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ABSTRACT

The management of education is an increasingly important consideration throughout the nation. Tested management concepts and systems are needed for vocational and technical education to efficiently resolve the complex problems of: (1) policy development, (2) planning, (3) provision and utilization of facilities and equipment, (4) budgeting and finance, (5) staffing, (6) pupil-personnel services, (7) evaluation, and (8) student-school-community-industry relations. This publication should assist in identifying substantive problems, methodological approaches, alternative solutions, and needed research and development in the areas of data and management systems, subsystems, and procedures. With emphasis given to synthesis and demonstration of concepts, major sections of the paper are devoted to: (1) Theory of Systems, (2) PPBS: A Management Subsystem, (3) Management Information Systems, (4) Management Techniques and Related Tools, and (5) Training of Administrators and Needed Research. (Author/JS)

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review and synthesis of research on

MANAGEMENT SYSTEMS FOR VOCATIONAL AND TECHNICAL EDUCATION

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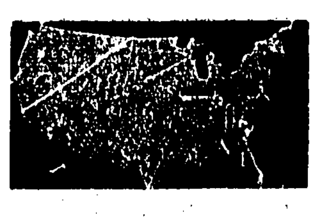

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REVIEW AND SYNTHESIS OF RESEARCH ON MANAGEMENT SYSTEMS FOR VOCATIONAL AND TECHNICAL EDUCATION

James A. Hale
Department of Educational Administration
University of New Mexico
Albuquerque, New Mexico

ERIC Clearinghouse on Vocational and Technical Education
The Center for Vocational and Technical Education
The Ohio State University
1900 Kenny Road Columbus, Ohio 43210

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PREFACE

The management of education is an increasingly important consideration throughout the nation. Tested management concepts and systems are needed for vocational and technical education to efficiently resolve the complex problems of policy development, planning, provision and utilization of facilities and equipment, budgeting and finance, staffing, pupil-personnel services, evaluation, and student-school-community-industry relations. This publication should assist in identifying substantive problems, methodological approaches, alternative solutions, and needed research and development in the areas of data and management systems, subsystems, and procedures.

This paper differs from normative literature reviews and state of the art essays in that emphasis is given to systhesis and demonstration of concepts. It is intended to be an authoritative analysis of literature and practice.

Those who wish to examine the primary sources of information should utilize the bibliography. Where ERIC document numbers and ERIC Document Reproduction Services (EDRS) prices are cited, the documents are available in microfiche and hard copy form.

The profession is indebted to James Hale for his scholarship in the preparation of this report. Recognition is also due Leon Sims, Tallahassee, Florida; Merle Strong, University of Wisconsin; and Paul Braden, research and development specialist, The Center, for their critical review of the manuscript prior to final revision and publication. J. David McCracken, Information specialist at The Center, coordinated the publication's development.

Robert E. Taylor
Director
The Center for Vocational and
Technical Education
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REVIEW AND SYNTHESIS OF RESEARCH ON
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PROBLEMS, SCOPE, AND LIMITATIONS

This paper differs from normative literature reviews and state-of-the-art essays in that emphasis is given to concept synthesis and demonstration as opposed to documentation of various conceptualizations of educational management systems, subsystems, and techniques. This approach does not imply a minimum regard for literature reviews and state-of-the-art assessments. Quite the contrary. This paper is based upon assessments and bibliographies developed by others, and the author acknowledges with appreciation those endeavors as significant contributions to the various conceptualizations presented here.

The pervasive nature of the topics assessed in this paper involved many theoretical paradigms and conceptualizations. The proliferation of papers demonstrating various analytical analyses and conceptualizations of systems, management systems, and operational techniques often boggles the mind. Therefore, the author chose to initiate several biases for purposes of expediency. Generally, those biases are articulated at the point of introduction or become obvious through the language employed during synthesis. Decisions relative to construct utility and selectivity of management techniques demonstrated were necessary; however, the extensive bibliography accompanying the synthesis should provide for those who are inclined to refine, expand, extrapolate, or completely reassess the multiple dimensions of management systems and techniques within the educational milieu.

Chapter II brings together conceptualizations of general systems theory into a framework within which one may test hypothesized input-output relationships. Extensive attention is given to the development of viable theoretical constructs. The problem addressed was not to build theory but to exhibit a transmutation growing out of a review of the literature. Further, concept demonstration is limited to conceptualizations within an educational context and often the development may seem trivial. However, if one is to develop complex structures for purposes of quantative and qualitative analysis, then one must give careful attention to structuring the theoretical base to avoid building in structural biases.

A systems approach is essentially an attitude of mind, i.e., how one views reality and engages in problem solving. Qualitative assessment of systems processes is avoided because one dimension of process evaluation is efficiency and comparable processes often are evaluated only relative to productivity (e.g., pupil gain). However, the theoretical constructs do provide a basis for extrapolating into reality through probabilistic models. One well researched systems model (social systems) applicable to education organizations is briefly described.

Chapter III represents an assessment of the literature and an esoteric demonstration of Planning, Programming, Budgeting Systems (PPBS). Despite the popularity of PPBS notions, the literature is often redundant and confusing. For example, national surveys of school districts by Hill, et al. (1967) (E) and The Association of School Business Officials have revealed that among those who claimed to have implemented PPBS, there existed extensive perceptual incongruence of PPB constructs. Further, when one assesses the contemporary literature relative to PPBS, it becomes immediately apparent that some educators seem to be engaging in a favorite bureaucratic pastime of making "alphabet soup." Close examination of constructs reveals very little differentiation between PPBS, PPBES, ERMD, RAMD, MBO, etc. Other characteristics common among the alphabetizers are: (1) their propensity to remain at a non-operational conceptual level, (2) proliferation of undefined terms which exacerbates accommodation (e.g., systems analysis), (3) vague generalizations relative to utopian utility, and (4) a missionary zeal rivaling that of St. Paul.

The PPBS conceptualizations presented in Chapter III could be implemented if one were predisposed to do so. However, the purpose of that demonstration is to reveal the evolutionary nature of program structures and the need for systematic structure and careful attention to definitions. The comprehensive characteristics of a PPB system seem to require extensive development and testing of each of its subsystems within a dynamic educational environment. Some direction relative to that development is offered and vocational education examples are used.

Chapter IV assesses some issues and problems relative to development and implementation of management information systems (MIS). For the most part the chapter evolves around electronic data processing (EDP) systems which may accommodate a portion of the "paper pollution" associated with educational institution managerial tasks as well as selective instructional strategies. The chapter only attempts to conceptualize some of the problems in terms of their application to educational management task, but provides an extensive bibliography related to man-machine needs and processes.

Chapter V surveys several management tools and techniques applicable to educational management. An attempt is made to demonstrate the techniques within the context of managerial tasks associated with vocational education programs. A major limitation of the chapter is that many techniques are not discussed. Again, a bibliography is provided for those who want to investigate other dimensions.

Many of the managerial techniques demonstrated are applicable at varying levels of management while others do not seem to be. For example, PERT seems to have pervasive application to project management (e.g., instructional, building construction, etc.), program planning, communication of complex strategies, and others. However, cost-benefit analysis seems to be an esoteric macro-economic concept relevant to planning purposes only at the highest level of abstraction.

Theoretical conceptualizations of decision-making are not discussed although some decision-making strategies are demonstrated. Decision-making theory is discussed in several of the selections provided in the bibliography (Griffiths, NSSE Yearbook, 1964 (A) and Thomas, 1963 (H)).

Chapter VI briefly assesses training programs currently developing managerial personnel for vocational education programs. Essentially two methods seem to prevail: (1) train experienced vocational teachers to become managers, and (2) give trained managers experience in vocational programs.

Finally, Chapter VII attempts to assess needed research and development in several areas of vocational education. Research needs extend from alternative instructional program strategies to manpower forecasting. Development needs extend from articulation of program objectives to managerial competence. Each statement of research and development needs is briefly summarized relative to possible directions one might take to generate substantive knowledge and/or models for operational purposes.

Educational administration is but one dimension of the educational enterprise, often consuming less than three percent of public expenditures for education. Vocational education administration is a management subsystem of the larger educational management system. It is to vocational education management that this paper is addressed, although the concepts are applicable elsewhere.

Finally, the scope of topics assessed in this paper is extensive. Many publications stand behind each dimension and more fully explicate the concepts. Hopefully the reader will be provided direction for further review and study as a result of this reading.

THEORY OF SYSTEMS

A review of the contemporary literature on systems theory reminds one of the words of Socrates relating his experiences with his teacher, Anaxagoras. He said, "What hopes I had formed, and how greviously was I disappointed! As I proceeded I found my philosopher altogether forsaking mind or any other principle of order. . . ."

One might hypothesize that the commonality of the term *system*, which has become so common in our technological society, has contributed to the loss of its true meaning. The most frustrating aspects of a review of the literature utilizing systems constructs prove to be the vagueness with which many characteristics and definitions are explicated. Thus, it would seem that a definition of *system* is a function of the esoteric conceptualizations a particular writer wishes to engage. Evidence of the latter is offered in the following:

"For now, one definition of *system* is given (some others will be considered later)."

The author then proceeded to offer a definition of *system* that would serve his purpose of the moment. The preceding example seems especially incongruous since in his introductory statement that writer, too, recognized a lack of consistency among those who have attempted to elucidate systems constructs.

Although a discussion of theory construction and definitions of theory are beyond the scope of this paper, the works of Kuhn (1962) (A), which demonstrate how a paradigm guides scientific progress, the theory typologies offered by Marx (1963) (A), and the general statement by Griffiths (1964) (A), may provide significant insights.

This chapter does not constitute a new systems theory, but may best be characterized as a synthesis of existing conceptualizations of systems. Many of the definitions find their basis in several mathematical notions—especially set theory and the calculus, but generally remain within the context of a good collegiate dictionary.

Finally, theories are developed to be used (Griffiths, 1962) (A), and if a theory cannot be accommodated to observations of reality then it is a bad theory. Thus, a theory is sustained by the rationality and consistency of its basic elements, i.e., its definitions, postulates, and constructs.

Conceptual Framework

A system is defined here as an orderly array of a set of objects, principles, and/or facts so arranged by some form of regular interaction as to present itself as a rational, coherent whole. No value judgments are to be inferred from the definition. Goodness and badness are relative concepts yet are often associated with definitions of a system. Also, one observes the tendency of writers to include expectations of process or product in their definitions. One should approach the above definition as a standard for assessing observable phenomena as being systems or non-systems.

A set, as used in the definition, is a collection of elements, e.g., a set of goals, a set of account codes, a set of people. Thus, a classroom may contain among others, a set of desks, a set of students and a set of teachers. Under normal circumstances the set of teachers for a given classroom contains one element. However, in a team teaching configuration one may find two or more elements in the teacher set, or if the teacher has not yet entered the classroom, one would identify the teacher set as an empty set.* Elements are defined as the objects, principles, and/or facts of a system. Object carries the same connotation as that given by the physicist, i.e., material existence. Principle is used in the aphoristic sense—a dictum. A fact is an unimpeachable truth. Although some may argue through *reductio absurdum* of the logician that there is no such thing as truth, the connotation seems clear (even if only in a relativistic sense) despite its denotative accuracy.

The terms "orderly" and "array" used in the definition of a system conform to typical dictionary definition, but implicit in the phrase "an orderly array" is the concept of a boundary which further modifies the notion of a set. A boundary is a circumscribed confine. The boundary may be physical, e.g., the walls of a classroom; it may be imaginary, e.g., a student's understanding of the internal combustion engine; it may be postulated, e.g., the accounting categories of a cost accounting structure.

Predicated upon the above definition of a system, two general types of systems may be phenomenologically identified:

1) Infinite systems are systems whose elements are so numerous that the process of counting them may never be completed, e.g., a stellar system.
2) Finite systems are systems whose set of elements may be identified through a terminal counting process.

For the most part, systems analysis is limited to finite systems, although at times it may prove propitious to treat as finite systems those which conceivably could be considered as infinite. The latter notion arises in practice when one disregards the elemental nature of a system because to identify each element may constrain all other activity. Although the epistemological character of systems may be somewhat weakened by the above notion, observable phenomena seem to constrain one to take a heuristic approach at that particular conceptual level.

