money, materials and equipment requirements of the system and are the start-up component upon which the system operates. The next element is the processor component. This component consists of the activities and tasks which transform the inputs into the outputs of the organization. The outputs are the results of the activities of the organization and the purpose and objectives for which the system was designed. Two other basic elements in any system are those of control and feedback. Control is primarily the system function which compares the outputs to predetermined standards, while feedback is the system function which provides information on the deviation between outputs and control standards into the input component and then into the conversion processor component.

II. Application

The complex operations of most school districts cannot be handled effectively through traditional management approaches.

The complexities associated with the instructional program, staff development, personnel matters, transportation responsibilities, maintenance of facilities, and the acquisition, allocation, utilization and replacement of resources cannot be monitored by the personal observation of the school administrator. A systems analysis approach provides a constant flow of information upon which the administrator can plan and operate an effective school district through the implementation of a feedback or information system. For example, such a system can provide information as to whether funds generated for specific functions (such as education of the gifted) have in fact been expended for those functions and the impact of the allocation of funds for those functions. This knowledge will assist the administrator in determining whether to continue such funding and at what level that funding should be.

A systems approach enables the administrator to more adequately define the school system. Instead of viewing the system as consisting of only those persons who are within it, the administrator can identify all persons, inside and outside, whose cooperation is necessary for the effective and efficient functioning of the school district. Additionally, such a definition of the district allows the administrator an upward and outward perception as opposed to the traditional looking down the hierarchy at subordinates viewpoint. This broader perspective thus permits the establishment of control over those not directly under the administrator's direct supervision, such as peers, superordinates and others outside of the traditional definition of the system.

A systems approach also provides a view of the school district as a set of formal subsystems which focuses attention on the essential interrelationships of activities carried on by the subunits, such as central office divisions, schools, departments and individuals. For example, the activities of the business management office are viewed from their effect on the instructional program in the district, student personnel services, and other system functions. The activities of the elementary school are viewed as inextricably interwoven with the functions of the middle school. This way of thinking about the organization provides an understanding of the total organization as the administrator carefully examines the subunits, their relationships to each other, and their contributions to the attainment of the purposes of the entire system.

III. Implementation

In systems analysis, the system is greatly dependent upon the originality and creativity of the individuals contributing to its design. Personnel throughout the system must be involved in the designing activities. The design must be pragmatic, yielding an operable, flexible system which achieves action oriented results. The subunits of the organization must be carefully designed from the perspective of their contributions to the total system. Overlap of functions among the subunits should be minimized. Finally, the focus must be on the goals, desired outputs of the system, first, and the inputs and conversion processes, the methods to achieve those goals, second.

For more information on systems analysis, see:

Banhard, Frank. Educational Systems Analysis. London: The Macmillan Company, 1969.

Kast, Fremont and James Rosenzweig. Organization and Management. New York: McGraw-Hill Book Company, 1974.

COMPUTER PROGRAMMING

I. Description

Computers perform information processing and mathematical tasks according to instructions stored within the machine. These instructions are called the program. Computer programming is the process of deciding what the instructions should be, assembling them in the proper order, and coding them in a form appropriate to the internal operation of the computer. Programming involves problem solving, that is, choosing instruction and putting them in the right order, and language translation. Most programming related to school management would be done in a higher level programming language, such as COBOL or FORTRAN (COmmon Business Oriented Language, FORmula TRANslator). These languages allow the programmer to use English-like statements which stand for many separate computer operations. A separate program called a compiler, usually purchased with the computer, then transforms the higher-level statements into machine instructions.

Most computers and programming languages are general purpose. That is, they are designed to work on any problem or task which can be reduced to the basic arithmetic and logic operations computers perform. Writing the program requires solving a particular problem as well such as how to schedule students most efficiently. Therefore programmers need some knowledge of the specific subject at hand. Consequently, programmers tend to be more specialized, concentrating on an area in which they develop some expertise.

II. Applications

Computer technology, and therefore programming, is potentially useful in virtually every aspect of school management. The most obvious are in accounting and financial record keeping, payroll, recording attendance, equipment inventory, pupil scheduling and test scoring and reporting. For common applications a set of programs may be offered for sale with the purchase or lease of a computer or from commercial services. For special tasks or where modifications are necessary in existing programs, a programmer on the staff or available to the staff is necessary. Special purpose programs are more likely to be necessary for less common applications such as management information systems, simulating energy use and research and evaluation of instruction, enrollment projections, complex file and record keeping systems, or development planning and organization development models. Another computer use is energy consumption. Computer program "packages" are also available for decision making problems such as linear programming and for analysis of statistics. These packages require specialized programming knowledge for the specific language developed for the package.

III. Implementation

Computer programming is on the interface between the computer and the school system. To be useful and efficient, the use of programs and programmers must be well integrated on both sides of the interface. Since programmers are typically trained in a computer-oriented environment, the problems of integration

usually come on the school district side. Management of computer use requires an understanding of the potentials and limitations of the technology. Someone on the management staff must be sufficiently familiar with programming to choose among existing programs or work with programmers in the development of new ones. Since computers are so versatile, there may also be competition for access, so means for setting priorities may be needed. Cost control and mechanisms for error checking and insuring reliability of programs are necessary. As one manager of a computer operations was heard to remark, "If architects built buildings the way programmers write programs, the first woodpecker that came along would destroy civilization." While this may be an overstatement, it indicates a basic concern with managing a complex and often highly individualistic process.

For more information on computer programming, see:

Dock, V. Thomas and Edward Essick. Principles of Business Data Processing (with BASIC), 3rd ed. Chicago: SRA, 1978.

Graham, Neil. Introduction of Computer Science. St. Paul, Minn.: West Publishing Col, 1979.

OPERATIONS RESEARCH AND MODELING

I. Description

Operations Research is a general approach to studying the detailed operations or activities of a complex process in an organization. The product of an operations research project is an analysis (usually mathematical) of the process and a plan for increasing its efficiency. This approach can contribute to improved problem-solving through:

1. disciplined thinking by concentrating on what is realistic and feasible,
2. objective thinking providing an unbiased evaluation of data,
3. systematic thinking through a step-by-step analysis of the entire problem, and
4. action-oriented thinking through initiating a thorough search for the solution that can be implemented most economically.

In the search for the acceptable solution to a problem, many possible solutions should be considered. Possible solutions are eliminated only because of actual constraints faced by the system. Types of constraints are: technological, physical, economic, political, moral, and societal. The search for a solution to problems should follow a modeling process that is simple enough to permit the study and accurate enough to reflect the system it is protraying. The basic steps in this modeling process are:

1. Problem identification - a need analysis is required to determine if there is a problem and is the problem worth solving, an analysis of the cause-and-effect through the identification of any controls and causes and their effects, and a utility analysis devoting primary attention to the few activities where most of the "action" is to determine whether the problem solution will have utility.

2. Model construction - develop a simplified representation of the "real" system. A model may be physical, such as a model train, or symbolic, such as a mathematical model. In designing a model, decisions must be made as to what aspects of the real system should be incorporated, what aspects should be ignored, what assumptions can and should be made, and into what form should the model be constructed. Thus, modeling is both an art and a science. Some basic principles are:

   a. do not build a complicated model when a simple one will suffice,

   b. beware of molding the problem to fit the technique in mind,

   c. the deduction phase of modeling must be conducted rigorously,

   d. models should be validated prior to implementation,

   e. a model should never be taken too literally,

   f. a model should neither be pressed to do, nor criticized for failing to do, that for which purpose it was never intended,

   g. beware of overselling a model,

   h. some of the primary benefits of modeling are associated with the process of developing it,

   i. a model cannot be any better than the information that goes into it,

   j. models cannot replace decision makers.

3. Experimentation - in testing the model, three phases should be attended to:

   a. a feasibility analysis in which hypotheses are tested on the model to see if they are feasible and within constraints, while satisfying all assumptions,

   b. optimality analysis - decision variables are studied to find a set of values that give the best performance,

   c. adaptivity analysis - sensitivity analysis of the proposed solution to changes in the environment, learning effects, and other dynamic behavior change possibilities,

4. Implementation - obtain management approval to implement the model and then, if possible, the proposed system should be implemented parallel to the existing system while "debugging" the proposed system. A small pilot operation is recommended when the parallel operation is not possible.

II. Applications

Over a period of years (i.e. from 1950's to the present), the science of Operations Research has developed a number of formal techniques that may be used to solve a number of general problems. An incomplete listing of these techniques includes: mathematical programming, such as linear programming, integer programming, dynamic programming; sequential analysis techniques, such as PERT, CPM, GANNT, Decision Trees; and Markov Analysis; Queing Theory, Game Theory, Probability Analysis and Bayesian Analysis, Inventory Models, Simulation and Monte Carlo Sensitivity Analyses, and Decision Theory. Many of these techniques are described in this document. However, all of these techniques have undergone the basic process described above in their development.

III. Implementation

Each of these techniques has its own unique assumptions and data requirements, as well as their own unique sets of applications. All of these techniques have the same general constraints which limit their application in educational problem solving. However, these limitations and constraints may be summarized as follows. First, most of these techniques require formal training in their use. At present, these techniques receive only cursory treatment in most training programs in educational administration. Second, these techniques require an intermediate level of understanding of mathematics. Because of the

background of most educational administrators, while a basic understanding of mathematics is gained, most administrators do not possess advanced mathematical training. However, this need not be a major problem, for it is not expected that the administrator necessarily develop the models themselves, but they should be conversant with the techniques to work with other staff or a consultant when facing problems that may be solved using these techniques. The administrators should be familiar with the techniques and their applications. Third, a computer capability is usually required. While this may have been a major problem in the not so distant past, with the general availability of computer centers now, computer time and expertise can be easily found.

For more information on operations research, see:

1. Richards, M. D., and P. S. Greenlaw, Management Decision Making, Richard D. Irwin, Inc., Homewood, Illinois, 1966, chapters 11-19.

2. Ackoff, R. L., Scientific Method: Optimizing Applied Research Decisions, John Wiley and Sons, Inc., New York, New York, 1962.

MANAGEMENT TECHNIQUE DESCRIPTION: SIMULATION

I. Description

The term simulation applies to a wide variety of activities, ranging from computer programs and mathematical models, to parlor games such as Monopoly, and multimillion dollar flight simulators used in pilot training. All of these have certain aspects in common: (1) an attempt to recreate, in a controlled way, selected aspects of a real situation, (2) a process or set of procedures designed to imitate the dynamics of the real situation, (3) a way to control certain elements of the process and behavior of the participants, and (4) a way to evaluate the outcomes of the process so as to make judgments about the consequences of the actions taken. Simulation is undertaken with these characteristics in order to test the consequences of some choice without actually making it or to practice in a realistic situation when the real one is unavailable, too costly, or involves too high a risk. (Simulations are also undertaken strictly for entertainment, but we will not discuss that use here.) If the simulation is a faithful reflection of reality in the important aspects, the results can be improved management through inexpensive evaluation of alternative decisions, improved management skills through better training, and more successful and accurate planning.