The definition of a system provides that it contain a set of elements that may be finite. What about the finite system in which the pervasive principle is that it be empty, i.e., it contains no elements as in the case where the teacher has not entered the classroom? A definition will provide the needed consistency for internal validity of the definition of system and further provide conceptual consistency when the transformation functions are structured below. An empty system is a system containing no elements; also known as the Identity System. The symbol for an empty (identity) system is: ( ) or sometimes $\emptyset$

* Although some students may wish to identify all teachers as "empty sets," we are not concerned with personality or mental ability but the quantity of the set.

Continuing construct development, the proposition is advanced that all non-empty systems have two types of subsystems:

1) Proper Subsystems (normally referred to only as subsystems) are systems whose elements are integrated into a supra-system. Each element or groups of elements in a system may be a subsystem. The definitional requirements of subsystem are (a) that it be a system and (b) that it be integrated into a supra-system.
2) An Improper Subsystem is the system itself. All systems have an improper subsystem, including the empty system.

One may conclude from the above that the empty system has but one subsystem which is the improper subsystem or the system itself. Non-empty systems may contain two or more subsystems. The symbol for a non-empty system is usually expressed as a capital letter enclosed within parentheses. Given finite system (A) having one element, we may identify two subsystems of (A). First, there is subsystem (A), which is the system itself and by definition an improper subsystem. Secondly, there is subsystem ( ), which is the empty system. (The empty system is the proper subsystem of every system except itself.) To state the above abstractly: (A) c (A), ( ); which is read—system A contains the subsystem A and the empty system.

Because the concept of a subsystem is very important to the explication of systems theory, another example seems warranted. Assume a system consisting of two vocational agriculture students, Mike and John. Let (S) be the system containing Mike and John. For referrent purposes assume them to be F.F.A. chapter's representatives in a public speaking contest. Abstractly, (S) = (M, J), which reads—the system of representatives equals the system containing the elements Mike and John. The possible subsystems are:

1) (M,J), the improper subsystem;
2) (M), the subsystem Mike;
3) (J), the subsystem John; and
4) ( ), the empty system.

It can be seen that a system of two elements contains four subsystems. If one adds to the above system, (S), a system of directive principles for interaction, the number of substantive subsystems increases at a geometric rate relative to the number of elements introduced into the given system which combine to form subsystems. If elements are permutated into subsystems then the limit of the identifiable number of subsystems is given by the equation $N = 2^{7}a$, where N is the number of subsystems and n is the number of elements to be permutated within the system.

The preceding notion gives rise to other questions: How are elements introduced into the system? Does one merely define them as such? Although the latter question may sometimes be answered in the affirmative, one must first examine the system transformation functions to answer the former.

Two definitions are helpful at this time and the concepts will later be demonstrative targets of systems analysis. Systems are said to have inputs and outputs (which may or may not be systems themselves). Inputs are those elements to be systematized. Outputs are the product or yield of a system. It may be appropriate to note at this juncture that this is the first mention of the yield concept of systems which others insist upon including in their definition of systems. It will be demonstrated below that systems may indeed not have identifiable outputs or yields. For illustrative purposes of the concepts of inputs and outputs, assume that a vocational school district defines a system boundary. Further assume two inputs—human resources and non-human resources. These inputs are illustrated at the left of Figure 2.1.

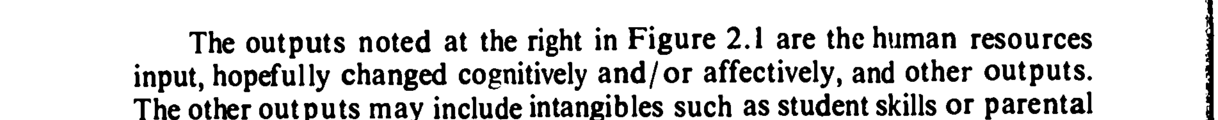

Figure 2.1—Input/Output Relationships of Systems

The outputs noted at the right in Figure 2.1 are the human resources input, hopefully changed cognitively and/or affectively, and other outputs. The other outputs may include intangibles such as student skills or parental pride and tangibles such as student-project products, curriculum guides, athletic events, etc. However, the output of a system may be an empty system.* The latter notion will be explicated in the later discussion of closed systems.

Systems have two transformational functions:

1) Integration—the process whereby two or more sets of elements are joined, resulting in a system. The construct further implies the joining of one input with an existing system to form a newly defined system.
2) Differentiation—the process whereby one or more sets of elements are disjoined from an existing set of elements (a system or non-system), resulting in a system.

Before exemplifying the two system generating constructs, a word about non-systems seems to be in order. A non-system is conceived to be a set of objects, principles, or facts that lack the functional part of the definition of a system. That is, they may not be "an orderly array" and/or they may not be "arranged by some form of regular interaction," and/or they may not constitute "a rational coherent whole." A possible referrent here would be a student-commons prior to the beginning of the school day. The symbol for a non-system is simply a capital letter without parentheses.

Return now to the transformation functions above. Assume that a principal purchases materials for utilization in the electronics laboratory.

* Again, no pun intended as to the character of the student products.

Further assume that the materials were requested by the instructor and represent a system of objects for a specific project and are represented by (A). If we further assume the electronics class in session (systematized) and denote the class by (B), we may now generate a new system by joining (A) and (B) through the integration function. If we define the intergration generator as *, then (A) * (B) = (C). The new system (C) represents the electronics class possessing project materials.

If we define the differentiation generator as / and provide a different kind of input to (C) above, such as a bell ringing bringing the modular session to a close, and denote that input by (R), then the differentiation function may be expressed as: (R) / (C) = Q. Here, Q is considered a non-system, although it may be so depending upon the subsequent activity's congruence to the functional part of the definition of a system. Also, Q may be an empty system if one views the result of (R) and (C) after the students have left the laboratory.

Many writers who apply systems notions often demonstrate their conceptulization through "flow-charts" or other graphic means. Generally, the approach helps to make complex constructs more meaningful. However, in some of the earlier uses of this technique there seemed to be a total disregard for consistency among the symbols used. One company very early developed templates for computer programmers but it seems that the uninitiated overlooked the system when they attempted to apply the flow-diagramming concept to non-computer programming theses.

The differentiation abstraction above may be demonstrated graphically by returning briefly to that portion of the definition of a system "so arranged by some form of regular interaction." Although that portion of the definition is usually accommodated through the ordering principles or nature of the elements, one may conceive an ordering symbol such as —›, which simply indicates that one system (or element) interacts with another system (or element). The interaction takes place within the system boundary. If inputs or outputs are ordered, then one may symbolize the external boundary ordering by ═›. Thus our differentiation generator in the above illustration was given as: (R) / (C) = Q. Figure 2.2 illustrates the simple notion graphically.

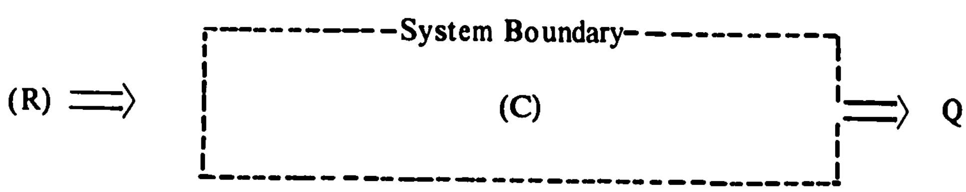

Figure 2.2—Systems Differentiation

Upon closer examination of (C), one may observe interaction of some of the subsystems of (C). In Figure 2.3 (S) represents students, (T) represents a teacher, and (M) represents materials.

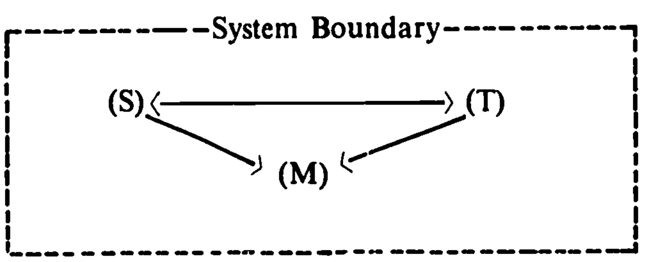

Figure 2.3—Subsystem Interaction

Note the dual direction ordered between (S) and (T) and the one-way ordering between (T) and (M), and (S) and (M). Some of the current adaptations of Flander's "Interaction Analysis" may provide an appropriate referrent here. Parenthetically, it is admitted that the above graphical notions are simplistic. However, the purpose here is systems construct articulation and not multiple concept diagramming. Other chapters utilize diagramming more extensively and more complexly.

Griffiths (1962) (A) postulated systems as being either "closed" or "open." Chinn(1964)(A) and Hare(1967)(A) preferred to describe systems as being either in "stationary equilibrium" or in "dynamic equilibrium." These differences in conceptualizations go beyond a sematic skirmish. Griffith's characterization of a "closed" system as being in a state of equilibrium and not changing matter with its environment is unfortunate, especially when his systems are also characterized as "being organismic in nature." One would seem to be hard pressed to identify an organism that did not exchange matter with its environment. Chin's approach is somewhat less tenuous in that he describes "stationary equilibrium" as a fixed point or level of balance to which the system returns after a disturbance. He hastens to add that these occasions are rare in human relationships. It is suggested here that such situations are rare in all relationships, in that inertia reduction introduced into a system, whether naturally or artifically, creates a new system or destroys the existing system. If a child reads a book, is he ever the same again? Or perhaps facetiously, yet paradigmatically correct, if a lawnmower tosses a rock to another position on the lawn, is the earth the same? Obviously the point has been carried to an extreme. Yet, the lack of consistency of definitions and the incongruence between constructs and observable phenomena contribute to the malaise one experiences after reviewing systems theory literature.

It would seem that the conceptualizations of the constructs "open system," "closed systems," and "stationary equilibrium" suffer more in their denotation than in their connotation. Further, it would seem that added qualifiers would greatly extend their relevancy. For example, "relatively closed" or "relatively equilibrated" could thus be examined in terms consistant with observations. It is recognized that computer programs or mathematical formulae are systems or subsystems which remain unchanged until they have been activated through the integration function and in this sense seem to be closed systems. However, they are neither organismic nor do they necessarily return to some fixed point or level of balance. And they do interact with the environment. Further, it would seem clearer if one were to articulate the concept of closure in a time frame.

For the purpose of synthesizing theoretical conceptualizations, the concept of "open systems" will be denoted as "dynamic systems" and defined as evolutionary systems containing recognizable principal components as substantive elements of the system over time. The concept of a "closed system" is rejected in favor of "relatively equilibrated system" which is defined as a non-evolutionary system possessing consistent characteristics and substantive elements over time. It would seem that the foregoing conceptualizations allow for one to establish the necessary limits relevant to the conceptual level of systems analysis posited.

Another systems construct often described in the literature is that of equifinality. It has been described as that property which refers to the observed fact that identical results can be obtained from different initial conditions. It is submitted here that results are never identical in any ultimate sense, and that matched pairs are only the result of acceptable limits. Granted, imperfection in instrumentation may be such that variances are not detected. Yet, differences do indeed exist. No teacher would propose that two students have identical skill because they obtained similar scores on an examination. Nor, would an industrial engineer claim that a given machine produces two product units that are in all respects identical. Each of the foregoing examples would require statements of tolerable limits which is another way of describing acceptable myopia. Thompson (1967) (A) stated this quite succinctly when he said that the kind of answers we get are limited by the kind of questions we ask. Developmental standardization of output would seem to be a viable construct for systems analysis but equifinality would seem to be an aberration of reality.

Finally, systems have feedback capability. Feedback is defined here as the sensory or monitoring component of the planned cybernetic loop. Often programmed initiating structures are developed to react to prescribed sets of monitored criteria. The notion of feedback pervades the educational profession in multiple forms. Possibly the most common form of feedback for a teacher is a student's response to a question. Evaluation systems are feedback; training relevance compared to employer expectations is feedback for curricular planning purposes. The notion seems to possess sufficient external construct validity for inclusion within the general systems paradigm.