II. Application

Opportunities for using simulation in school district management are quite broad. Simulation is most appropriate for recurring situations and where data are available. Some school management areas are more easily simulated, especially operational and financial planning. Quantitative simulations can be constructed to examine possible changes in the local

tax base, effects of changes in tax rates or state revenue patterns, pupil mobility or decline, or inflation and rising energy costs. To construct such a simulation one needs a set of equations or computer program which includes the variables of interest. The equations or programs reflect the expected pattern of changes. The results of a series of calculations are new values for the variables which show "What would happen if ...?" The same applies to simulating some operation within the school district, such as bus transportation, cafeteria service, consumption of supplies, or teacher turnover. For some commonly simulated process, such as waiting in line for a service, or transporting material or people, general purpose computer programs are available to facilitate the construction of a workable model.

Constructing simulations is more difficult, but no less useful, in management areas which are not easily quantified, such as hiring and promotion decisions, collective bargaining, choosing new curricula, or or improving communications in public/community relations. As long as realistic materials and decision situations can be constructed, management staff can use them to plan, test their skills, or evaluate alternative strategies. In fact, informal simulations are a common part of management deliberation. Whenever a deliberation includes an analysis of "what would happen if ...?" it can be said a simulation model is in use, whether specified or not. Much can be gained in improving decisions if the implicit models used so often in this matter are spelled out and evaluated.

III. Implementation

Successful simulation requires a clear specification of the process and situation to be simulated. This requires both experience and adequate

data. Also, the construction of a simulation may be too costly or slow for the issue at hand; investment in the analysis and material development necessary for a realistic simulation are only justified when the consequences are significant, or when the decision situation is common enough to amortise the development cost over many iterations. Simulations must also be rigorously tested for their conformance to the real situation. This can be done using historical date, to see how well the simulation would have predicted known consequences. Or they must be evaluated against the best judgment of the managers and board members who will use them. If found to be feasible and accurate, simulations can be important tools for improving management decisions.

For further information on simulation, see:

Greenblat, Cathy S. and Richad D. Duke. Gaming-Simulation: Rationale, Design, and Applications. New York: Halsted Press of John Wiley and Sons, 1975.

Abt, Clark. Serious Games. New York, Viking, 1970.

Section II

DATA ANALYSIS

Introduction

Data analysis is concerned with the manipulation of data to provide information useful to the decision-making or policy analysis process. Data are required for management purposes such as planning, decision making, organizing and changing, so the scope of the use of data analysis techniques is wide. In this section, four basic data analysis techniques are discussed. First, a summary of descriptive statistics is given to acquaint the reader with basic terms and methods. Next, a section on graphics is used to describe how data may be displayed visually. A discussion of multiple regression analysis is included to introduce the reader to the possible uses of more sophisticated statistical methodologies. Finally, Markov Analysis is discussed to bridge the gap between statistical methods and probability theory. However, all of these techniques are used to "make sense" out of collections of data, and these data analysis methods are quite often used in conjunction with other management tools.

DESCRIPTIVE STATISTICS

I. Description

Statistics are procedures used in extracting information from data. A person may want to describe the data in short and precise terms, such as the average salary of employees. Under other conditions an analysis of relationships between two or more variables is required, such as the relationship between kindergarten enrollment, housing starts, and birth-rate. Still under other circumstances, an inference to a larger population may be desired, or what is known as generalizing to a larger population, such as comparing the achievement of a randomly selected group of elementary students who have been given a new method of reading instruction and comparing them to a group of students who have continued under the old method to determine if the results are significantly different. This is known as inferential statistics.

Descriptive statistics are used to describe a group of data. It is especially useful where it is necessary to describe interrelationships among more than two variables. There are basic and advanced descriptive statistical techniques. The basic tools are frequency distribution, measures of central tendency, and measures of dispersion. Simple and multiple correlation and regression are examples of more advanced techniques.

Frequency distributions are listings of the number of observations that fall into each of several categories or class intervals. They are often presented in tabular form or on graphs. Percents are often used to represent the data in the categories or intervals.

Measures of central tendency are used when a comparison between groups or the variables require additional measures beyond the frequency distribution. Measures of central tendency are the arithmetic mean, median and the mode.

Measures of dispersion are utilized when a complete description of an empirical frequency distribution requires than an accounting of the dispersion, or heterogeneity, of observation, as well as typical values. The measures of dispersion are the range, interquartile deviation, variance and standard deviation.

When it is necessary to describe the relationship between two variables, simple correlation and regression statistics are used. For instance, if the concern is to determine which variable is related to another variable and the extent of that relationship, a correlation technique is appropriate. However, once the significant variables have been established a regression analysis is used where an attempt is made to predict the exact value of one variable from the known value of another.

If a need exists to use several variables to explain a particular phenomenon, such as school district enrollment trends, and if there is a need to isolate the effects of one or more of the variables while controlling for the other ones, then more advanced statistical tools are required. These advanced techniques include analysis of variance, multiple and partial correlation, multiple regression, and other multivariate analysis techniques.

II. Application

Frequently in school organizations, a quantity of data is generated to the extent that a person will discover that it is impossible to absorb all of it. Community surveys may have been collected from large numbers of community members, student achievement data may exist for all students on standardized examinations, fiscal data concerning income or revenues, expenses, tax rates and other data may have become too cumbersome to present and understand in its present form. It would be embarrassing to ask "What am I going to do with it now?" It would be impossible to intuitively grasp all that is in the data. Descriptive statistics permit a reduction of the data to a point at which the manager and others can see what is in the information. The volume necessitates its being summarized.

III. Implementation

In utilizing descriptive statistics, attention must be directed toward the selection of the most appropriate technique. For example, if you want to present data concerning the selection by high school students of specified program areas according to the sex of the student, the mean and median would not be the most appropriate technique. The most useful basic technique would be a frequency distribution in the form of actual numbers and/or percentage of male and female students in each program category. However, if a comparison of grades by program and/or by sex is desired, the mean or median would be appropriate.

Attention must also be focused on the interpretation of the findings. It is possible to obtain results which are misleading due to the loss of information which occurred in summarizing or grouping the data. Conclusions and interpretations about averages and correlations apply to entire

groups and not to specific individuals in the group. The average salary of an employee group does not necessarily mean that all group members are at that salary level. In fact, none may be at the average level.

A positive correlation between the satisfaction of community members with school programs and the passage of the school budget or bond referendum is indicative only of a greater probability that a person who is satisfied will vote for passage. It does not indicate that every person who is satisfied will vote in favor of the budget or that every person who is not satisfied will vote against it. Additionally, such a correlationdoes not establish a cause-effect relationship. Satisfaction with school programs and the way people vote are related, but it does not necessarily follow that satisfaction is why people vote positively or dissatisfaction is why they vote negatively.

The appropriate use and limitations of each descriptive technique should be understood.

GRAPHS

I. Description

A graph is a representation of numbers of geometric figures drawn to scale. The use of graphs is important because there are always people who hesitate to read tables and who gain a better understanding of materials if the materials are presented in graphic form. Additionally, there are situations which require the use of visual displays of information. The effectiveness of a graph is dependent not only on the audience factor, but also on the way in which the relations among the geometric figures are used to represent the relations among the numbers. In developing a graph, the purpose for the graph must be clearly understood. The graph is a representation of numerical data, a partition of a total into its component parts, changes over time intervals and relationships among variables. The choice of geometric figures to represent the numbers must be selected, followed by the choice of the scale to be used. The last step is to organize the elements above into the complete graph.

There are different ways the data can be displayed. The bar graph depicts numbers represented by bars drawn to scale. The pie chart is a circle which is partitioned into its component parts. The line graph has its scales laid out on axes at right angles to each other and a grid is constructed. A pictograph contains rows of little pictures which are symbolic of the variable it represents. Each picture represents a specified number.

When a bar graph's areas or heights are proportional to the frequencies in each category, and the bar is used to represent each category and the height of the relative size, the resulting graphic is called a histogram. A frequency polygon can be derived from the histogram by simply connecting the midpoints of the tops of each of the bars of the histogram with straight lines and then removing the bars. Frequency polygons can also be utilized in presenting cumulative frequency distributions. The resulting graphic is called an ogive. Ogives can be used in illustrating the number of cases below and above a particular value. The form of the ogive is either increasing or decreasing, depending upon whether the designer is accumulating data up or down. The frequency polygon and ogive are variations of a line graph.

II. Application

The use of graphs by school organizations can effectively present data to the community concerning enrollment trends, tax information data, budget allocations, revenues, expenses, student achievement data, and other numerical data the district wishes to disseminate. Additionally, graphs can be used to present this type of information to school board members, teachers and other staff members who might not have the time to read detailed accounts and tables. Graphs can also depict to these groups comparisons of salaries of categories of staff members with other districts, over a period of time, or a combination of the two. Since school districts collect large

amounts of data, the utilization of graphic displays of that data is useful in assisting people who need to have that data more easily understand it.

III. Implementation

In designing a graph an account of the make-up of the audience must be considered in making the choice between the diverse ways of grouping the data. Also to be considered are the circumstances under which the presentation is to be made. The presentation of a graph should only be made when the figure makes an essential contribution beyond what one might gain by reference to data in a paragraph, written presentation, or speech. The development of a graph takes time and effort and occupies a great deal of space in a report. But, if it makes a contribution for an audience that does not have the time nor the interest to devote to a comprehensive examination of statistical data, it is an effective tool of communication.

For more information on graphs, see:

Minium, Edward. Statistical Reasoning in Psychology and Education. New York: John Wiley & Sons, 1978.

Hinkle, Dennis; William Wiersma and Stephen Jurs. Applied Statistics to the Behavioral Sciences. Chicago: Rand-McNally College Publishing Company, 1979.

Spence, Janet; John Cotton, Benton Underwood and Carl Duncan. Elementary Statistics. Englewood Cliffs:N.J.: Prentice-Hall, Inc., 1976.

MULTIPLE REGRESSION

I. Description

Multiple Regression is a multivariate statistical technique used in analysis and description of data. Multiple regression is based on the concept that a criterion variable (such as an outcome) is a product of several contributing factors, called independent variables. Through the use of multiple regression, the proportion of contribution of each independent variable may be estimated statistically, As such, one of the primary applications of multiple regression is that it may be used to estimate the relationships between a set of independent variables and the dependent variable. Once the functional relationship between the independent and dependent variables has been estimated, multiple regression may then be used to predict values of the dependent variable from a different set of data. Thus, multiple regression is a statistical tool that may be used in a variety of ways to aid in the decision making process and in policy analysis.