Application to Education

Above all, the systems approach in any endeavor is essentially an attitude of mind—another way of viewing the world (Meals, 1967) (A). Several references have been made previously to systems analysis. Systems analysis was broadly defined by Quade (1966) (B) as "any orderly analytic study designed to help a decision-maker identify a preferred course of action from among possible alternatives." The integration and differentiation constructs postulated earlier in this paper provide for systems generating functions and for structuring alternative courses of action. Thus, it would seem that the educator who addresses himself competently to the systems generating functions has captured the scholarship of the social scientist who investigates the interrelationships of systems and the dynamics of the systems' model predictability. For example, the concept of scheduling, whether modules of time, instructional strategies, or curriculum sequences are all structural processes. Structure is the sinew of systems. Thus, a theoretical application of the systems model is found in the structuring activities one engages to select from among alternative courses of action.

Application of systems analysis (*a la* Quade) and management techniques based upon the systems approach is the subject of subsequent chapters. To this point of development one might surmise that a systems approach requires one to view his activities in a broad perspective. There is reason to suspect that a complete taxonomy of inputs for an educational institution would be virtually infinite. Certainly they would be dynamic. The educator must decide at what position he will "close" input consideration, at what position he must limit his interaction analysis, and at what level he will establish limiting criteria required to perform his output evaluation. The three decisions are not independent; quite the contrary. The interdependence and constraints imposed by the decisions are the essence of systems analysis.

Theoretical models further provide psychological references for establishing courses of action in the absence of substantive data for simple extrapolation or stochastic predictability. One systems model was developed by Getzels and Guba (1957) (A) and further explicated through research (Getzels, Lipham, and Campbell, 1968) (A) into a viable predictable model of Parson's (1959) (A) conceptualizations of social systems of formal organizations. It is not the purpose of this paper to fully explicate but to synthesize. For a full explication of the theoretical constructs and research base one should consult Getzels, Lipham, and Campbell, *Educational Administration as a Social Process: Theory, Research, Practice.* One purpose of this paper is to demonstrate applications of management systems, therefore a brief review of the theoretical constructs and the systems model's predictability is offered.

An Application to Educational Administration

Regardless of the corporate structure of organizations—whether they be industrial, religious, military, or educational—the problem of integrating idiographic and institutional variables is fundamentally the same, and, in the final analysis, seeks to insure productivity and growth among position incumbents. Organizations need people and people need organizations.

Lawrie (1967) (A) suggested that what might seem to be appropriate conditions for a perfect marriage often may be characterized by a divided house or "armed truce;" each role incumbent tacitly performing in suspended animation—a captive of the system. Obviously, an organization cannot change to accommodate the total need-dispositions of its members. In the first place, it is doubtful that a taxonomy of need-dispositions of incumbents can be assessed accurately beyond a few personality variables; secondly, it seems unnecessary to assume that any one organization should become responsible for meeting all of the idiosyncratic needs that can be assessed with relative accuracy.

Change seems to be an integral part of man's nature. However, the new structure may not be what is important; significance may be a function of the process. The degree of personal selection and involvement in the assimilation and accommodation processes become key issues in the process of change because of the personalistic nature of change. Therefore, the focus here is that suggested by Lipham (1964) (A), i.e., to concentrate "upon the relationship of the individual to the organization," and to become concerned with the fact that a major source of conflict derives from discrepancies between the basic personality structure of an individual and the demands of his organizational role. For example, take the simple notion of changing from a line-item object-of-expenditure budget to a program budget format. At least three accompanying sources of conflict may be expected, including role conflicts, personality conflicts, and multiple role-personality conflicts. A brief description of those potential conflicts will be given and then a brief presentation of the psycho-social systems model.

Two definitions are needed to facilitate application of the constructs associated with the above sources of conflict. First, role is defined in terms of the institutional expectations for the behavior of a position incumbent. These would include his obligations, responsibilities, powers and privileges (Getzels and Thelen, 1960) (A). Secondly, personality is defined in terms of a taxonomy of need-dispositions that govern an individual's unique response to his environment (Getzels and Thelen, 1960) (A).

Role conflicts occur when specifications and/or expectations for a given position are not clearly articulated by the organization. The position incumbent is presented with multiple requests for services and is sure of neither the priority nor validity of such requests relative to his operational responsibilities. This type of conflict might be experienced by the budget supervisor relative to information requests from news media. He may possess the requested information and feel an obligation (public servant role) to accommodate the request; however, the school system employs a public relations coordinator who has responsibilities for public information dissemination but is often on the golf course and not available to service his position adequately. Conflict—what are the limits of a position incumbent's role?

Personality conflicts occur where there is a lack of congruence between the personality needs of a position incumbent and the role expectations held for that position by the organization. This type of conflict might be experienced by the budget supervisor who has a low tolerance for ambiguity yet must facilitate multiple changes within and among accounting categories to accommodate requests of vacillating program managers. Conflict—can the personality accommodate role demands?

Multiple role-personality conflicts occur when two or more roles are occupied by the same individual at the same time and the personality needs fail to be accommodated or are confounded by incongruent demands. This is often the case in small school districts (although not restricted to small districts) where a program director (and other administrative personnel) is required to be "all things to all people" relative to the operations of a school's programmatic activities. Often his understanding and desire for program activities cannot be accommodated to the realities of his community's fiscal capacity to provide identified program needs. His obligations as both a professional educator and as a community leader may conflict where tangential. Conflict—can the personality accommodate multiple role demands?

Behavior is the resultant of an individual's need-disposition interacting with environmental conditions. A clear understanding of the model's constructs allows one to extrapolate into anticipated behavior under given conditions—especially structural change within organizations.

Figure 2.4 presents the modeled constructs from which the above examples were extracted. The well researched constructs continue to offer insights to those who would study its constructs and implications.

For the purposes of this paper four dimensions of the psycho-social systems model are presented. The dimensions are:

1) Cultural—Ethos, Mores, Values;
2) Nomothetic—Institution, Role, Expectations;
3) Idiographic—Individual, Personality, Need-dispositions; and
4) Biological—Organism, Constitution, Potentialities.

As one views the model horizontally he is moving from an abstract conceptual level of each dimension to a more refined conceptual level. For example, on the idiographic dimension the personality provides constructs which measure a dimension of the individual and need-dispositions are personality constructs.

As one views the model vertically he is moving from a more abstract conceptual level to a more refined conceptual level as he reads from the extreme exterior to the interior. For example, the concept of an organism is refined as one moves to the individual and the concept of ethos is refined as one moves to analysis of the institution.

The targets for research relative to conflict are generally at the needs-expectations interactions although our example above identified the constructs of role and personality and the possible conflict that might ensue given certain conditions.

Various studies of organizational health (Halpin and Croft, 1963 (A), Miles, 1964 (G) demonstrate conditions of organizations. The psycho-social model presented above demonstrates possible causes of organizational health deficiencies. It is the transactions between the nomothetic and idiographic dimensions that one gains substantive insights for predictive purposes. For example, congruence between expectations and need-disposi-

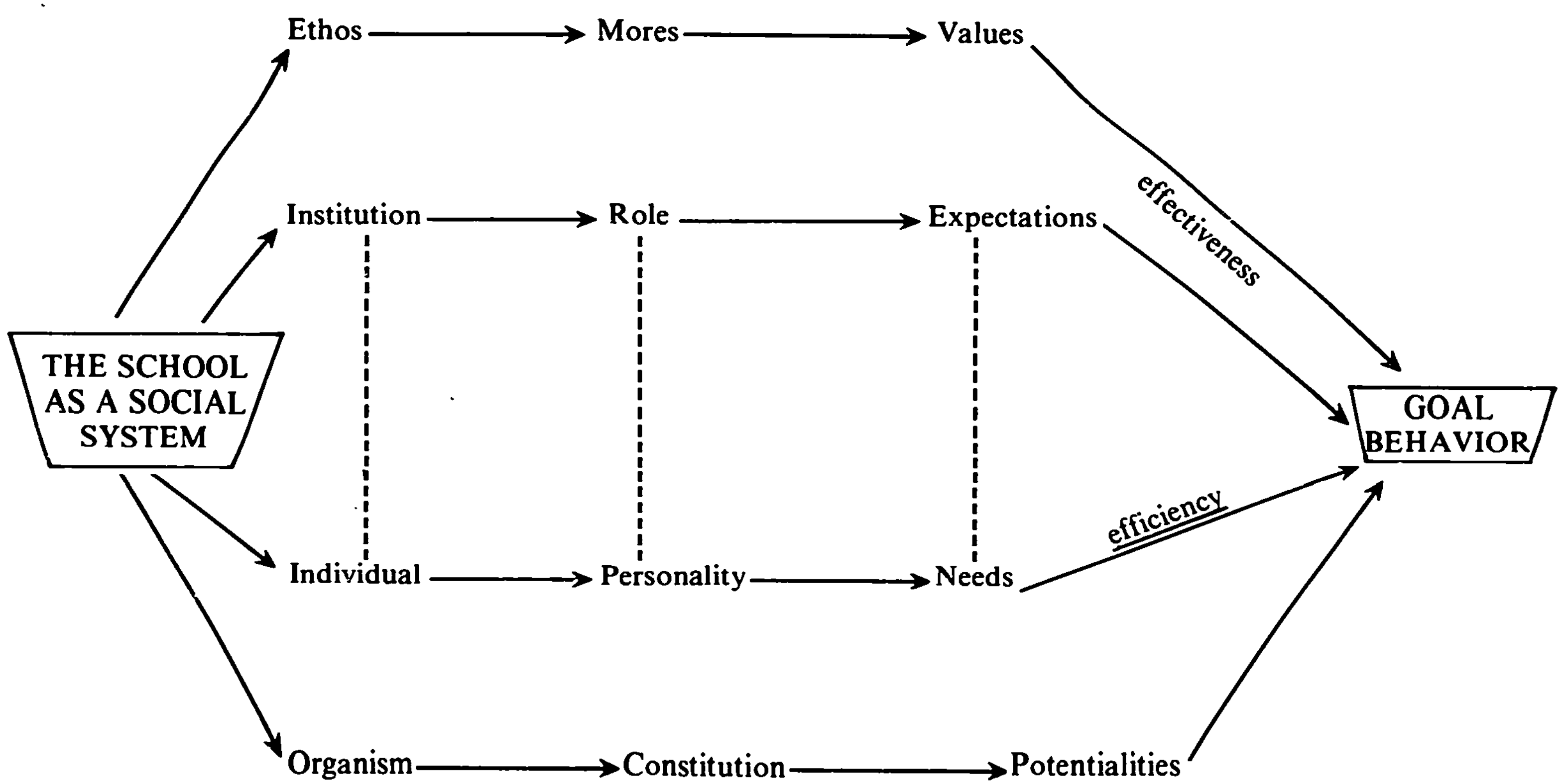

Figure 2.4—Theoretical constructs of the school as a social system.

tions is measured through satisfaction. Congruence between role and personality is measured through climate; organizational effectiveness is measured through goal satisfaction; the individual's behavior is measured through efficiency; and finally, morale is the measured relationship between effectiveness and efficiency. The above are systematic attempts to match theoretical notions with observable phenomena. Integration and differentiation functions structure the constructs for purposes of analysis. The output of the congruence studies provides indirect insights for one to grossly determine organizational health yet more directly give rise to notions about organization and administrative practices.

Summary

The purpose of this chapter was to synthesize theoretical conceptualizations of systems and to offer a theoretical framework upon which one might build rational management systems for vocational-technical education programs. Those applications will be offered in subsequent chapters covering such topics as Planning, Programming, Budgeting Systems (PPBS), Management Information Systems (MIS), Management by Objectives, as well as Management Tools and Techniques.

A system was defined as an orderly array of a set of objects, principles, or facts so arranged by some form of regular interactions to present itself as a rational, coherent whole. Two general types of systems were identified: infinite systems and finite systems. The notion of an empty system provides logical completeness for system generation and two generating functions were posited. Those functions were described and demonstrated as the integration function and the differentiation function.