II. Applications

This technique is of importance to decision making and policy analysis because in the specification of the model, both endogenous (those variables within the control of decision makers) and exogenous variables (those variables outside the control of decision makers) may be specified as independent variables. If this is done, the decision maker may then manipulate the indogenous variables to his benefit because the relationships between the independent and dependent variables are known and estimated.

There are a number of educational applications of multiple regression. For example, the development of educational production functions, and the

cost-of-education idices use multiple regression to estimate the models. Other studies have been done to examine the determinants of school bus accidents, good cash management practices, optimal school size, whether a school district should consolidate, etc. In short, multiple regression may be used to examine what the major determinants that effect any dependent variable are, and the size and direction of the effect. For example, the functional relationships between the dependent and independent variables for an educational production function study might look like:

$$Y = F(X_1, X_2, X_3, X_4)$$

where Y = reading achievement test score

X_1 = level of teacher's verbal ability

X_2 = pupil's socio-economic status

X_3 = pupil/teacher ratio

X_4 = expenditure per pupil of the district

III. Suggestions for Use of the Technique and Limitations

In order to use this technique, the administrator must have a basic working knowledge of statistics, as well as a knowledge of modeling processes relating inputs to outputs. Once the functional relationships between variables are known, data must be obtained on the variables to estimate the model empirically. The actual empirical estimation of the model may be done through the use of computers that are readily available through most university and other computer service centers. With the widespread availability of computer programs for the solution of multiple regression problems, and the very general nature of the technique, the use of multiple regression in decision making and policy analysis will increase in future years in educational administration.

For a more complete discussion, see:

Hays, W., Statistics for the Social Sciences, second edition, New York, N.Y., Holt, Rinehart, and Winston, Inc., 1973, chapter 15.

Draper, N. R., and H. Smith, Applied Regression Analysis, John Wiley and Sons, Inc., New York, N.Y., 1966.

MARKOV ANALYSIS

Markov Analysis is a decision making tool which provides information concerning movement processes over time, and is used to estimate the probability that movement from one state of nature to another state will occur. The first step in Markov Analysis is the identification of the initial states of nature possible for the first time period. Next, the possible states of nature for the next time period to which movement may take place from the initial state must be identified. This movement from the initial state to the second or transition state must be observed over many repetitions called "trials". Over repeated trials, not only the possible transition states may be identified, but a probability of moving from the initial state to the transition state may be estimated. After a probability matrix of these movements is developed, the estimated probability that a final state will be reached through movements over time may be calculated. Further, a visual display of this movement process may be developed through the use of a decision tree. Both the estimated probability and the flow diagram of the decision tree may be used as aids in the decision making process. For example, if the researcher is interested in determining what product a housewife will buy this week, he will need to collect information about what she bought last week (the initial state), the possible products to be bought this week (the second state of nature) and the probability of moving from any initial state to any second state.

II. Application

Markov Analysis has been used as a market research tool to predict consumer behavior towards products over time. The technique is also used by the military to determine the career paths of personnel with changes

of rank. Markov Analyses have been used in educational management to determine career paths of educational professionals with varying backgrounds and levels of training. Suggested uses include analysis of the drop-out problem by estimating the probabilities of various groups of students dropping out after each year of high school, and an analysis of teacher to administrator movements by various teacher groups over time.

III. Constraints and Limitations

While the identification and enumeration of the initial states is simple because they are known, the movements and identification of transition states requires a lengthy and detailed research effort. This effort is further complicated by the fact that the estimation of transition probabilities and their subsequent manipulation requires training and expertise in the areas of probability theory and matrix algebra. However, the development of the Markov chains of movements and their visual representation through decision trees, provides useful informational input to many decision processes.

. For a more complete discussion, see:

Achoff, R. L., and P. Rivett, A Manager's Guide to Operations Research, New York: John Wiley and Sons, 1963.

Section III

DECISION MAKING TECHNIQUES

Introduction

Central to successful school management is making the best choices among alternative courses of action. A great deal of effort has been directed toward developing tools to help managers improve their decisions. For this section we have selected some of the more commonly used and potentially valuable of these tools for description. These tools share some common features. Most importantly, they emphasize the rational basis of decision making: choices made in terms of clearly ordered steps of analysis, with known objectives and evaluation of alternative courses of action. Where this kind of decisionmaking is possible, the tools discussed here can be of considerable assistance in asking the right questions, assembling and analyzing the needed information and clarifying the value of each choice possibility.

Even when the conditions do not allow for full analysis or completely rational processes, the basic concepts retain some usefulness. The notions of clearly specifying objectives, assessing costs and benefits, using orderly processes to assemble and review alternatives, can all be helpful in any decision situation. We should, however, be sure to note that the conditions for a fully rational decision in these terms are seldom met. School managers work in a world where information is incomplete, objectives are often vague or in conflict, and costs or benefits are only dimly seen. Thus there is no substitute for well-grounded professional judgment. These techniques are not seen as a substitute for that judgment, but rather as possible aids in the overall decision process.

This section includes seven decisionmaking aids. The first three, management information systems, gaming, and decision trees, are more general. They are suitable for many types of decisions and management situations. The remaining four, linear programming, program planning and budgeting systems, cost/benefit and cost/effectiveness analysis, and production function analysis, are designed for quantitative problems, usually involving the allocation of resources and optimizing the output of some particular process in the organization.

MANAGEMENT INFORMATION SYSTEMS

I. Description

A management information system (MIS) is a communication structure set up to collect, organize, store and retrive data which are needed in making organizational decisions. A MIS is typically used in patterned, habitual task areas where spotty and incomplete information should be replaced by a system of catalogued and interpreted information. A MIS is designed to provide organizational decision makers with a system of more useful, comprehensive, timely and accurate information.

There are three basic elements of a MIS - the data themselves, the communication network established to collect, update, organize, store, and retrieve the data, and decision tools used to assist the decision maker in analyzing and interpreting the data (e.g. PPBS, Simulation Models, Linear Programming).

Virtually all organizations have some type of management information system. The more successful organizations more often have excellent systems, while the less successful organizations relate their lack of success to improper planning and use of their MIS. Although information systems can function without the use of the computer, the time demands for information and the volume of data needed in making decisions has made the computer a critical part of most MIS.

II. Application

There are many different ways to use a MIS in educational organizations. They can be used for relatively simple as well as relatively complex tasks, such as: managing structures of information, developing information reports, projecting possible outcomes or consequences, and developing decision alternatives. Almost all organizations now use them

for maintaining a payroll structure, setting up bus or student schedules, or generating summary reports or financial activities such as balance sheets or current inventory status. A few organizations (particularly those with access to a computer) have begun to use them for strategic decisions, such as providing answers to questions like: (1) what would be the impact on our budget if a teacher wage increase was granted; (2) if three new school buses are purchased rather than five school buses are refurbished, what would happen to our school bond package; or, (3) what could happen to our student-teacher ratio by 1990 if present cohort projections continue. In the future (particularly if interactive procedures in using the computer continue to improve with data sharing systems), MIS can be used for policy decisions concerning purchasing of new equipment, identifying class size and teacher staffing requirements, or determing profitable portfolio designs. In this area the projected reports are coupled with certain mathematical models (simulation or linear programming) to generate suggested decision alternatives.

III. Implementation

There are several reasons why MIS has not been uniformly used for strategic or decision alternative situations. First, schools have failed to carefully analyze their MIS needs. Second, schools have not carefully managed the implementation of MIS programs. To be successful, MIS needs to be applied to those areas judged as recurring and complex, related to high organization pay-off, and dependent on developed information systems. To institutionalize an MIS, managers need to carefully design the system, orient the staff to its use, and support initial and continued organizational efforts of adaptation and use. Other manage-

ment tools such as Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) are critical to the design phase. Decision strategies such as thorough identification of MIS objectives, constraints, information needs, information sources, and information processes are collecting, organizing, storing and retrieving the data are essential to appropriate design. And, thorough orientation of the staff to their expected role in implementing and using the MIS, careful planning and acquiring of space and equipment for managing the MIS, and design and testing of the procedures and forms for collecting and using the information prior to its implementation are critical steps in institutionalizing a MIS.

For more information on management information systems, see:

Anderson, David R., et. al., Essentials of Management Science. New York: West Publishing Company, 1978.

Murdick, Robert G. and Joel E. Ross, Information Systems for Modern Management. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1975.

GAME THEORY AND GAMING

I. Description

Game theory and gaming are two distinct techniques primarily used for data analysis and the analysis of decision making behaviors. Game theory is concerned with the decision-making of two or more players interacting with each other in a situation involving a conflict of interest. In this "game", each decision maker has available to him a limited set of two or more alternative courses of action each with a specified end result and pay off. A crucial assumption of game theory is that each player is able to assess the alternatives available not only to himself, but also available to the other player, and that the other player will behave in a rational (i.e. predictable) manner thereby reducing the uncertainty in the decision making process. Through game theory, optimal strategies may be adopted by the players to either minimize their maximum possible loss for all alternatives, or to maximize their minimum possible gain. A game involving two players in which one player gains what the other player loses is called a "two-person, zero-sum" game.

Gaming, however, refers to a simulation setting in which decision making is performed by one or more real decision makers. It is essentially an experimentation in which the behavior of the decision makers is observed under controlled conditions. The major problem with gaming is making inferences based on the game situation to the "real" world. The principal use of gaming has been as a teaching device although it has been used as a research tool for a number of years by the military and

businesses. The uses of gaming fall into three categories:

1. to help develop a decision model by providing a basis for testing the relevance of variables in a model,
2. to help find solutions to a model by helping to uncover possible courses of action and decision strategies, and
3. to help evaluate proposed solutions by comparing the alternatives.

Thus, the principal justifiable use of gaming is the exploration of structural relationships, or making suggestions or hypotheses for further testing. Gaming could be viewed as a way of obtaining information which can be used to generate models where analysis of or experimentation on the "real" situation is impractical or impossible.

II. Application

While both game theory and gaming have had minimal use on educational decision making and policy analysis, their potential is great as a research tool. Game theory has been applied to collective bargaining analysis in which the outcomes and behavior of bargaining was explored. Gaming has been used more widely under the rubric of "role playing" or simulation. (See, simulation)

III. Implementation

The primary reasons why game theory and gaming have not been used extensively in educational planning and analysis is that few educational administrators have been trained in their use. Game theory and the "two-player, zero-sum" game is relatively simple which, unfortunately, reduces the scope of its

potential use,; however, game theory gains in complexity rapidly as the number of players, strategies, or assumptions grow. Gaming, on the other hand, could be used extensively as an aid in policy analysis. While, simulations may be done through the use of the computer, most gaming may be performed merely by formalizing a set of observational procedures to obtain the necessary data for analysis of the gaming situation. As such, it would be relatively inexpensive and non-time consuming, assuming that a number of reasonable players could be obtained.

For more information on game theory and gaming, see:

Ackoff, R.L., Scientific Method: Optimizing Applied Research Decision, John Wiley & Sons, Inc. New York, New York, 1962.

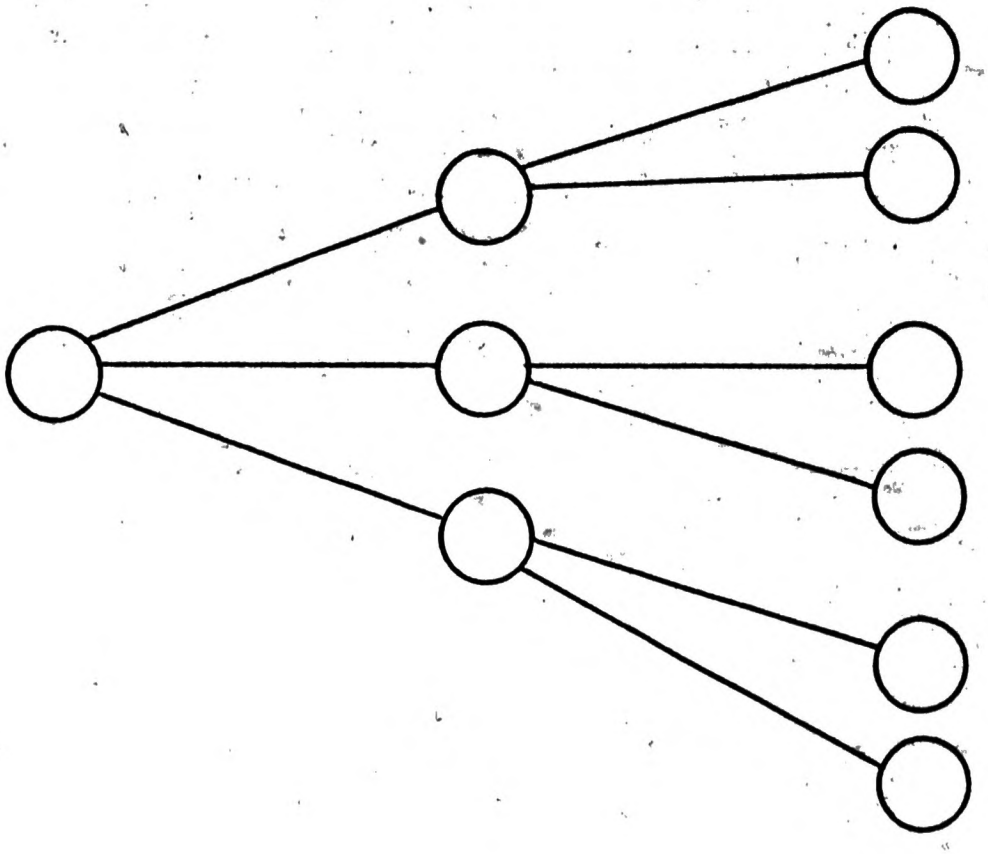
DECISION TREES

I. Description

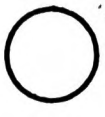
A decision tree is a graphical representation of a decision-making process involving a number of alternatives. Figure 1 shows an example of a decision tree. A decision tree consists of nodes and branches. A node represents a decision or a state of nature that will occur in time. A branch is a connector between two nodes. To develop a decision tree, the decision maker identifies all decisions to be made and the consequences of that decision. Since each decision has a number of alternatives, there will be a branch for each alternative available. Each alternative may then result in necessitating another decision of choice between new alternatives. Thus, a decision tree shows the natural or logical progression that will occur as a result of decisions or changes in the nature or environment of the system.

The end result of a decision tree development process is a visual display of all series of decision alternatives and their consequences. The decision tree may be quantified by expressing the consequences of decision in terms of a quantified criterion measure, such as the monetary value of the decision outcome. The probability of each alternative occurring may also be estimated. By multiplying the probability of occurrence by the criterion measure, an expected value of the criterion may be estimated. This expected criterion for each alternative may then be used to further aid in the decision making process.

A decision tree, then, provides a visual framework for the structure of alternatives to decisions in a logical manner, as well as providing a means of quantifying the summative results of a series of decisions through the process of obtaining an expected value of the criterion measure for each alternative path of decisions.



LEGEND:



A Node representing a decision

A Branch representing an alternative.

Figure 1.

A Sample Decision Tree

II. The Application of Decision Trees

Decision trees are generally used to organize sets of data on sequential decisions to facilitate the analysis of decision consequences. As such, it is useful as a decision making tool in many diverse circumstances. It is also useful as a visual aid in attempting to explain what the consequences of actions are. Decision trees also form the basis of understanding many more sophisticated management techniques such as network analysis and PERT, queing theory, Markov Analysis, and dynamic programming. A specific example of the use of decision trees in in evaluating possible investment and their returns in order to decide which series of investment paths would yield the highest return over a period of years. Decision trees may also be used in conjunction with a number of other management techniques such as net present value analysis to aid in the decision making process.

III. Problems, Constraints and Considerations in the Use of Decision Trees

The construction of decision trees assumes that the decision maker is able to enumerate each decision alternative available to him, and to estimate th result or consequence of each decision alternative. Further, the decision maker must take the time to develop a decision tree. The process of developing a decision tree is in itself a useful activity because it forces the decision maker to analyze the possible outcomes of each alternative. However, if too many alternatives are formulated, the decision tree becomes unmanageable. Thus, this process, while mentally rigorous, is a straightforward technique, which assumes no other analytical abilities. However, if the probabilities of each alternative occurring are estimated, then a minimal level of understanding of mathematics and probability theory is required.

For a more complete discussion, see:

Magee, J. F., "Decision Trees for Decision Making", Harvard Business Review, 1974, pp. 126-138.

LINEAR PROGRAMMING

Linear Programming (LP) is one of a set of general mathematical modeling techniques that can be used to determine the optimal allocation of resources among competing activities. LP may be used to either maximize or minimize an objective within the limitations of a set of constraints. Linear Programming is applicable when a program is directed towards some measureable goal. Clearly some goals in the educational process are more easily related to contributing input factors than others. Essentially, the LP technique analyzes the various combinations of inputs in such a manner as to achieve optimal results of the output in terms of some measureable criteria.

The following steps are required in the formulation of models of the problem to be solved through LP:

1. recognition of the problem - is there a problem which is amenable to LP methods for solution?
2. formulation of the mathematical model - necessary steps are:
   a. the identification of the decision variables (input and output measures.
   b. choice of a measure of effectiveness - what is it that needs to be minimized or maximized?
   c. symbolic representation of the objective function where the objective function includes the measures of effectiveness.
   d. identification of the constraints - the relating of inputs to outputs.
   e. algebraic representation of the constraints.
3. estimation of the parameters of the model to obtain the solution to the problem.

In order to use LP, certain assumptions concerning the nature of the data and the constraints need to be made. If these assumptions, such as the linearity of the data, are violated, other mathematical programming techniques should be used. Other techniques include non-linear programming, integer programming, dynamic programming, quadratic programming, and goal programming. All of these techniques are similar as to the steps involved in the problem solution; the differences lie in the mathematical representations of the objective functions and constraints (i.e., integer programming requires that one of the constraints be formulated in discrete terms such as a 0-1 variable instead of a continuous distribution with decimals such as a value of 1.25).

II. Applications of LP

There are a number of educational applications of LP found in the literature. For example, with LP, it is possible to maximize the number of students taught within certain budget constraints, minimize the number of stops in a school bus routing system, minimize instructional expenses given the costs of various input factors and the minimum number of students, and maximize the net interest earnings of a district given inflows and outflows of cash, and the termstructure of interest rates. In general, LP may be used where an objective is to be maximized or minimized given some limiting constraints.

III. Problems of Implementation

Although the technique of LP is versatile, its use among educational administrators has been limited because it is a relatively new tool, and few educational administrators have been trained in its use. A further difficulty is that few educational goals can be quantified, or measured

objectively, or related to contributing factors. The major problem in using LP is not in the solution of the LP model, but in the formulation of the model because the structuring of an application into mathematical terms is difficult without previous training or experience in the use of LP. However, consultants are readily found at most universities who can formulate the model relatively easily and quickly for most problems. There are also a number of "canned" computer programs that are now available to estimate the general linear programming solutions. If the educational administrator can recognize a problem as amenable to solution through LP methods, with the technical expertise readily available, the use of LP techniques in educational management will increase dramatically.

Smythe, W. R., and F. A. Johnson, Introduction to Linear Programming with Applications, Englewood Cliffs, N. J., Prentice-Hall, 1966.

PROGRAM BUDGETING (PPBS)

I. Description

The basic idea of program budgeting (or Planning, Programming, Budgeting Systems) is the creating of an integrated plan for allocating resources. The plan is based on the evaluation of alternative resource use according to estimates of their relative contribution to achieving organizational goals. The purpose of PPBS, as it is commonly called, is to increase the efficiency of resource use by relating the allocation decisions directly to the objectives and educational activities. Thus in program budgeting, one would compare costs and outcomes of several different teaching strategies on instructional materials. The term program refers to the collections of activities and resources that are directed to a particular objective, such as alternative reading programs. Once these resources and activities are identified, the planning and budgeting system is designed to determine the cost and the effectiveness of alternative allocations of resources. This involves both detailed accounting of resource costs as well as evaluation in terms of specific objectives. This allows the budget decisionmakers to choose the most efficient one. The concept also generally includes the regular evaluation of budget choices so that allocations can be adjusted to continually improve efficiently. The idea of an integrated system is central to the design; that is, the entire decisionmaking process is conceived of as interrelated. Program design, resource allocation, operation, and evaluation are all connected in the decisionmaking and management process.

II. Applications

PPBS is applicable, in theory, to any level of decision-making of the school system, from the entire district budget and management, to specific programs or parts of the organization. It is necessary that measurable objectives be identified for a program area. For instructional programs, these are part of the curriculum planning process. For example, in maintenance, certain levels of building condition may be specified or certain desired levels of activity determined, such as frequency of lawn care of heating inspection. Once the objectives are set, alternate ways of achieving them are examined for effectiveness and costs. For example, various configurations of lawn care equipment and routines could be evaluated in terms of projected personnel and purchase costs, equipment maintenance and depreciation, and operating effectiveness. Once the cost and evaluative data were examined, the most cost-effective alternative could be selected.