Further, the notion of subsystems was extensively developed for purposes of functional relationships and clarity. Inputs and outputs were defined and exploited in terms of their relationship to interacting subsystems. Feedback was defined as the sensory or monitoring component of the planned cybernetic loop of systems.

An application of a systems model to social systems theory was briefly offered and the relationship of that model to role behavior and administrative practitioner's utility was offered. Thus, a theoretical framework has been established upon which subsequent systematic developments may be based. It was suggested that the systems approach is essentially an attitude of mind—another way of viewing the world. Goodness and badness are relative terms and are avoided; structural validity must be measured in terms of incipient anomalies that challenge construct validity.

PPBS: A MANAGEMENT SUBSYSTEM

Quantification of the marginal utility received by an individual having engaged and successfully completed a learning experience is indeed a complex model. One of the assumptions of marginal utility analysis is that the factor units (each learner being a unit) may be considered homogeneous. This assumption was rejected long ago by educational theorists and often serves to engender the endemic feudality between those who attempt to measure educational output and those who challenge the efficiency of measurement in education. However, several econometric models have provided excellent analytical frameworks (within stated limits of planned myopia) to assist educational decision-makers in reducing uncertainty and increasing rationality in the exercise of human judgment (Hartley, 1967) (C). The ever increasing use of such techniques in education has been extensively documented and participation by economists in educational planning is reported to be at an all time high (Hartley, 1967) (C).

One of the more popular economic models appearing in contemporary educational literature is the Planning, Programming, Budgeting System (PPBS), which is reported to have its roots in Keynesian economics and the new technology of systems analysis (Schick, 1966) (E). Since most of the literature provides extensive review of the historical developments of PPBS and its subsequent popularity among educational administrators, that approach will not be a major dimension of this paper. The reader is referred to the Alikim and Bruno chapter of *Social and Technological Change* (Piele, 1970) or (Schick, 1966) (E) for historical documentation. The approach of this paper will be one of integrating selected historical developments into a general explication of PPBS concepts for the purpose of establishing an operational rationale.

Planning, Programming, Budgeting Systems: A Brief Perspective

In the early 1960's McNamara transplanted one of Ford's "Better Ideas" to the Department of Defense and thus popularized PPBS as a management tool and in 1965 President Johnson ordered all federal agencies to develop PPB systems. Many levels of government both within and without the federal establishment have since attempted, with varying degrees of sophistication, to design their perceptions of a PPB system. Unfortunately, congruence of what constitutes a PPB system is sorely lacking in the literature—and seemingly a lack of parallelism in practice. This is not to infer that all levels of government, or even similar governmental agencies, should design PPB systems in concert.

Many papers have been presented during recent years on the subject of planning, programming, budgeting systems. Few are of a comprehensive nature, but they do supply some insight to the rationale of the PPB system. The purposes of this section are (1) to survey some of these theses and attempt to identify some PPB constructs, (2) to look at some PPB studies outside the field of education, and (3) to survey some PPBS-related studies within the education profession.

Hirsh (1966) (E) identified the beginning of the program budgeting process within the governmental units of the United States with the activities of David Novick who directed the Controlled Material Plan of the War Production Board during World War II. In a recent keynote address to invited guests of the Association of School Business Officials at Denver in 1969, Novick described these activities as a strategic materials planning process.

The problem was to insure that necessary resources for war goods production would be channeled into "optimum-use" finished products and to determine the effect of any production decision upon other war and non-war demands for resources.

Schick (1966) (E) identified three distinct orientations inherent in every budget system and indicated that the structural emphasis will determine the overall orientation of the system. The control orientation attempts to enforce propriety of expenditures. The first phase of budget reform in the federal establishment was identified with the expenditure control orientation. About 1920, proper checks-and-balances were instituted through various accounting schemata to insure the fidelity of managers. The management orientation attempts to organize for goal accomplishments through resource management and has been identified with the recommendations of the Hoover Commission in 1949. The management orientation is sometimes referred to as "performance budgeting." Using the control function of budgeting, performance budgeting attempted to identify some measure of output with each line item. The planning orientation of budgeting emphasizes the long-range goals and objectives of the organization. PPB attempts to combine the three orientations—planning, output, and control—into one integrated structure with the emphasis on planning.

Smithies said that program budgeting is intended to improve government decision-making both by clarifying and refining policy objectives and by allocating resources efficiently in pursuit of those objectives (1965) (A). Similar statements are attributed to Hirsch (1966) (C), Smith (1967) (E), Williams (1966) (C), and others.[1]

Quade (1966) (A) emphasized the systems analysis techniques available to those who implement a PPB system, as did Kershaw and McKean (1959) (A). Hitch described systems analysis as a framework which permits the judgment of experts in various disciplines to identify results which transcend any individual judgment (1964) (A). Hatry and Cotton (1967) (C) identified the cost accounting system and non-fiscal performance reporting systems as "very important" in providing the basic data for PPBS analyses.

Based on the explications above, it is now possible to enumerate the following expectations held for the PPB system. The PPB system:

1) attempts to minimize incremental planning through explicit statements of objectives and long-range program forecasting;

[1] See Howard L. Vincent, *Selected Bibliography: Application of Economic Analysis and Operations Research to Problems in Education Planning*. Washington, D.C.: Division of Operations Analysis, Office of Education, July 15, 1966.

2) attempts to aggregate all costs to "programs" through the cost accounting structure and to forecast future budgetary requirements;
3) attempts to identify and relate qualitative and quantative data in a fashion useful to decision-makers and provide choices among valid alternatives; and,
4) attempts to view each decision in the long-run dimension and to institutionalize change by providing continuous analyses of goals, objectives, and operational techniques of the organization.

Conversely, the PPB system is not:

1) just another budget format;
2) a substitute for judgment and intuition;
3) another way to save money; nor
4) an attempt to promote computerization.

Although the individual elements of a PPB system are not new, the total configuration may be. Program accounting in education on a regular reporting basis would indeed be new.

Non-Education PPB Studies

The interest of the federal government and especially the Department of Defense was previously noted. Non-federal governmental units have also shown interest in the PPB concept. The Society for Public Administration featured PPB concept papers in the December, 1966, issue of *Public Administrator Review* and held a PPB symposium at its May, 1969, convention in Miami Beach.

The State-Local Finances Projects funded by the Ford Foundation and administered by George Washington University selected five states, five counties, and five cities to participate in a one-year pilot project to explore the implementation of PPB systems. Although the funding ended in July, 1968, Dade County, Florida (a metro government organizational unit) has continued its efforts and has developed guidelines for:

1) identifying responsibility for instituting a PPB system;
2) explicating justification for program initiation and change;
3) preparing a sample program budget;
4) describing programs for all budget requests; and
5) preparing and displaying a program analysis.[2]

The states of Wisconsin, New York, California, and Florida have engaged in similar studies.[3] The reorganization of service departments

[2] Gloria Grizzle, *PPBS in Dade County: Status of Development and Implementation.* A Report to the Sub-Committee on Economy in Government of the Joint Economic Committee, United States Congress, for a Compendium on the Development of Planning-Programming-Budgeting Systems in State and Local Governments. Miami, Florida: Metropolitan Dade County, April, 1969, p. 16.

[3] For a critique of the California system see Richard A. Seigel, "Reflections of PABA, An Analysis of California's Programming and Budgeting System," Unpublished paper of Arthur D. Little, Inc., Sacramento, California, April, 1969.

into functionally related bureaus is evidence of these states' initial implementation. The International Organization for Economic Cooperation and Development devoted three days to papers dealing with issues related to various PPB concepts at its April, 1968, meeting in Paris, France. These papers tended to be more theoretically than operationally oriented. Although they were addressed to the field of education a paucity of examples were related to the profession.

Educational PPB Studies

Mushkin and Cleaveland (1968) (B) recently prepared a document for the National Education Association's Committee on Educational Finance, adapting some of their work on the State-Local Finances Project to the field of education and describing the PPB system as a unifying and comparing process. They further stated that, for programming purposes, expenditures must be grouped in terms of program objectives. However, it is difficult to conceptualize just how this would be accomplished for the program structure they illustrated.

Kent (1968) (E) described 48 programs meticulously costed in the Skokie, Illinois, effort toward program budgeting. In the Skokie effort an attempt was made to separate the activities of elementary teachers into subject disciplines and to prorate teacher time to each of these programs. The accuracy of this procedure as a means of providing quantitative data on the teaching process seems highly questionable. Evidently, Superintendent Gibbs found this to be so, because he reported to the National School Board Conference Symposium on PPBS at Miami Beach on April 14, 1969, that his district had changed its previously reported program structure. However, the new structure identified 110 programs and one might question the efficacy of such program proliferation.

The Philadelphia school district has attempted to apply several PPBS concepts. Roberts (1969) (C) reported that the Philadelphia system provides the administration with greater flexibility in allocating resources. The process of budgeting relative to the Philadelphia decentralization study was reported in functional detail by Rappaport (1967) (B). The 1967-68 proposed operating budget document described allocations by grade levels for elementary programs, by subject area for secondary programs, and by mixed function-task identification for other services.

The New York City Public School System, in cooperation with the Stanford Research Institute, has been attempting to operationalize a PPB system since 1967. (School districts in New York State are under legislative mandate to develop PPB systems.) The major components of their PPB system have been identified as:

1) comprehensive program structure;
2) multi-year program and finance plan;
3) program analyses;
4) program updating procedures;
5) program/budget review; and
6) assessment of current operations.

As the result of an extensive national survey of program budgeting as a new approach to budgeting in public education, Hill, et al. (1967) (E) concluded there is a genuine possibility that experts from data processing, accounting, and other professions will lead the development of PPB systems in education, including program structuring and measurement, without the leadership and active participation of educators. He specifically recommended that a distinction be made between (1) the official state program budget document which would display summary data of major programs and objectives, (2) the adoption budget which would delineate sub-programs as desired, (3) the working budget for management and control, and (4) supportive data and cost analysis information. It seems that Hill has reference to the utility of the information supplied to various sub-publics and position incumbents. Information requirements also would need to be determined for operating school districts and it would seem that the pervasiveness of report pyramiding, generated by a management information system, would be a function of organization size and the delegation of authority implemented by the superintendent. Hill and Mattox (1967) (E) reported that the school system that adopts the program budgeting techniques will indeed develop a more extensive budget document. The absence of high quality information about operating programs always has been a school board member's dilemma when confronted with economic decisions. Although not specifically identified with program budgeting, James (1968) (E) proposed several changes in current accounting and budgeting practices to provide a more descriptive information base than is normally available to school administrators. These proposed changes include:

1) explaining the cost of education to the public in terms of services rendered; and
2) developing a system of accounts that will break down the complex operation of modern school districts into rational subsystems within the total system.

The California Department of Education, also under legislative mandate to develop a PPB system, contracted with Peat, Marwick, Mitchell, and Co. (PMM&C) to assist in the development of a program budgeting and accounting system for that state's local school districts. Fifteen pilot districts, deemed to represent the characteristic environments of all school districts within the state, were chosen for investigation and development. Six of the 15 districts were chosen initially to work in cooperation with PMM&C in the first phase of the project. The project was divided into four distinct stages: (1) investigation, (2) conceptual system design, (3) experimental design testing, and (4) evaluation and synthesis. In Progress Report #2, the findings of the investigation phase were reported and recommendations for Phase II were made.[4] A recent discussion between the author and Dale Scott, chairman of the California Advisory Commission, at the Denver conference of the Association of School Business Officials

[4] Advisory Commission of School District Budgeting and Accounting, California Department of Education, Unpublished Report #2, Sacramento, California, January, 1968.

(ASBO), revealed that the program budgeting and accounting designs had encountered some difficulty in their initial attempts to relate program objectives to cost (similar to the Skokie, Illinois, first thrust). However, different program structures currently are being explored.

During 1966, the Dade County, Florida, Public School System began investigating the utility of the PPB system for their adult and vocational programs. The thrust of the project has been to develop a cost accounting structure which could provide the cost per student hour of instruction. Because of the technical orientation of the project staff, little has been done in the planning, programming or evaluating subsystems described above. In an oral report to the Superintendent of Schools, the project manager indicated that the development of the budget-reporting formats should be completed by January, 1970, and that attention then would be turned toward developing evaluative criteria.

In 1968, the Dade County school system entered into a three-year contract with the U.S. Office of Education to investigate and develop an operational PPBS model for school systems. The project contract calls for cooperative efforts between the Dade County school system and the Association of School Business Officials. ASBO is committed to develop a PPBS model for nationwide adaptation by school systems and to disseminate the findings and developments.

If the contemporary literature conceptualizing PPBS and reported PPBS practice are any indication of the state-of-the-art, however, there seem to be more evangelists with gross generalizations than model builders with direction for development and implementation. Two contemporary practices seem to pervade the themes of PPBS proponents both throughout the literature and among special PPBS seminars. The first practice is a seeming reluctance to move beyond gross conceptualizations. One genuinely interested in PPBS engineering, is offered redundancy. The second popular practice is the age old bureaucratic game of "alphabet soup." It seems that many PPBS proponents insist upon esoteric initials which, it is assumed, supposedly differentiate their conceptualizations from all others. The resultant seems to be an extension of confused mediocre conceptualizations.

Because of the pervasiveness of the concepts involved in the notion of a PPB system, such a system inextricably bounds a multiplicity of theoretical paradigms. Chapter II posited the basis of general systems theory. The PPB conceptualizations explicated in this chapter utilize those constructs and are based upon the general systems rationale.

PPB—A Management Subsystem

A planning, programming, budgeting system for educational organizations is a complex management subsystem consisting of four interdependent subsystems integrated through a management information system (MIS). PPBS is a management subsystem because it encompasses only a portion of the totality of techniques educational organization managers bring to bear upon the management process. (Other techniques are the subjects of subsequent chapters of this paper.) Therefore, one must view PPBS as a subsystem of a supra-management system. Possibly one of the most overlooked contributions of PPBS to the management process is the handle it provides education managers in their attempt to grasp the multiple activities characteristic of educational institutions.

McGivney and Nelson (1969) (B) observed that an integrated system involves major innovations in each of its subsystems to achieve fully operational status. Figure 3.1 presents the PPB subsystem interface to which this paper is directed.

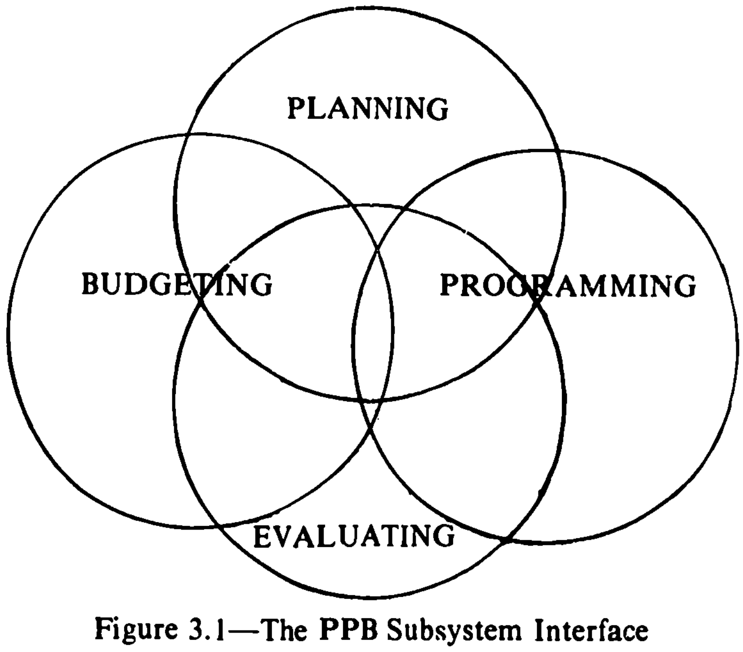

Figure 3.1—The PPB Subsystem Interface

Each of the above subsystems, as well as others identified by Hartley (1968) (C), require extensive analysis and a comprehensive analysis of each is beyond the scope of this paper. However, The Center for Vocational and Technical Education Leadership Series Numbers 18 and 19 provide cogent references (McGivney and Nelson, 1969) (B).

The Program Planning Subsystem

Educational planning is concerned with defining priorities among competing objectives and designing criteria for programs which could achieve them (Lecht, 1967) (A). A program is a set of activities designed to attain certain stated objectives. Educational program planning not only draws upon key issues of curriculum and instruction but also upon strategies, procedures, and methodologies inherent to the planning process. The six steps described by Hansen (1967) (C) may serve as a planning model for reviewing existing educational programs and considering innovative practices. An analysis and synthesis of some models for planning will be explicated in the chapter on Management Tools and Related Techniques.[5]

One of the outputs of program planning must be a set of aims toward which the school district is willing to commit all of its resources. The aims are dynamic in that they develop as human knowledge and understanding develop, and in this sense they will never be fully attained. New learners, new educators, new knowledge, all evolve. Therefore, the aims toward which the goals of a specific school district will be established, are directed toward the development of concepts, convictions, and competencies within individual learners relative to multiple environments. Before preceding with the explication of planning subsystem constructs the author assisted in developing for an urban school district,[6] it seems appropriate to place the constructs into perspective relative to the conceptual level to which they are addressed and subsequently the level at which they become operational.

Figure 3.2 demonstrates the systematic relationships between the concepts: aims, goals, and objectives.

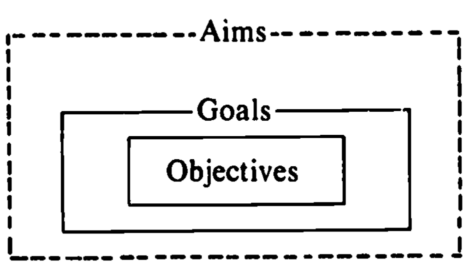

Figure 3.2—Relationships Among Educational Aims, Goals, and Objectives

Aims

Aims provide the system boundary for educational program planning purposes. The goals become statements of programmatic intent and the objectives provide operational definitions for accomplishing goals. The following represent instructional program aims relative to multiple environments:

1) The Immediate Environment—To function effectively and efficiently within his immediate environment, the learner needs to understand certain concepts which help him better understand himself and his im-

[5] An annotated bibliography covering the general topic of Educational Planning has been prepared by the ERIC Clearinghouse on Educational Management, University of Oregon, Eugene, Oregon, 1971.

[6] The author edited and contributed to all chapters of "Comprehensive Long Range Planning in the Division of Educational Planning and Services." Unpublished working paper, Dade County Public Schools, Miami, Florida, 1968.

mediate environment. He needs to develop certain convictions upon which value judgments are made about himself and his immediate environment, and he needs to develop certain competencies for self-sufficiency and problem solving within his immediate environment.

2) The Community and National Environment—To function effectively and efficiently within his community and nation, the learner needs to understand certain concepts relative to the nature of the social, economic, and political structures in which he lives and to identify his role as a participating member. He needs to develop certain convictions about social, economic and political structures of his community and nation. Having made those value judgments, the learner needs to develop certain competencies that will enable him to design his contribution toward the betterment of his community and nation.
3) The World Environment—To function effectively and efficiently within his world environment, the learner needs to understand certain concepts relative to broad human problems and his personal response to them. He needs to develop convictions about the dignity of man and to form value judgments about humane international intercourse. He needs to develop certain competencies that will enable him to make a contribution toward the improvement of the general welfare of man.

Goals

To insure that resources are identified and extended to proper priorities, the educational organization attempts to communicate its endeavors by identifying and maintaining a dynamic set of educational goals. The goals are not operationally measurable among learners. The yardstick of success is found in program objectives directed toward goal attainment. However, goals do serve to indicate the areas toward which resources are directed at any given point in time. There are goals for pupils, goals for educational planning and services, and goals for educational administration and support services. Categorization of goals under these headings does not deter their direction from the learner. The latter two categories merely represent more explicit facilitating goals.

Examples[7] of pupil goals are:

1) to develop humanizing experiences that develop respect for oneself and one's fellowman; and
2) to develop functional English literacy and computational skills for each learner.

Examples[8] of goals for educational planning and services (EP&S) are:

1) to develop programs relevant to contemporary social problems; and
2) to achieve optimal mix of program content and process.

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[7] Only two of eight goals are provided for illustrative purposes.

[8] Only two of 10 goals are provided for illustrative purposes.

Examples[9] of goals for educational administration and support services (EA&S) are:

1) to provide adequate physical facilities for an effective learning environment; and
2) to match authority with responsibility at different levels of decision-making through decentralization and effective management.

The above statements of categorical goals are articulated at the second level of complexity. The goals provide direction for program development, program sequencing, research, and establishing gross measures of evaluation criteria. Operational specificity will now be demonstrated.

Objectives

The effectiveness of effort cannot totally be measured simply because the totality of learner behaviors cannot be measured. However, samples of learner behaviors may establish predictable yardsticks by which program efforts may be assessed. Much confusion seems to have been generated by the uninitiated relative to the role of program objectives within the PPB system. For example, those who would attempt to cost-account individual program objectives would seem to be cost-accounting minutia. Programs are costed, not individual program objectives.

Two examples of district-level program objectives are given for one goal in each category illustrated above.

Student goal: To provide humanizing experiences that develop respect for oneself and one's fellowman.

0_1 : The learner will demonstrate knowledge of the roles and contributions of black, brown, red, white, and yellow men to the American culture as assessed by the appropriate form of ____ school districts Social Studies Cultural Inventory.

0_2 : The learner will demonstrate knowledge of the social contributions of various vocational/technical roles to his community and nation as assessed by the appropriate form of ____ school districts Social Studies Cultural Inventory, vocational sub-test.

EP&S goal: To develop programs relevant to contemporary social problems.

0_1 : The program will exhibit experiences and activities designed for greater understanding of the nature of drugs, their positive contributions, and their danger in misuse.

0_2 : The program will exhibit experiences and activities designed to reduce the incidence of social deviancy.

The objectives for educational planning and services establish criteria for program elements and each instructional strategy is evaluated relative to its contribution to program goals.

[9] Only two of seven goals are provided for illustrative purposes.

EA&S goal: To provide adequate physical facilities for an effective learning environment.

0_1: The program will determine educational specifications for effective learning through modern architectural techniques.

0_2: The program will provide for systematic maintenance of existing educational structures to insure the health, safety, and effectiveness of the learning environment.

The objectives for educational administration and support programs establish criteria for program elements which are related and subsequently evaluated relative to their contribution to program goals.

Program objectives form the third order of complexity of the program planning subsystem. The above example demonstrates the systematic structuring of the planning process at the central administrative level of a public school district. It shall be demonstrated below that planning exists at other levels of the educational enterprise. However, it must be kept foremost in mind that program planning is directed toward a school district's program structure.

The Program Structure

A program structure is a set of categories into which programs may be classified. A program category is a classification within the program structure which expresses the purpose of the programs classified therein. Program structuring is no mean task. Probably the best advice was given by Seigel (1969) (E) when he remarked that program structures are not cast in stone. From a philosophical view, the history of education may be seen as attempts to structure man's knowledge; man studied science, then he studied scientific disciplines, then he studied interdisciplinary science, then around again, with each proponent of a specific structure attempting to demonstrate the relevance of his particular penchant for a given program structure. It would seem that the degree of specificity found in program structuring is directly proportional to the intensity of criticism. Many will parrot Seigel's dictum but few seem to accommodate it. Even fewer get to a comprehensive program structure in their PPBS developmental activities. Those who have attempted to develop program structures provide a curious carousel of programs. Before demonstrating several program structures at the school district level, it seems appropriate to develop a rationale for the structuring process.

Granting the philosophical implications above, Hale (1970) (B) suggested four relatively simple criteria against which the effectiveness of a program structure may be measured. These are:

1) Does it accommodate all of the operating programs identified by the school district to the extent that every activity is accounted?
2) Is it rationally consistent with the philosophy of those who must maintain it?
3) Does it provide for information output compatible with management needs?

4) Does it provide for changing program configurations?