Measuring objectives and relative costs of alternative operational approaches is easier in some areas than in others. Evaluating alternative building use to conserve energy may be straightforward. The costs of a public relations program may be obvious, but precise measurements of its effects may be quite elusive. The basic logic of examining the costs and consequences of alternatives may be useful in most cases, but the exact application will vary with the nature of the school program area involved.

III. Implementation

While it may lead to better decisions, PPBS and related techniques are not without problems. They require extensitve information collection and analysis capability. Detailed specification of objectives for all parts of the school operation must also be developed. Program budgeting requires accounting for expenditures in ways not necessarily compatible with other budgeting purposes, such as state reporting, so two budget formats may be required. The process of making program budgeting analyses and decisions requires a great deal of management time and technical capability, both with substantial costs. In addition, the specification of objectives and evaluation of alternatives may be a high-conflict process, which causes organizational and political problems.

The overall concept of PPBS does offer the possibility of more efficient school operations. But the cost of implementing a full PPBS management process can be quite high and may not be feasible for all elements of the school program.

For more information on, Program Budgeting, see:

Knezevich, Stephen J. Program Budgeting: A Resource Allocation Decision System for Education. Berkeley, Calif.: McCutchan, 1973.

Alioto, Robert F. and Yungherr, J.A. Operational PPBS for Education. New York: Harper& Row, 1971.

COST/BENEFIT AND COST/EFFECTIVENESS ANALYSIS

I. Description

In a decision situation, alternative courses of action can sometimes be evaluated in terms of their relative costs and benefits or effectiveness. The cost of an alternative includes direct expenditures and consumption of resources along with the costs of lost opportunities and other less tangible consequences such as loss of morale or political support. Evaluation of benefits or effectiveness may be more difficult. The concept of benefits is a broad one, covering direct and immediate gain produced, such as increased achievement, as well as indirect effects to clients of the school and the general public, such as satisfactions and income increases. Benefit analysis is thus meant to include a comprehensive view of all the good (expressed in dollar terms) that may result from each possibility. Effectiveness analysis is narrower and does not require a dollar value on the outcomes. It focuses rather on the direct and intended accomplishment of the objectives of the action taken. For example, the effectiveness of a new reading program would be expressed in terms of achievement in the specific objectives of the program. The benefits would be much broader, including the spillovers to other areas of the curriculum, higher morale among students and staff, parent satisfaction, etc. The ratio of costs to benefits or to effectiveness provides a simple quantitative way to compare the relative merits of alternatives. The higher ratios indicate the preferred choice.

II. Application

Some rough estimate of cost/benefit or cost/effectiveness ratios is probably part of most decisions in school management. However, the formal application of these techniques is limited to those decisions

where each of the alternatives can be clearly expressed and evaluated in these terms. This can be seen in specific instructional programs, such as remedial reading, or in management decisions with clear outcomes, such as reduced maintenance due to purchase of new buses. In this sense, cost effectiveness calculations are much more common. The effectiveness of alternatives can often be evaluated. For example, performance data on alternative computer systems is often readily available. If management can agree on the desired performance characteristics of a new system, the costs and effectiveness can then be compared, and the preferred choice will become apparent. Similarly, effectiveness evaluations may be available for alternative mathematics program materials (perhaps from internal achievement records), or for insurance programs, or office equipment. Even independent consumer testing data on product performance may be useful.

For benefit assessment more difficulties are involved. Subjective judgments and estimates are necessary for such concerns as public support, staff morale, aesthetic appeal, or versatility. A computer manufacturer may claim, for example, that their product will "grow with the organization." This may be an important benefit, but its measurement is not very precise. Often assigning arbitrary dollar values to such subjective benefits aids in analysis without major distortion.

III. Implementation

The most troublesome aspects of this approach come in attempting to develop a comprehensive view of both costs and benefits. Management agreement in the desired performance or objective of a decision is

necessary to assess results. Even where objectives are clear and costs are known, effectiveness and benefits may be elusive. Independent evaluations of products and services are seldom readily available; vendors' claims are usually suspect, and many schools cannot perform internal testing. However, careful records of experience with a variety of products and situations can provide the basis for quite accurate evaluation.

For more information on cost effectiveness and cost benefit analysis, see:

1. Benson, Charles S. The Economics of Public Education, 3rd ed. Boston: Houghton-Mifflin, 1978, esp. Chapt. 7.

2. Cohn, Elchanan, Input-Output Analysis in Education. Cambridge, Massachusetts: Ballinger, 1975.

PRODUCTION FUNCTION ANALYSIS

I. Description

Schooling and some other activities in school operation can sometimes be usefully thought of as production processes where some measurable product is "manufactured." Managers often think of parts of their responsibility as a production process. They may work with informal production functions for planning and decision making, such as a business manager thinking through the food service operation and deciding on dofferent mixes of inputs (workers, equipment, etc.) in terms of his estimates of how productive they are. If the output of the production process can be formalized and measured along with the contribution of each of the inputs, a full production function can be developed. A formal production function is usually expressed as an equation which reflects the mathematic relationsip among the inputs of the production process and the output. The production function can then be analyzed to estimate the optimal mix of inputs, that is, best combination of resources which will produce the largest amount of or lowest cost product. The output may be achievement test scores, or other measures of student outcomes, or district operations. The inputs are the specific supplies and other physical resources consumed, teaching or other activities, and pupil time and characteristics when learning is the production process of interest. A production function analysis can assess the relative importance of each of the inputs and suggest reallocations which could improve production.

II. Applications

This form of analysis may be useful in aspects of the school operation where the relative importance of each of a mix of inputs is desired. The central "production" process is, of course, the instructional program. Production functions may be constructed for any part of the program where measures of both inputs and outputs are available for a fairly large number of students or other units of production. For example, elementary mathematics instruction might be examined. Achievement might be seen as resulting from a mix of teacher and student time on various activities, instructional materials, physical arrangements, and pupil background. Once a production function is specified, data for a sample of students could be analyzed through multiple regression. The results might show that, say, teacher time in small groups was much more important in affecting achievement than seat work. This could then lead to program changes to emphasize the more important inputs. The same logic could be applied to increasing the efficiency of a central cafeteria in a lunch program. If the measures of inputs and outputs were obtained over a large number of production units, such as days or weeks, a production function analysis might show the same relative importance of inputs. For example, it might be found that the unit cost of a lunch depends more on certain food prices than on labor costs. While such information shows only a part of the overall operation of schools, it could contribute to more efficiency in those areas.

III. Implementation

Specifying a production function requires two types of information which are not readily available for most elements of instructional programs: measures of inputs and of outputs, and knowledge of the relation-

ships between each input and the product. Many of the most important outcomes of schooling are not measurable or even directly observable. The way each input contributes to the results is also not often understood which are not subject to school control. However, in those areas where some meausrement and control are possible, a production function analysis can be a powerful tool to improve decisions about resource use.

For more information on production function analysis, see:

1. Thomas, J. Alan, The Productive School. New York: Wiley, 1971.

2. Averch, Harvey et al. How Effective is Schooling? A Critical Review of Research. Englewood Cliffs, New Jersey: Educational Technology Publications, 1974.

PLANNING

Planning is perhaps the most basic of all management functions since it involves thought and decision concerning where the organization is to go and alternative courses of action to get there. A plan is a sequence of future activities to which an individual, department or total organization is committed. Planning is the process of designing, modifying and coordinating such plans. It is deciding in advance not only what is to be done, but how and when to do it, who is to do it, and where it is to be done. Yet planning is probably the most neglected of the management functions. Daily routine demands too often claim the manager's time at the expense of planning. This is particularly true concerning long-range planning. But the harmful consequences to effective organizational functioning due to serious errors in planning, or the lack of it, cannot easily be offset by good organizing, controlling and directing. While planning cannot predict the exact future, without adequate planning, organizational events are left to chance.

In this section various planning techniques to assist the administrator in the planning process are presented. First, a general discussion of forecasting techniques is provided. Forecasting is the projection of specified future events within a given time frame. Emphasis in this discussion is given to one such technique, Cohort Survival Estimation and its use in forecasting future enrollments. Next, Multiple Scenario Analysis, a forecasting technique which involves the identification of alternative futures or solutions to a problem presently encountered, or anticipated is described. Finally, the use of two network analysis methods, Program Evaluation Review Technique (PERT) and Gantt Charting, in the planning and controlling of both large complex and small projects is discussed.

NETWORK ANALYSIS: PROGRAM EVALUATION REVIEW TECHNIQUE (PERT) AND GANTT CHARTING

Network analysis is a managerial planning and control concept which focuses attention on significant program components, highlights potential problems and monitors progress toward the attainment of program goals. In network analysis each component of the system is viewed in relation to the other parts or activities. The activities or events are arranged in a sequential order and the time required to complete each component. The total system and the relationship among its components can be seen from its schematic model in the form of a flow chart or diagram.

PERT is a network analysis method for planning and controlling large complex projects by identifying the relationship between the component parts and time. It is very similar to another technique, Critical Path Method (CPM). PERT and CPM aid the manager in recognizing the relationships which exist among the subparts of the project. Both are refinements of earlier planning and controlling efforts, such as Gantt Charting.

The Gantt Chart consists of equal divisions of space in a single horizontal line which shows equal divisions of time and the quantity of work scheduled and completed. The width of each horizontal bar defines the time committed for each activity. Overlapping bars on the chart represent which activities can be work on simultaneously. An absence of overlap indicates that the preceding activities must be completed before the next ones can begin. Completion is monitored and marked along the horizontal bar for each activity. The manager, by identifying the points of completion on the chart, exercises control by this measuring of results compared to the planned time to complete each activity. Gantt

Charting is most useful for small simple projects since it provides only a limited analysis of task interrelationships.

PERT, as contrasted to Gantt Charting, involves the identification of the total network of activities and associated events. These activities and events culminate in the attainment of the system's goals. PERT utilizes a time-event network analysis. Each circle in the schematic represents the beginning of one event and the completion of another Each arrow represents an activity required for the completion of the event. The arrows connect the circles in the PERT chart. The arrows indicate the effort that must be expended between events. The time required to accomplish an event is known as activity time. Three time estimates are generated by the program designer. The optimistic time is the activity time required if everything moves along exceptionally well. The time which the designer believes is actually required to complete the project is called the most likely time. The pessimistic time is an estimate of the activity time which will be required if serious problems are encountered. These three time estimates are then averaged, with the greatest weight given to the most likely time. The result is known as the expected time. The next step in the PERT analysis is the completion of the critical path. It is the series of events which takes the longest time to complete in the network. It is important to identify because if there is a delay in the accomplishment of an event, it will have an impact upon the completion time of succeeding sequential events unless the manager can take action to shorten the time period for other future activities. If such a delay is not remediated, the project will not be completed on schedule.