Active debate should be encouraged during the process of developing a program structure. However, at some point a decision must be made to ensure progress toward the goal, even though the existing product may be considered imperfect. If, indeed, the program structure is dynamic, as has been suggested, then the criteria above would seem quite serviceable. If the development process is perceived as hierarchical, then one might organize the integrated constructs as:

Program Structure
    Program Categories
        Programs

Further divisions could include sub-programs and program elements. However, the systems approach seems to provide a more viable conceptualization of the integrated structures. Employing this approach, one may draw upon the systems theory explicated in Chapter II. Figure 3.3 demonstrates the relationships of the program structure components.

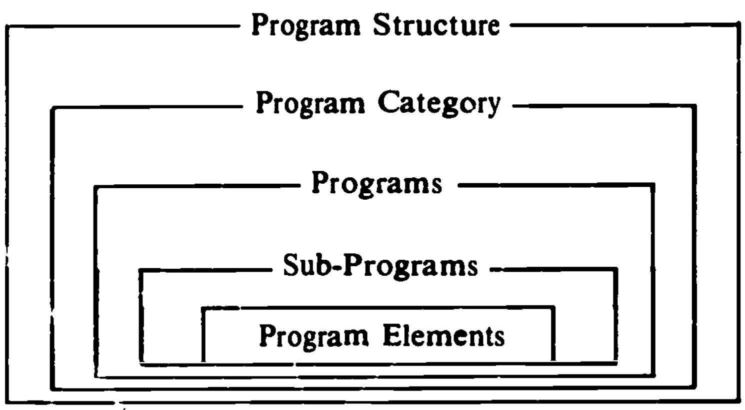

Figure 3.3—The Constructs of Program Structures

It is doubtful that program structuring for an educational organization can begin by postulating a structure and then developing the subsystems down through the fifth order of complexity, i.e., program elements. In fact, the author's experience proved to be diametrically opposite in process.

A rationale and concomitant limiting definitions must be developed for each level of sophistication. For example, the following should clearly demonstrate both the internal and external validity of systematic program structuring assuring the four criteria above have been accommodated. For the purposes of the example, four program categories will be postulated. The rationale of the four categories is based upon the following—categories number one and number two instructionally divide the student population, category three represents instructional programs of a different character than categories one and two, and category four relates to all instructional programs in a non-instructional manner. The four program categories are:

1) Instructional—General;
2) Instructional—Exceptional;
3) Instructional—Supplementary; and
4) Support.

The following rationale establishes the criteria for classifying programs within the program category components.[10]

I. Instructional—General
   A program which—
   1. Involves students for instructional purposes.
   2. Is designed for students who *are not* considered educationally exceptional.
   3. Is not designed primarily to support other programs.

II. Instructional—Exceptional
   A program which—
   1. Involves students for instructional purposes.
   2. Is designed for students who *are* considered educationally exceptional.
   3. Is not designed primarily to support other programs.

III. Instructional—Supplementary
   A program which—
   1. Involves students for instructional purposes.
   2. Is designed primarily to instructionally support programs classified under I and/or II.

IV. Support
   A program which—
   1. Does not involve students for instructional purposes.
   2. Is designed to facilitate programs classified under I, II, and/or III.

An example of programs classified under the above structure is provided in Figure 3.4 and has been tested for program cost-accounting capability and partially tested for program planning and program evaluation modeling. Other examples of program structures are Skokie, Illinois, which initially identified over one hundred programs in a K-8 school district. Because the organization was subject matter based at the elementary level, the cost-accounting process was cumbersome. A revision of the Skokie structure reveals a grade-level classification similar to Philadelphia. One notes the heavy influence of the business division in the program designations of the Philadelphia program structure.

[10] Much of this rationale was developed in cooperation with J. Troy Earhart of the Dade County School Systems' PPBS staff.

Instructional General		Instructional Exceptional		Instructional Supplementary		Support	
Art	(9200)	Compensatory	(9130)	Art	(9850)	Administrative Planning and Services	(9800)
Business	(9210)	Emotionally Disturbed	(9140)	Co-Curricular Activities	(9860)	Educational Planning and Services	(9810)
Driver Training	(9230)	Homebound/Hospital	(9150)	Community Services	(9870)	Financial Planning and Services	(9820)
Foreign Language	(9240)	Learning Disabilities	(9160)	Corrective Reading	(9880)	Operations Planning and Services	(9830)
Health/Safety/ Physical Education	(9250)	Mentally Handicapped	(9170)	Guidance	(9890)	Personnel Planning and Services	(9220)
Home Economics	(9260)	Physically Handicapped	(9180)	ITV and Radio	(9900)	Plant Planning and Services	(9840)
Industrial Arts	(9270)	Socially Maladjusted	(9190)	Library/A-V	(9910)		
Intermediate	(9280)			Music	(9920)		
Kindergarten	(9290)			Psychological Services	(9930)		
Language Arts	(9300)			Reading	(9940)		
Mathematics	(9310)			Remedial Reading	(9950)		
Music	(9320)			Speech Therapy	(9960)		
Natural Sciences	(9330)						
Primary	(9340)						
Social Sciences	(9350)						
Vocational/Technical	(9360)						

Figure 3.4—Program Structure and Classified Programs

If one continues the development of structural constructs in figure 3.3, the next level of complexity is the development of programs. A program is a set of activities designed to control a predetermined objective or set of objectives. The program should facilitate:

1) long-range planning;
2) short-range alternative testing and implementation;
3) sequencing of objectives;
4) evaluation of objectives; and
5) cost accounting.

To determine if the criteria are facilitated for any selected program, one would need to specify each of the five functional criteria relative to the program designation. For example, if vocational is identified as a program, one should identify long-range plans for vocational program development. One should further identify short-range configurations of alternatives being tested, such as mini-courses, variable instructional strategies to meet specific objectives, etc. The sequencing of objectives is normally a hierarchical configuration in terms of student competency and behavioral sophistication. Further, one would need to identify evaluative techniques to assess effectiveness of the vocational program offerings. Effectiveness may be assessed in many ways and several will be explicated in the section on evaluation. Finally, one should be able to identify the cost of operating the vocational program separate from other designated programs.

As sophistication develops relative to PPBS and more specifically to program structuring, the school district may desire to identify sub-programs within their program structure. For example, the vocational program could be dimensioned into categories congruent to the U.S. Office of Education's taxonomy of vocational-technical programs. And, each of the classified courses listed under each dimension of that taxonomy could become the program elements. However, care should be taken in such an ambitious undertaking initially. Little would be gained, for example, to cost-account minutia when the planning, programming and evaluating subsystems are developmentally retarded. That statement does not imply that a simultaneous and parallel development of each subsystem is necessary, for it is questionable whether such a dynamic system can indeed provide for all subsystems to be developed in concert.

The problem of developing a program structure for any organization is replete with pitfalls. To accommodate theoretical and philosophical issues which must be resolved if one is to produce a program structure is no mean undertaking—especially among professional educators who take pride in their authorship establishing and articulating institutional goals.

A final word about program classification. Problems are encountered when a given activity (or sub-program) may meet an objective identified in more than one program. However, the task is not insurmountable. For example, consider two program designations—Business and Vocational/Technical. Both programs may express objectives relative to typing competency if care is not taken in conceptualizing the programming of objectives. Students engage in typing instruction for various reasons, e.g., college preparatory, self-development, and employment preparation. Therefore, the student's motive for engaging the course may confound criteria established on this basis under this particular program structure. Under another structure, student expectations may be valid criteria. The crucial question is which program controls the particular instructional objectives.

The tangential development of program structure constructs has been extensive because the program dimension is the sinew of a PPB system. Here it has been explicated in terms of planning, subsequently it will be explicated in terms of the remaining PPB subsystems.

Program planning takes on varying characteristics at varying levels of program management. State level program planning differs from school district program planning which differs from classroom program planning. The example provided here was at the school district level. The Education Commission of the States has published a comprehensive statement on educational planning at the state level. Time prohibits a review of that dimension although some statements will be forthcoming relative to state-level vocational/technical education planning in the section on evaluating subsystems.

The Programming Subsystem

Probably the most neglected dimension of PPBS in the literature is the concept of programming. Actually, many writers assume the two P's in PPBS to represent Program Planning or their intention is to limit their discourse to Planning and Budgeting, with a noticed preoccupation in those discussions with the budgeting dimension, along with what has become standard jargon (e.g., systems analysis) sprinkled throughout seemingly only to add a mystique of respectability.

Programming is the process of arranging a sequence of operations to be performed. Notice the subtle difference between programming and planning. Planning arranges a set of decisions for future action where programming requires that certain enabling decisions be made to sequence a set of operations to be performed. Thus, planning establishes criteria where programming engineers operations relative to pre-established criteria. Applied programming involves developing instructional and non-instructional activities to meet educational objectives, devising alternative strategies to accomplish the objectives, and identifying appropriate organizational units responsible for implementing selected programs. Sequencing of objectives into an integrated instructional system is followed by developing alternative activity configurations. Objectives and concomitant activities become instructional packages (sub-programs) which are incorporated properly within the curriculum of appropriate operational units, or they become operational specifications for non-instructional operating units. The key construct of programming, that of designing alternative activity configurations to accomplish planned objectives, is most certainly familiar to the creative classroom teacher.

To fully conceptualize the role of programming among educational organizations one must quickly abandon management oriented literature and survey the professional literature directed toward issues of curriculum and instruction. Probably the most discussed topic in that literature today is individualized instruction, the forerunner of which was what was commonly termed programmed instruction. Generally, two conceptual levels are assessed among instructional programmers. First, there are those who address themselves to the design of instructional systems and secondly, there are those who address themselves to innovative designs and sequencing of instructional packages.

Those who conceptualize and explicate instructional system designs generally address themselves only to operational abstractions of the total system. A noted deviation of the above approach is Ullery's (1971) (D) recent article on project ABLE where he moves from the conceptual level to the operational level explicating a system of individualized instruction for vocational education.

Romberg's (1968) (D) prototype instructional system design amply illustrates the conceptualization offered at the highest level of abstraction. Figure 3.5 represents Romberg's working draft which he presented to members of the American Educational Research Association at their annual meeting in Chicago during 1968. Romberg and his Wisconsin associates have subsequently systematically researched the viability of the model through various instructional designs at the operational level.

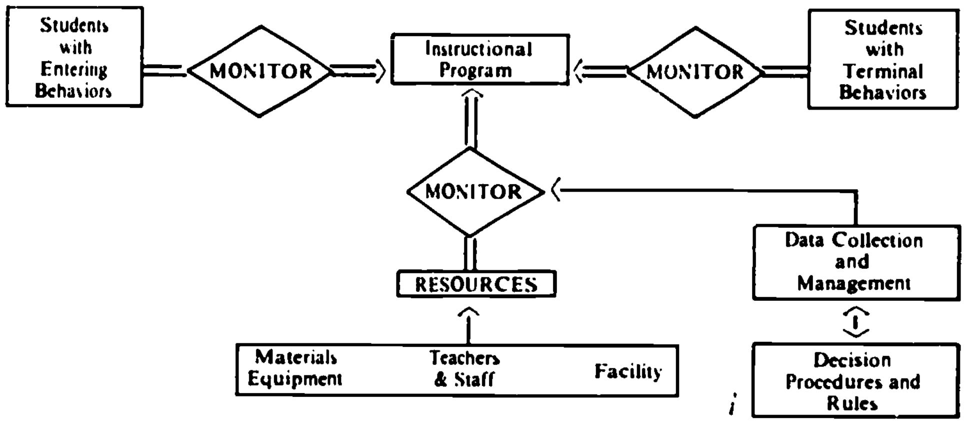

Figure 3.5—Romberg's Model of an Instructional System

Probably the most familiar programming models to educators are resource allocation formulae at the federal, state, and local levels. Although those formulae are generically fiscal as opposed to instructional, they do represent programming designs. Other esoteric programming designs will be presented in the chapter on management tools.

Educational programmers who address themselves to alternative instructional strategies are most commonly proposing innovative strategies within a specific program area. Examples include BSCS biology, PSCS physics, SMSG mathematics, English 2600, etc.* Other "tracking" strategies include Pittsburgh's Individualized Programmed Instruction (IPI), Valentine's (1965) (D) linear program of a general electronics course, and various computer assisted instruction (CAI) strategies—not the least of which is Suppe's work in mathematics instruction at the Far West Education Laboratory and non-computerized innovations in bilingual education thrust at the Southwest Regional Laboratory. For other references specific to vocational/technical education one should consult Larson (1969) (C).