II. Application

PERT and Gantt Charting force managers to plan. It is not possible to construct a time-event analysis without planning. PERT particularly requires planning at all levels in the system and encourages participation in decision making since each subordinate must plan the event for which he is responsible. If, for instance, the budget development process is subjected to a PERT analysis, each principal or department head would be responsible for planning the event related to the budget development for the school or department. PERT also focuses attention on the critical elements of the project which may need attention and creates an opportunity for a forward-looking kind of control. The business officer of a school district knows that certain aspects of the budget process must legally be completed and presented to the district's constituents by a specified time before the budget vote. Knowing this the business officer makes sure that the events along the critical path of the PERT chart do not fall behind their scheduled completion which could result in a rescheduling of the budget vote date.

PERT and Gantt charting are practical tools for planning when a repetitive sequence of events has not been established and a system of control is required, such as the planning of a curriculum development project or the building of a new school. They are also useful techniques when programs are clear and when reasonable estimates of time can be expressed, such as the production of a high school play or yearbook.

III. Implementation

PERT and Gantt Charting require the involvement of persons in the organization who are responsible for performing or supervising the project's activities in the design of the network. The project must

also be sufficiently clear to these persons so that the required events, activities and reasonable time estimates for the completion of the project can be specified. Smaller projects with limited resources might better utilize Gantt Charting, while PERT is more useful for larger complex problems concerned wtth district wide projects. Setting up, analyzing and interpreting a PERT network is not any more expensive than other time and control techniques, unless the designer makes the network extremely detailed and complicated. Finally, top administrators must be careful not to utilize the PERT network in a way that excessive control is exercised. This will restrict the flexibility of the system and the ability of persons responsible for performing the activities to make the adjustments which may be required as the project moves toward completion.

For more information on network analysis, see:

1. Cleland, David and William King. Systems Analysis and Project Management. New York: McGraw-Hill Book Company, 1968.

2. Banghart, Frank. Educational Systems Analysis. London: The Macmillan Company, 1969.

3. Koontz, Harold and Cyril O'Donnell. Principles of Management: An Analysis of Managerial Functions. New York: McGraw-Hill Book Company, 1972.

FORECASTING AND TREND ANALYSIS

I. Description

Forecasting is the projection of specified future events within a certain time frame, usually on the basis of incomplete information. Thus, in order to forecast, certain assumptions are made. There should be an event or objective of the forecast. Examples of objectives of forecasts may include: future enrollments, expenditures, revenues, personnel requirements, etc. The time frame should be identified. Is the forecast to be one year into the future, five years, ten years? Finally, the need for a forecast presumes that information available is incomplete. If complete information were available, there would be no need for a forecast.

II. Application

There are many levels of sophistication in forecasting. If the decision maker is interested only in the analysis of a trend, it may be sufficient to "eyeball" the data by plotting the previous years of data over time. For example, a graph of the total enrollment by year may be developed for the last ten years. Such a graph will show the general enrollment trend experienced by the district over that time span. However, the "eyeball" method is not sufficiently accurate for obtaining enrollment predictions for future years.

To forecast enrollments for future years, several techniques may be used. Some of these techniques, according to increasing levels of sophistication, are: Cohort Survival Estimation, Least Squares Regression, Mathematical Modeling, and Simulation. Cohort Survival Estimation is most commonly used because of its simplicity of calculation and limited data requirements. Cohort Survival estimates are based on average changes over time, and assumptions that the rates of change are constant. If these

assumptions are violated, inaccurate forecasts may result. The use of Least Squares regression for forecasting is more versatile because many more variables may be introduced to the enrollment model which will improve the predictive capability of the model. Also, data transformation, such as transforming all data to logarithms, will allow curriculinear functional relationships between enrollments and other variables to be estimated. It is always recommended that two or more methods of forecasting be used before a predicted figure is accepted. In this way, the assumptions of the various models, and their results, may be examined to determine which assumptions and results are most plausible for the trend situation faced by the school district.

III. Implementation

Forecasting is used by many school districts as part of their planning processes. However, seldom are more than one forecasting method used for comparison purposes. This is due, in part, to the fact that there is no agreement as to which forecasting technique is the "best". There is no best because all school districts differ in their characteristics. The more sophisticated forecasting techniques require a knowledge of statistics, and a computer capability. A further constraint limiting the use of many of these techniques is that few training programs of educational administrators include the use of these techniques for planning purposes. In implementing any of the forecasting techniques, data may be over or under estimated to yield an optimistic or pessimistic forecast.

For more information on forecasting, see:

Hentschke, G. C. Management Operations in Education, McCutchan Publishing Corporation, Berkeley, California, 1975, Chapt. 14 and 15.

MULTIPLE SCENARIO ANALYSIS

I. Description

Multiple Scenario Analysis (MSA) is a forecasting technique which involves the identification of alternative futures or solutions to a problem presently or projected to be encountered. It follows a rational comprehensive approach for planning in that the alternative solutions/futures are developed from systematically collected data and are designed to be logical and feasible in light of the present context of the problem. In mahy situations, scenarios/alternatives can be developed without application of mathematical formulas. Usually anywhere from three to six different scenarios are developed for any problem area.

The technique is principally used to clarify future goals and objectives, identify divergent opinions and value structures related to the future goals, and illustrate alternative futures so that the most rational future can be isolated. In most cases, scenarios are designed in group settings.

Once a problem area is identified and defined, mutually exclusive, probable and relevant futures/solutions can be isolated and a precise scenario analysis process can be followed. Each scenario presents a completely detailed picture of a projected event given a set of different values of assumptions. After alternative themes are identified, all organizational and environmental factors which may be pertinent to the present and future context of the problem are identified, expert judgment is obtained on reducing those factors to a list most critical to the problem, values are attached to each critical factor, the present situation is defined in terms of those factors, and each future situation

is defined around its selected theme. Once this first scenario is designed, the same format and factors are used in describing each additional alternative theme so as to expedite the decision making process in comparing and selecting the most relevant scenario towards which the organization will work.

II. Application

MSA can be used for generating solutions to projected problems such as how best to deal with the declining enrollment in school districts expected by 1985 or how to best organize and manage the energy needs of the school district by 1990. MSA can also be used for generating solutions to present problems such as what kind of school district staffing plan could be designed as a substitute to tenure given decling enrollment or how could we best organize our school district to involve the community in school decision making. Scenario analysis is most useful when different value structure and perspectives or the social, economic and political constraints operating on school districts compose different themes around which potential solutions can be generated.

III. Implementation

MSA appears to be infrequently used in educational settings because it is a time consuming process, requires good group process skills, rests upon agreed upon alternative goals, and requires defined decision rules in terms of going about the comparison and selection of the desired alternative. Groups interested in using Multiple Scenario Analysis consequently, need to be schooled in its use. If these constraints are focused on, the technique may prove very valuable in illustrating alternative futures.

For more information on Multiple Scenario Analysis, see:

1. Anderson, David R., et. al., Essentials of Management Science. New York: West Publishing Company, 1978.

2. Johnson, Richard A., Fremont E. Kast, and James E. Rosensweig, The Theory and Management of Systems. New York: Mc-Graw-Hill, 1973.

ORGANIZATION DEVELOPMENT TECHNIQUES

Introduction

Organization Development (OD) is primarily concerned with assisting organizations in coping more effectively with the need for designing and implementing changes in response to internal and external pressures, dissatisfactions, and mandates. As an educational strategy, it focuses on people and organizational relations. In this, it deals with generic problems of communication, conflict, leadership, organizational and individual goals, employee satisfaction, organizational rewards, and organizational effectiveness. As a social philosophy, it focuses on the need of organizations to move beyond classical, rigid, bureaucratic frameworks, to develop more adaptive, self-renewing structures in which individual as well as organizational goals can be accomplished. And, as an eclelectic area of study, it has integrated the theory and technology of applied behavioral science to assist managers in making these changes.

Although there are many techniques used in organization development, the techniques differ in terms of their level and degree of intervention with an organization's activities. The seven techniques selected in the document are representative of different levels of intervention. Survey Feedback and Organization Design methods relate to system-wide intervention; Job Design and Management by Objectives relate to individual/organizational interface intervention; Process Consultation and Team Building relate to interpersonal relations and work style intervention; and, Conflict Management relates to intrapersonal analysis and work group relations intervention. Each one will be described at length in the next few pages.

SURVEY FEEDBACK

I. Description

Survey feedback is first an expressed value of problem solving and second a process of information collection and dissemination. As an expressed goal, it views collection of information in an organization as necessary for the thorough definition of organization problems and staff generation of more accurate and relevant solutions. As a process, it consists of collecting two or more rounds of data via survey, interview, observation (etc.) techniques from the informed unit(s), organizing the data in terms of providing a descriptive account, and feeding the data back to the affected unit or involved decision making group.

Survey feedback rests on several assumptions: that feedback should be viewed as a continuous organization function, that summarized and quantified perceptions and performance measures on an organizatio provide valid data, and most importantly that motivation to resolve problems and make needed changes occurs when presented data allows individuals to see the discrepancy between real and ideal organizations and encourages them to develop their own solutions to the defined problems. Although external consultants are frequently used to manage the feedback process, adequately trained internal individuals or units can assume this responsibility as well.

There are many standardized diagnostic survey instruments available for use in education settings. The Survey of Organization Questionnaire designed by the Institute of Social Research at the University of Michigan and the Profile Extension Form designed by the University of Rochester have both been used as initial diagnostic tools in school districts. Both surveys collect surface information on an organization's climate, structure and effectiveness; employer's satisfaction, expectations, and role harmony;

intra- and inter-work relations; and, leadership styles. The initial survey is used to identify possible problem areas needing further investigation. Then, self designed surveys, interviews, or observations are typically constructed to collect more specific and detailed information.

The process followed in using survey feedback to diagnose organizational problems and develop relevant solutions has several phases. In the first phase, top organizational members are involved with survey feedback experts in preliminary identification of where information may need to be collected. In the second phase, they are involved in selecting appropriate diagnostic instruments. In the third phase, the survey feedback experts administer the instruments to members of the affected or involved unit or entire organization. In the fourth phase, the experts aggregate the data descriptively and summarize trends and central tendencies. In the fifth phase, the data are fed back to the top group members who are trained in group feedback techniques. In the sixth phase, the top group feedbacks the data to lower organizational units and works with them in planning corrective actions and collecting more detailed information on the identified problem areas. From the sixth phase on, affected units and individuals are involved in data gathering, solution generation, and decision making.