Educational programming is an art, just as creative teaching is an art. Both art forms are not dissimilar and the ultimate goal of each is the same. The term "programming" seems to remain abstractly cool among practicing teachers who daily engage the process while preferring their own descriptive phraseology such as "advancement steps," "spiral learning" and "self-actualization."

At the district administrative level, programming concepts proliferate. For example, the program structure presented in Figure 3.4 was programmed among school levels and is presented in Figure 3.6. After one has identified each of the programs in Figure 3.4 that are operational within the schools identified in Figure 3.6 then the school districts' curriculum has been programmed among its clients. Other district level programming includes: bus routes and scheduling, the school year calendar, maintenance schedules, payroll processing, and class scheduling. Many of the management "tools" related in a subsequent chapter are essentially esoteric programming techniques.

Budgeting Subsystems

In a previous section of this chapter the functions and processes of budgeting were identified. In this section some of the concepts of school business accounting and budgeting will be identified which provide the foundation for program budgeting. An excellent review of the budgetary practice evaluation has been provided by Benson (1961) (E) and a taxonomy of functions for school budget management was offered by Roe (1961) (E). Much of the literature dealing with school business management ascribes more activities and responsibilities to the school districts fiscal control personnel than this author is willing to grant. Too often the accounting-tailwags the program-dog. Ideally, program decisions will be left to educators while fiscal accounting accommodates those decisions and simultaneously provides control over fiscal resources and informational services for decision-making and evaluation. School accounting is a specialized professional endeavor. The processes are encumbered with federal, state, and local regulations as well as artful professional practices. A skillful cost accountant is a valuable asset to a skillful school superintendent.

* A noteworthy innovative vocational program in industrial arts for the junior high school level is The Ohio State Project.

EDUCATIONAL PROGRAMMING

NORTHEAST DISTRICT LOCATIONS

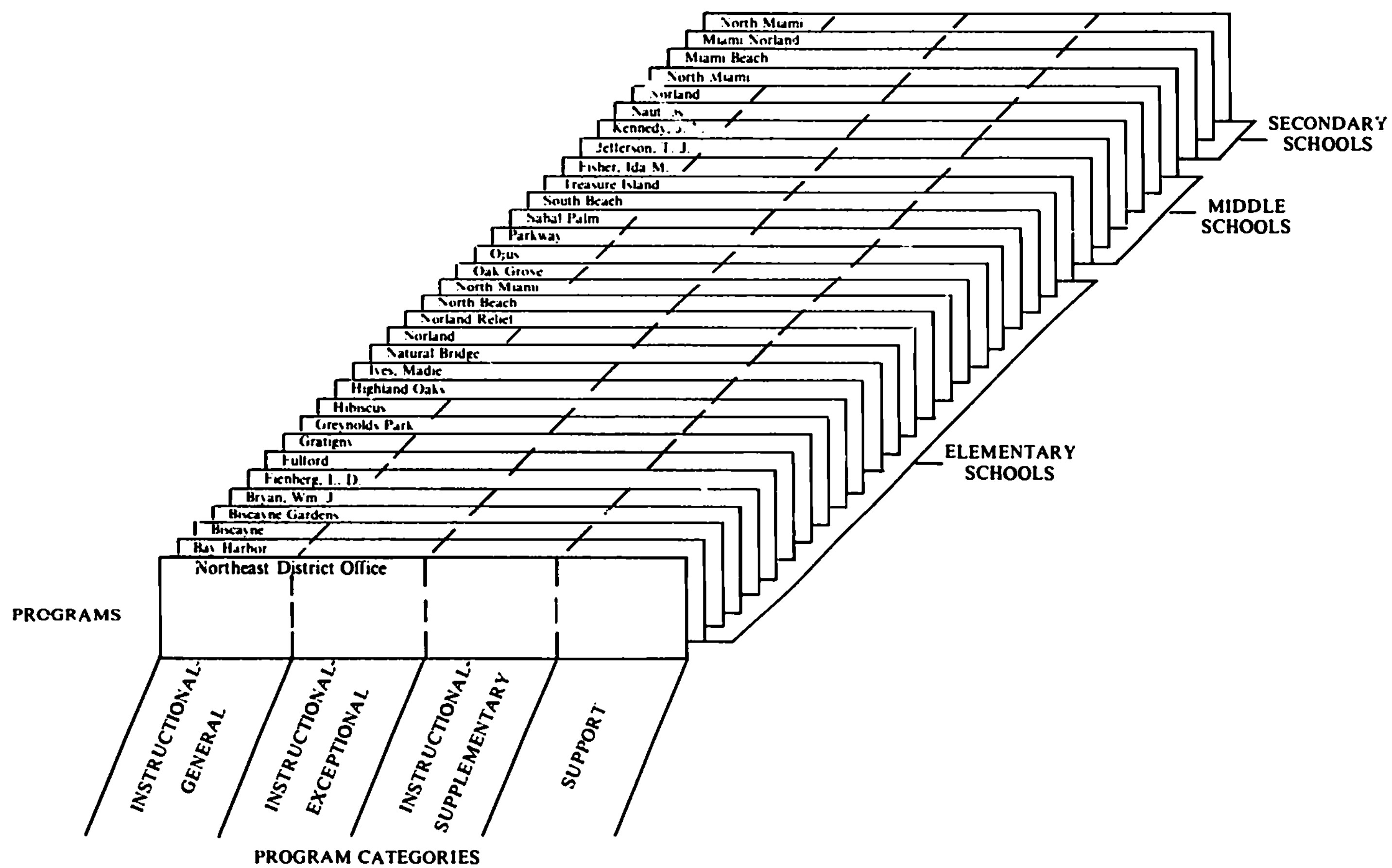

Figure 3.6—Educational Programming of Program Categories

Accounting is the art of recording, classifying, and summarizing in a significant manner and in terms of money transactions and events which are, in part at least, of a financial character, and interpreting the results thereof. (Committee on Terminology, 1953) (E)

A detailed examination of accounting practices and terminology is beyond the scope of this paper. Although program budgeting models rely heavily upon the many dimensions of revenue and expenditure accounting, it is assumed that school districts practice what is known as the "accural basis of accounting."[11] On the accural basis of accounting, the revenue accounts reflect expected income (as receivables) from various sources for the period in which income is due, normally the fiscal year, regardless of when the income is received. For example, state aids may be computed prior to the beginning of a fiscal year to determine the revenue amount expected from that source for budgetary purposes. This amount becomes an asset for the school district as soon as the state's obligation is legally recognized even though adjustments may be made due to changes in categorical criteria (e.g., enrollments) and regardless of the state's payment schedule. On the expenditure side, costs would be attributed to the fiscal period for which they are incurred regardless of the school district's payment schedule. An example of this concept would be prepayments for magazine and newspaper subscriptions for school media centers. The prepayments are reflected in an asset account until such time as the subscriptions become current operating costs to the participating schools. For the purposes of this paper, the budgeting subsystem addresses only revenue and expenditure dimensions of current operations although capital asset accounting and accompanying depreciation schedules are recognized as an integral component of the school districts fiscally related activities.

Revenue is defined as the inflow of assets which result from the school district offering services to its clients and includes gains from the sale or exchanges of assets, interest earned, and other increases in assets for which the organization is accountable. Expenditure is a payment, in cash or otherwise, or the incurring of an obligation to make a future payment, for a benefit received. Cost is the measure of the expenditure (Finney and Miller, 1958) (E).

An essential tool of an accounting system is a classification scheme. Three criteria for classifying expenditures have been identified (Benson, 1961) (E) and could be applied to revenue as well. First, the scheme should provide utility for decision-makers. Second, the scheme should facilitate effective budget execution. Third, the scheme should provide for accountability, i.e., be susceptible to audit (also, see Burkhead, 1956) (E). In most states the classificatio system for school accounts is provided by the State Department of Education and generally follows the guidelines of

[11] This assumption is not valid for some school districts which operate on a "cash basis" of accounting. It would seem safe to assume that most school districts do "obligate" expenditures which is one step toward accural accounting.

the U.S. Office of Education Handbook II (Reason and White, 1957) (E). Generally, the states provide a set of "objects-of-expenditure" to serve as sub-categories within the classification system—these are sometimes known as "line-items" when used in reference to budget documents. To facilitate the accounting and reporting processes, a system of numerical codes generally is provided. Local school districts make deviations to facilitate the utility criterion expressed above. A relatively simple programmed conversion process facilitates multiple coding structures with the aid of electronic data processing equipment. An example of an expenditure classification scheme is partially illustrated in Figure 3.7.

CLASSIFICATION OF EXPENDITURES

CODE	OBJECT	AMOUNT
100	Administration	$
101	Board Members' Salaries	xxxxx
102	Superintendent's Salary	xxxxx
200	Instruction	
201	Teachers' Salaries	xxxxx
202	Teaching Supplies	xxxxx
300	Food Services	
301	Lunchroom Aide Salary	xxxx

Figure 3.7—Illustration of Expenditure Classification Scheme

On the revenue side, the classification scheme is normally dimensioned into one or more categories called Funds. The sub-system of fund categories allows the partitioning of revenues relative to some state or locally prescribed scheme. Examples of these are: General, Capital Outlay, Debt Service, etc. Many school systems use the word "operating" instead of the word "general" as it seems to carry a more accurate connotation of its purpose.

The school budget may easily become a "sacred cow." An administrator can quickly avoid a subordinate's request for expenditure by quoting the time-honored phrase, "it's not in the budget." Of course, some students of administration would contend that proper planning and need-forecasting would eliminate such requests. Neither position seems completely tenable. Burke described the school budget as "a plan for attaining the purposes of the institution" (Burke, 1960) (E). Knezevich and Fowlkes (1960) (E) asserted that "the budget must be regarded as the fiscal translation of the educational program" and further identify three main factors to be considered when preparing the budget document. These are:

1) the educational program for the period in question;

2) the statement of expenditures (or disbursements) necessary to realize the educational program; and
3) the estimate of revenues (or receipts) anticipated from local, state, or federal sources which are needed to support the expenditures (*ibid.* p. 21).

Similar criteria are offered by Johns and Morphet (1960) (E). Some authorities on school budgeting recommend a performance budget which includes a description of the expected product following each item of expenditure (Linn, 1957) (E). Others contend that the difficulty of measuring units of work in quantitative terms is further confounded in educational practice because of the multiple activities of teachers (Benson, 1961) (E).

Hirsch (1965) (E) when referring to the U.S. Office of Education budget, called for a recasting of the present budget format to replace the administration's uninformative education budget. Ashen (1965) (E) asserted that program budgeting would help remove some of the deficiencies by collecting economic d .ta in a design applicable to instruments of analysis. "School systems tend to show relatively slow progress in adopting advanced financial procedures" (Knezevich and Fowlkes, 1960, p. 19) (E), yet

> The affluent country which conducts its affairs in accordance with rules of another and poore. age also foregoes opportunities. And in misunderstanding itself it will, in any time of difficulty, implacably prescribe for itself the wrong remedies (Galbraith, 1958) (E).

The Budgeting Models

The budgeting models developed here will differentiate the budgeting subsystem into two separate but functionally related subsystems: Revenue and Expenditure. By drawing upon the definitions and constructs of the general systems theory developed in Chapter II, a graphic conceptualization of the relationships of some operating subsystems of the budgeting subsystem is presented in Figure 3.8.