II. Applications

Survey feedback has been primarily used to deal with individual-organizational behavior problems related to supervisor-subordinate relations, communication gaps and weaknesses, role and inter- and intra-group conflict, and employee satisfaction with and performance under defined organizational structures and policies. If managers encounter resistance from individuals in performing their roles, they may want to investigate the degree to which:

superordinates and subordinates have defined their role expectations and performance criteria for each other; lateral as well as vertical and two-way as well as one-way communication networks are used; internal issues of power, status, and position interface in groups' performing their tasks; and, formally established policies restrict employee autonomy, professional choice and freedom. Survey feedback is particularly useful in assisting managers in planning how to implement a change into the system. The diagnostic information and resulting feedback and group processes facilitate organization motivation and support for needed change.

III. Implementation

Survey feedback as a group diagnostic approach has not been thoroughly applied in educational settings because managers have not typically accepted the importance of involving affected units or individuals in planning remedies or taking corrective actions. In addition, feedback experts have not been readily available for initial training of managers and staff in collecting and diagnosing relevant information and developing improvement plans. Third, the philosophy behind survey feedback has not been accepted - continuous personnel behavior feedback systems are not within most school district prioritized goals. And, finally, paper and pencil instruments are not always useful in obtaining "hard" data on school district indicators. Since the "soft" data which is obtained is often open to many subjective interpretations, the message is not always clear and the groups are not always able to identify the problems or understand their elements. Problem identification is an important preliminary step to group problem solving.

For more information on survey feedback, see:

1. Burke, W. Warner, Editor, Current Issues and Strategies in Organization Development. New York: Human Sciences Press, 1977.

2. Huse, Edgar T., Organization Development and Change. New York: West Publishing Company, 1975.

ORGANIZATION DESIGN

I. Description

Organization Design is a decision process intended to integrate an organization's goals, people and structure so as to improve organizational efficiency and effectiveness. The process rests on several assumptions: (1) that there are general theories of organizations which make it feasible to generate alternative design strategies; (2) that there is a wide variety of alternative strategies from which to select in fitting goals, people and structure together; (3) that although there is no one best way to organize, certain systematic patterns of organization design are associated with greater effectiveness; (4) that organizations are structured in a rational way; and, (5) that efforts lead to organizations which perform bettern than those which arise naturally.

There are several phases in the process of organization design. First, the critical set of organization variables are identified and information is collected on each one. Second, profiles of similar organizations are matched with the present organization, alternative strategies to link goals, people and structure are developed after a review of empirical literature, and a rational choice process is followed in selecting the strategy(ies) to implement. Critical variables are thought to fall into five broad categories: goals, tasks, people, primary structure and secondary structure. Variables in the goal category level of spcificity, type of statement (operational, strategic, tactical), or degree of consensus. Variables in the task category relate to task attributes of simplicity, variety, meaningfulness, clarity, and acceptance. Variables related to people include intra- and interpersonal relations, leadership style, group processes, and individual goals, personalitiess and expectations. Secondary structural variables include management levers of introducing and managing reward structures, information systems,

decision making systems, and rules and policies. Primary structural variables relate to organizational size, work processes followed in achieving goals and authority and line-staff patterns.

II. Application

Like many organization development techniques, organization design is more typically applied after organizational problems are encountered. Problems related to poor organizational performance, communication breakdown, interpersonal or role conflict typically provide the background to design efforts. For example organization redesign may be required in dealing with the impact of declining enrollment in the organization of teachers and supervision and the use of class and building space. It may also be required in restructuring communication channels so that teachers, administrators and parents are kept more informed of school activities across all school building and grade levels.

Design efforts are likely to facilitate - the implementation of changes, utilization of certain management tools, and resolution of organization problems. In most contexts the primary and secondary structural variables are the ones manipulated by the manager. For example, the manager may reduce class size and consolidate the number of subject supervisors in response to declining enrollment or may set up a public relations office and formal communication channels to the office in response to the need for more coordinated information exchange across the varied district groups.

III. Implementation

Until fairly recently, managers have not undertaken organization design efforts because the theory base, profiles of more and less successful organization types, and multiple variable correlational studies were either not available or not yet undertaken. With the development of integrated social

science and management theory, though, this effort is now more feasible. Managers who do undertake design efforts frequently encounter constraints related to developing contingency design (e.g. adapting the theories to their local setting), collecting needed information, finding the time for system wide assessment of the major factors in the organization, and deciding on appropriate strategies. With some training in design work, these constraints may be more readily handled.

For more information on organization design see:

1. Gailbraith, Jay, Organization Design. Reading, Massachusetts: Addison-Wesley Publishing Company, 1978.

2. Levinson, Harry, Organization Diagnosis. Cambridge, Massachusetts: Harvard University Press, 1972.

JOB DESIGN

I. Description

Job Design is a process concerned with analyzing job components and requirements so as to satisfy both the technical and performance requirements of an organization and the social and personal requirements of an individual. Since the 1940's, organizations have been concerned with the relationship between job content, individual motivation, job satisfaction, and individual performance. Although little "hard" data has been found to connect all four of these concepts, studies have shown that the nature of the job itself impacts on an individual's motivation and satisfaction on the job and that high job satisfaction and motivation leads to reduced absenteeism and turnover and improved morale.

Job design theorists believe that potentially motivating and satisfying jobs have five characteristics - (1) they clearly define task requirements; (2) they require a variety of individual skills in their performance; (3) they allow for some autonomy; (4) they are perceived as being significant; and, (5) they provide for feedback on job performance. For them, a whole job consists of planning, doing and evaluating a series of connected tasks.

Managers who accept the basic premises of job design may be involved in any one of several design activities. They may construct jobs initially to meet these criteria, or (most likely) they may need to assess present job contents and individual satisfaction and work on redesign activities such as enrichment or enlargement. In this, enlargement usually relates to the expansion of similar tasks (e.g., developing a curricula outline for the fifth grade social studies program as well as the sixth grade), while job enrichment relates to addition of both vertical and horizontal tasks (e.g., developing a curricula outline for fifth grade social studies

program and assisting teachers in implementing it). There are many standardized instruments available for diagnosing job content and individual satisfaction and motivation.

II. Application

Job design programs are typically applied after problems with individual dissatisfaction, low morale, high absenteeism and turnover, and low quality of performance have been encountered in the organization. The resulting organization response can be formal and pervasive (i.e., all affected jobs are diagnosed and redesigned), formal and selective (i.e., some of the affected jobs are diagnosed and redesigned) or informal and selective (i.e., some of the affected jobs are redesigned without prior discussion). In any case, managers undertaking these activities do need specialized training.

III. Implementation

Although the basic philosophy of job design appears to be widely accepted, few school managers appear to use its tenets in designing or redesigning jobs. There are several reasons for this. First, most school district jobs have already become socialized and accepted as they are. In this context, neither the managers nor the role holders themselves are convinced that the nature of the job is the factor which leads to individual dissatisfaction with the role. Most school district workers believe it is the way in which organizations intervene in the job which leads to dissatisfaction. Second, most managers neither have the specialized training nor the time necessary to design and implement such programs. And third, many managers working within the constraints of a bureaucracy often find that

changes in job content are impossible without changes in the entire organization.

For more information on job design, see:

1. Hackman, J., G. Oldham, et. al., A New Strategy for Job Enrichment. New Haven: Department of Administrative Sciences, Yale University, May 1974, Technical Report Number 3.

2. The Journal of Applied Behavioral Science, Volume 11, Number 4, October-December, 1975.

MANAGEMENT BY OBJECTIVES (MBO)

I. Description

MBO is a management approach which specifies in advance the results to be achieved and the program steps required for the achievement of those results. It is management philosophy built upon a number of assumptions about people, supervision and performance appraisal. It is a process in which the superordinate and subordinate managers of an organization jointly identify organizational goals, define each individuals major areas of responsibility in terms of results expected, and use these measures as guides for operating the unit and assessing the contributions of each of the unit's members.

MBO began to be adopted by industry in the early 1960's. Its success encouraged management specialists in education to suggest it as a solution to chronic problems of management in educational institutions. During the late 1960's and early 1970's, the first attempts were made to apply MBO processes in educational organizations.

The MBO process has its distinctive features. Its implementation is based on the prior specifications of the organization's goals and obejctives, on the chanelling of the individual member's activity towards accomplishing those goals, and finally, on the assessing of the degree of accomplishing those goals. Within this context the manager assumes responsibility for identifying the common goals which all his subordinates share with him/her, and toward whose achievement he must direct their combined talents and energies; each person is able to

state, in advance of the attempt, areas of responsibility and measures acceptance results for his/her position; each person has knowledge of the goals he/she is to achieve, has worked out a plan for achieving them and is evaluated by his/her efforts in achieving the results; and, the subordinate moves in a more results-oriented manner because he/she knows what his/her goals are. Additionally, the superordinate provides the instruction and assistance that will help him/her succeed.

II. Application

The potential of MBO when applied to school organizations are that it provides a means for educational accountability, provides a basis establishing and arranging priorities based upon the availability of educational resources, promotes participatory management on the part of all the staff because of each member's input into the process and each individual's accountability for the outcomes, promotes communication among staff participants and integrates their educational endeavors toward unified goal orientation and toward a systematic procedure in attaining these goals, provides a formalized method and approach to the improvement of the member's ability to organize, obtain results, and adapt to changing conditions, encourages long-range planning and improved goal setting for the development of increased goal-directed behavior, helps to clarify work expectations, provides feedback on how the subordinate is doing and how the organization is moving towards attaining the stated goals, strengthens control because it encourages inner control by the individual and decreases the need

for external control by the superior, enhances problem solving through its system of cooperative planning and individual responsibility for results, and encourages individual creativity on how to get the job accomplished.

III. Implementation

Disadvantages of MBO relate to a somewhat narrow view concerning employee performance and educational outcomes, an orientation towards the individual, as opposed to the total organization, the adoption of a reward-punishment process rather than analyzing and understanding the entire educational organization.

For more information on management by objectives, see:

Odiorne, George. Management by Objectives. New York: Pitman Publishing Corporation, 1965.

Drucker, Peter. Managing for Results. New York: Harper and Row, 1964.

PROCESS CONSULTATION

I. Description

Process Consultation is one of the third-party intervention approaches used in assisting groups to understand, assess and improve the way in which they work with each other in work related tasks. Interpersonal conflict and poor group practices and norms can be barriers to group work. Individual intervention can make group members aware of their own unconscious attitudes and behaviors and help lower the barriers.

In process consultation, an individual (who may or may not be a group member) assumes two roles: observer of critical group activities in terms of communication, decision making, leadership, conflict resolution, information collection and aggregation processes, and intervener in these activities so as to improve the group's awareness of and acceptance of alternative norms and performance behaviors. As participant observer the process consultant attempts to influence how group members work with each other by modeling, counseling, or advising appropriate behavior, setting agendas and presenting information, and supporting desired behavior and discouraging other behavior. Unless the group is adequately schooled in accepting this role, someone external to the group's membership may be initially required. Ultimately, however, it is hoped that the group will come to see the value and utility of this role and will allow someone in the group to assume it.

II. Application

In an informal sense, process consultation is not a unique role. Most organizations have individuals who by their nature or training are concerned with group and interpersonal dimensions and, thus, often assume a "process" posture in working with groups, anyway. Their role may not always be evident but more pronounced as groups encounter difficulties. In this

context, however, the strength of the role rests on the individual's credibility, personality, persuasiveness, and acceptance within the informal network. In a formal sense, process consultation is an unique role; few education organizations have trained group process facilitators to work with school district groups. Those that do, may have process leaders only temporarily in terms of hiring them to help implement planned changes. Typically, these externally hired consultants don't leave behind a legacy of internally trained process facilitators.

In the past the need for process facilitators may have been fairly limited, as teachers took directives designed by administrators. Today, however, teachers, administrators, students and community people are all vying for a decision making role. In this context, there is a need for process facilitators to assist district groups to become more skilled in reaching collaborative decisions. Groups need to be made aware of how hidden agenda, domination by a few individuals, discouragement of minority views, loosely planned agenda, personal animosities, and use of status and position, hinder group decision making. The process facilitator's role is to bring this to the group's attention (without) provoking resistance) and develop new norms of openness, collaboration and shared power.

III. Implementation

The problems discussed in the application section are also illustrative of the problems faced in the emplementation of process consultation. As yet, most professional schools have not been concerned in training group process experts and school districts have not been concerned in hiring them because of their low level of acceptance for participative management. It is expected that group conflict in reaching district decisions and resolving

district problems will increase in the next decade, especially if present hierarchal structures and bureaucratic staff-line authority relations are not altered to meet demands for increased participation in decision making.

For more information on process consultation, see:

1. Argyros, Chris, Intervention Theory and Method. Reading, Massachusetts: Addison-Wesley Publishing Company, 1973.

2. Schein, Edgard H., Process Consultation: Its Role in Organization Development. Reading, Massachusetts: Addison-Wesley Publishing Company, 1969.

TEAM BUILDING

I. Description

Most education organizations today are finding that management does not have (as in the past) the same prerogatives of using power and position to supervise and control subordinates. Increasingly, demands are being raised for greater staff and external community involvement in planning and implementing policy changes. As a result, managers today must develop new structures, processes, and skills for working with a wide variety of groups.

Team building is an organization development technique designed to assist managers in setting up more effective, committed and efficient groups. For the group member, the goal of team building is to have the individual understand how authority, control, power and role perceptions, attitudes and stereotypes influence group behavior and performance. For the entire group, the goal of team building is to have the group understand how group goals, priorities, norms, roles and processes impact on individual goal achievement.

Team building typically consists of two phases of activities. In the first phase, the work group is trained off-site in desired group norms and processes. Specifically, group members are trained in checking their perceptions of themselves, others and the group with the other group members, encouraged to resolve their perception discrepancies, encouraged to develop open and supportive norms for group participation in potentially conflicting areas, and provided information on how to organize the group so that it can operate at optimum effectiveness. In the second phase, the trained group is assisted (back at the organization) in implementing these norms and processes. In this phase, group members try out their new perceptions and skills as they work on required group tasks.

II. Application

When team building has been systematically applied to all levels of an organization and the norms of openness and support for group decision making have been reinforced by the managers, the outcomes have been improved relationships, improved attitudes toward collaboration and organization commitment, and improved group efficiency and effectiveness.

Despite the potential benefits, the concept and effort of team building have not been systematically applied in most school organizations because the line hierarchy in the school bureaucracies have maintained the preeminence of their position in reaching decisions. In this context, teams are not needed. The one exception might be that informal team building efforts may be used in setting up more efficient and effective management groups, particularly at the central office and building levels in school districts. When managers spend time together ironing out their differences of opinion over certain issues, defining how their roles should overlap, and forging common commitments to certain solutions, they are engaged in team building. Usually the informal efforts of team building are not valid substitutes for the formal efforts, the former are more likely to lead to agreed-upon structures and roles in team work, but not improved communication, trust and openness in problem solving and decision making.

III. Implementation

Team building efforts have often been less than successful in education organizations because (if they have been attempted at all) they require a complex support network. Initially, time should be set aside for team training and maintenance efforts rather than task efforts. In

this, team members need to develop openness and trust in working with each other and acceptance of group norms of equal satisfaction and power in reaching decisions. Ultimately, top managers need to reinforce these new behaviors by manipulating the informal and formal incentive systems in support of optimal group practices. Both activities require strong internal commitment for the concept and goal of improved teams.

For more information on team building, see:

1. Francis, Dave and Don Young. Improving Work Groups. San Diego, Diego, California: University Associates, Inc., 1979.

2. Schmuck, Richard A., Philip J. Runkel et al., Handbook of Organization Development in Schools. Eugene, Oregon: National Press Books, 1977.

CONFLICT MANAGEMENT

I. Description

Conflict is a behavior which occurs when two or more parties are in opposition as a result of perceived or felt differences between them. It occurs in all organizations between individuals, groups, departments, superordinates, and subordinates. Sources of conflict include such factors as problems of competition for resources, task interdependence, jurisdictional disputes, communication barriers, value differences, and personality and status needs. In the past, conflict was viewed as totally dysfunctional to the organization and its members. The present viewpoint is that conflict can contribute to organizational effectiveness and survival. The search to resolve the conflict can lead to innovation and change and often make the change more acceptable. It also energizes people to action, not only in resolving the conflict but often provides stimulation for other activities. The issue is not one of reducing conflict to zero in the organization, but the effective management of the conflict. How the administrator manages the conflict affects the extent to which the conflict has negative or positive consequences for the organization and its members.

Conflict management is a process of diagnosing conflict situations as to the source of the conflict and a selection of strategies to resolve the conflict. Conflict management approaches assume that the amount of conflict can be increased or decreased by modifying the conditions which led to the conflict. It is also concerned with regulating the manner in which conflicts are handled by the individuals or groups involved and by third parties to the conflict. There is no single method of coping with conflict situations. Each situation should determine the strategy used.

Strategies utilized may vary from withdrawal, smoothing and conciliation, forcing, and problem solving. Withdrawal is the actual refraining from a quarrel and remaining silent. Smoothing and conciliatory tactics play down the differences between parties and emphasize common interests. Compromising strategies involve searching for an intermediate position, sharing differences, and bargaining. Forcing and pressure tactics emphasize fixed positions and polarize the parties. Participants are viewed as antagonists and competitors and the outcome is viewed as victor and vanquished. Problem solving involves a sharing of information about the conflict as each party perceives it and a process is utilized by which a solution is found which is advantageous to both parties.

When the conflict cannot be resolved within the organizational unit, a third party may be required to settle the dispute through mediation, arbitration or process consultation. The third party may be a person within the organization, such as the superordinate, or a person external to the organization. The mediator is an intermediary between the disputing parties and is free of the emotionalism of the conflict. The mediator's role is to assist the parties in reaching a resolution by persuasive means, providing new insights to the conflict situation, and suggesting possible solutions. The arbitrator is also free of emotional involvement in the dispute, listens to the arguments of the involved parties and renders a decision. The process consultant utilizes very flexible consultative interventions which are aimed at helping the parties understand and do something constructive concerning the conflict. The consultant and the parties work together in diagnosing the conflict situation and plan a solution on the basis of the diagnosis. Mediation

and arbitration generally take the form of compromise while process consultation is generally concerned with integrative problem solving.

The basic aim of creative conflict management is a solution which permits the parties to achieve their objectives. The basic goal is a win-win approach (problem solving strategies) where each party is satisfied with the outcome as opposed to a lose-lose situation (compromising strategies) where neither party is totally satisfied or dissatisfied in achieving their objectives, or a win-lose approach where only one party is satisfied with the conflict resolution.

II. Application

Each of the conflict sources listed above are found in educational organizations. Competition for resources occurs not only at budget development time, but also during the year when modifications are often required in the budget plan. Jurisdictional disputes concerning who has the authority and responsibility for various activities are common between teachers and administrators, central office personnel and building level personnel, boards of education and school personnel, and various departments and groups in the school organization. Bargaining with various employee organizations is mandated by state laws. Grievance procedures are part of district-union contracts. Personality conflicts occur between students and teachers and other school personnel. Value differences between various departments often erupt into hostile situations. The values of individual parents or parent groups and the values of the school and its personnel are common occurrences. In fact, much of the administrator's day is involved in handling such conflictive situations.

III. Implementation

The effective management of conflict is dependent upon the administrator's ability to correctly diagnose the source of the conflict and to select and effect the appropriate strategy which will bring about the desired resolution. Additionally, consideration must be given to the costs incurred in using one tactic as compared to another and to the personal values of the administrator.

The failure to correctly diagnose the conflict source is similar to a physician who treats symptoms of an illness, rather than the illness itself. An administrator must be able to diagnose the conflict source correctly if appropriate strategies are to be selected. Once selected, the administrator must possess the qualities and skills to effect the strategy. For example, if arbitration is selected as the appropriate strategy to settle the conflict between two subordinates, the administrator must be well informed and perceived by the parties to be impartial and fair. If an integrative problem solving method is selected the administrator must possess effective interpersonal skills and clinical sensitivity and perceptiveness.

The decision to use one strategy as opposed to another must be concerned with the costs involved for each choice. Costs must be considered not only in terms of money, but also with time and the consequences of the use of each strategy. It may well be that the use of a process consultant would provide an optimal solution, but the district may not have the funds nor the time in resolving the conflict which this strategy would demand. An alternative solution which would provide a satisfactory solution, but which would require less money and time, could be selected.

Finally, the values of the administrator might be an inhibiting factor in the selection of certain strategies. For example, an administrator with a strong human relations orientation might not select forcing or pressure tactics to resolve conflicts, but might be more prone to select compromising, conciliatory or problem solving strategies. On the other hand, an administrator who is highly dogmatic, might be more willing to select pressure tactics.

For more information on conflict management, see:

1. Wexley, Kenneth and Gary Yukl. Organizational Behavior and Personnel Psychology. Homewood, Illinois: Richard D. Irwin, Inc., 1977.

2. Filley, Alan. Interpersonal Conflict Resolution. Glenview, Illinois: Scott, Foresman and Company, 1975.

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