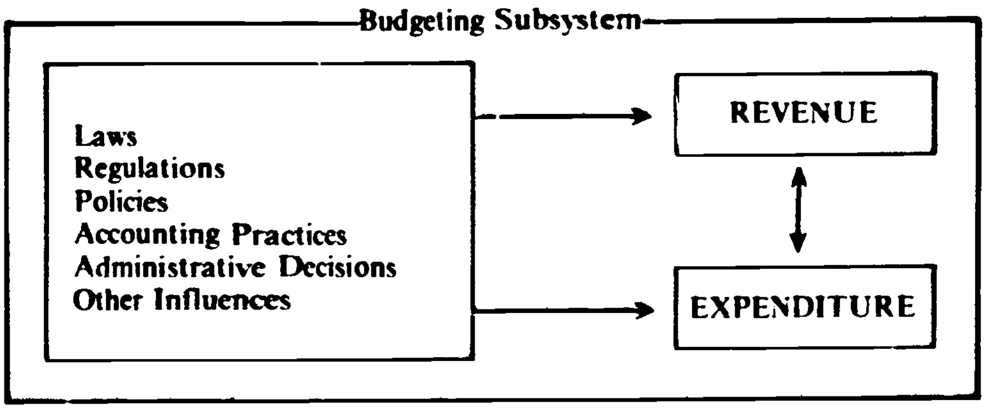

Figure 3.8—Relationships of Two Budgeting Subsystems with Other Subsystems

Within the budgeting subsystem are subsystems of laws, regulations, policies, accounting practices, administrative decisions, and other influences which are differentiated and integrated wholly or in part to produce the revenue and the expenditure subsystems. The functional relationship between the revenue and expenditure subsystems is that each is predicted upon and may be constrained by the other. For example, if total program financial needs are not being met, then one may assume that this is, at least in part, due to constraints imposed by the revenue subsystem. Viewed another way, the programs determine the fiscal requirements to which the revenue subsystem must be addressed. The primary concern of this paper is to demonstrate both a revenue and an expenditure model for classifying and storing financial data which can readily be accessed in varying configurations for management information. A model is defined to be an abstract representation of reality through which actual problems may be simulated for evaluation and prediction.

The Revenue Model

The revenue model for the school district must identify and classify all income received by the district. The multidimensional model may include classification of funds:

1) by agency providing funds[12];
2) according to a selected accounting scheme;
3) according to program or special project;
4) by target population;
5) by expected duration of support; or
6) by other schemata.

The criterion for classifying monies received by the operating district is that each dimension must provide for logically discrete elements both within and between dimensions. Thus, a dimension may be perceived as a subsystem and be further differentiated into classified elements. This is predicted upon the definition of a subsystem given in Chapter II that a differentiated subsystem may or may not be a system. At the point which the differentiating process no longer produces a subsystem, one may identify the residuals as elements. Now, using category 1 above, an attempt will be made to explicate this construct.

DIMENSION: Classification of funds by agency providing funds.

Supporting agencies are first classified into governmental agencies including: Local (L), State (S), and Federal (F). Non-governmental agencies will be classified as Other (O). The Revenue (R) is given by equation 1, as follows:

1) $R = L + S + F + O$

The appropriating agency dimension (a system) has been differ-

[12] For the purpose of this paper, non-dollarized resources will not be identified as revenue.

entiated into four other dimensions (subsystems). If the Local (L) dimension were to be further differentiated it may include: Taxes (T_L), Fees (F_e), Interest on Investments (I), Benevolences (B_L), and Other-local (O_L). Equation 2, the local revenue (R_L) equation, would be:

$$2) \quad R_l = T_L + F_e + I + B_L + O_L$$

Each of the differentiated categories become elements when they cannot be further differentiated. For example, if the district has only one source of taxable income, say real property taxes, and these are remitted at the 100 percentage level, then this dimension may be considered to be an element of the local revenue dimension. Normally, for operational purposes a tax base such as property would provide two elements—District Current and District Tax Redemptions. District Current (D_c) is the income expected during the fiscal year generated by applying the district mill-rate for schools (M_r) times the assessed valuations of non-exempt property (V_p) times the expected percentage of collections (P_c) during the fiscal year. District tax redemptions (D_r) are collections of taxes from previous years. The local tax (T_L) dimension then is expressed by the equation:

$$3) \quad T_L = D_c + D_r$$

where, 4) $D_c = M_s \times V_p \times P_c$

Each of the elements described above will vary from school district to school district, as will the elements of the other dimensions expressed in equations 1) and 2). However, the revenue plan for most school districts generally follows this scheme. Similarly, other dimensional classifications could be differentiated as was done above for the supporting agency dimension.

The basic question to be satisfied when explicating a revenue model for local school systems is: "Does it supply management with the information required?" Of course, information requirements are relative because information needs change. This, then, becomes another criterion of the revenue model—it must be a dynamic system that can provide for changing information requirements. Functionally, changing information requirements may necessitate changes ranging from totally redesigning the system to simply differentiating a dimension into another subsystem or its elements. The conceptual revenue model for the purposes of this paper includes the following basic dimensions:

1) SOURCE
2) FUND
3) PROGRAM

The Source Dimension

The source dimension must identify each supporting agency that provides revenue to the district during any fiscal accounting period. The purpose of this criterion is twofold: control and information.[13] The second order of complexity for the source dimension was given in equation 1 above:

1) $R = L + S + F + O$

and the third order of complexity for one dimension (local revenue) was given in equation 2 above:

2) $R_L = T_L + F_e + I + B_L + O_L$

Each of the dimensions in the second order of complexity may be presented as a third order of complexity as was demonstrated for local taxes in equation 3 above. Equation 3 could be further dimensioned into a fourth order of complexity by identifying the incidence of the tax (where the burden lies). The degree of complexity initiated to identify and classify revenue will be a function of the information required for analytical purposes. For this paper, revenue sources will be dimensioned as given in Figure 3.9.

Dimension	Dimension Components	Dimension Elements
SOURCE	FEDERAL STATE LOCAL OTHER	Taxonomy of support categories for each component

Figure 3.9—Revenue Source Dimensions

Conceptually, the three dimensional categorization above is not "clean." The dimension components may be perceived to contain two dimensions—governmental and non-governmental. Also, the taxonomy of elements for each component could be expressed as separate or as "nested" dimensions. The source dimension may go beyond a narrow definition of identifying agencies.

The Federal Component classifies those revenues received by the school district as a result of direct grants or contractual arrangements with the sponsoring federal agency. The so-called "flow-through" monies are not included in this category because technically they are administered by the state agency.

The State Component classifies those revenues received by the school district through grants authorized under the state support formula, and

[13] These constructs will recur within each of the three basic dimensions.

categorical or general aids provided to operating school districts as a result of state or federal appropriations which are administered by the state.

The Local Component classifies those revenues received by the school district generated by local governmental activities.

The Other Component classifies those revenues received by the school district as a result of benevolences and/or contracts with non-governmental agencies. The location of the agency awarding the grant generally is not relevant, although some districts may desire to dimension this component geographically.

It may be well to reemphasize that non-money resources such as products or services received by the school district are not considered here as revenue. Good accounting practices will dictate how these non-revenue items should be handled relative to the asset accounts and the operating accounts in the instance where revenue was budgeted but a product or service was donated prior to expenditure execution.

The dimension elements are identified in a taxonomy of support categories for each dimension component. These will vary from school district-to-school district and from year-to-year. It is to this category that the chief financial officer of a school district must direct exceptional energies and analytical abilities. The support formulae and allocation criteria are quite dynamic and the implications are often extensive. An example of the intricacies relative to the state component is evidenced by the actions of a 1968 special session of the Florida state legislature to provide additional funds for educational support. Sweeping changes were made in the existing state aid support which resulted in increased funding among many categories, the addition of new funding categories, and the imposition of restrictions on local support categories in terms of a "millage roll-back" for local non-exempt property assessment for schools.[14] Florida school districts were further required to match the retirement contributions of professional employees—a substantial new expense for the school districts.

Examples of the source elements classified by each source component are given in Figure 3.10.

The Fund Dimension

The fund dimension must classify revenue according to state regulations and/or local preferences. The efficacy of this strategy is again related to control and information. For the purpose of this paper, the second order of complexity of the fund dimension will include the following four funds.

1) Operating Fund
2) Debt Service Fund
3) Capital Improvement Fund
4) Contracted Program Fund

The third order of complexity for the fund dimension is the taxonomy of accounting categories practiced by the local school district. The degree

[14] The Florida State Legislature SB 77-X (68).

COMPONENT	ELEMENT
Federal	Office of Economic Opportunity Teacher Corps Job Corps Head Start
	Impacted Area-(P.L.874)
State	General and/or Categorical Aid
	Tax Sharing Income Taxes License Taxes Federal Money Received Through State Agencies School Lunch Act ESEA (P.L. 89-10) Other
Local	District Taxes Tuition Other
Other	Cash Benevolences Foundations Industries

Figure 3.10—Examples of Source Elements Classified by Source Components

of accounting specificity is often regulated by the source agency; however, local practices should consider the analytical aptitude available through other accounting schemata. With the aid of electronic data processing, conversion tables may be designed to translate from one accounting structure to another if reporting formats are specified by the source agency. For example, if the state aid program provides categorical support, then the revenue model should account for each income category even though the state department of education may only require that the gross amount of state aid received by the local district be reported on the district's monthly financial statement filed with the state. The revenue fund dimensions developed above are illustrated in Figure 3.11. As with the source dimension given above, other dimensioning is available with the model established here for revenue fund.

DIMENSION	DIMENSION COMPONENT	DIMENSION ELEMENT
FUND	Operating Debt Service Capital Improvement Contracted Program	Taxonomy of accounting categories

Figure 3.11—Revenue Fund Dimension

The Debt Service component could be dimensioned into "long-term" and "short-term" categories. A more serious conceptual problem may develop from the thoughtful reader regarding the criterion for discrete categorization between components when perusing the operating and contracted program components. Explication of these constructs below should alleviate such misgivings. Attention will now be given to the component constructs. The concept of revenue fund accounting is much like that of a family which forecasts expenses for a given period of time by identifying amounts for mortgage payments, household operations, benevolences, recreation, education, etc.

The Operating fund is a current asset account created for the purpose of payment of current liabilities and current expenditures. It is through this asset account that the normative day-to-day expenses of the operating school district are executed. This component is much like the housewife who is given X-dollars at the beginning of the month to operate the household. She may placeY-dollars in an envelope for the paper boy, Z-dollars in another envelope for the milk man, etc.

The Debt Service fund is an asset account created for the purpose of identifying revenue which will be used to satisfy current and long-term liabilities brought about due to prior or planned borrowing commitments. This fund is analogous to the escrow account maintained by a family at the local savings bank into which periodic payments are made to satisfy accruing interest and principle obligations relative to their home mortgage.

The Capital Improvement fund is an asset account created for the purpose of identifying revenue which will be used for new construction, alterations, and/or the purchase of equipment with life expectancy greater than one year. Continuing the analogy above, this account would identify monies set aside by the family for cash purchases of products (e.g., color television, etc.) and/or services (e.g., remodeling of the kitchen, etc.).

The Contracted Program fund is an asset account created for the purpose of identifying revenue which will be used for specific programs or projects as a result of contractual arrangements between the operating school district and a revenue source agency. Theoretically, a contract exists between the local school district and the state for normative operations of schools; however, this may be considered to be a continuing contract, where the programs or projects identified within the contracted program fund may be considered short-term in nature. Within the family unit this would be analogous to a father, who is an accountant, agreeing to perform income tax services at a specified remuneration for several of his associates.

A taxonomy of accounting categories is often designed to specify the objects for which the revenue was granted. These may or may not be of the same degree of specificity utilized in the expenditure model. Often, the degree of specificity required will not be as detailed within the revenue model as within the expenditure model, although the function of the object may be similar. For example, the revenue operating fund may specify a category as salary reserves, whereas the expenditure model may specify categories of salaries (e.g., principals, teachers, custodians, etc.). Information requirements normally will dictate the degree of specificity, since the control criterion may be accomplished at a relatively gross level for revenue and expenditure purposes. If the source agency allocates revenues by identifying specifically the objects funded, then the district should consider using those categories as at least one degree of complexity. Examples of the revenue fund dimension elements classified by the fund components are given in Figure 3.12.

COMPONENT	ELEMENT
Operating Fund:	System-Wide Administration
	Instruction
	Plant Operation
	Other
Debt Service Fund:	Reserves for Interest Payment
	Reserves for Obligation Redemption
	Other
Capital Improvement Fund:	School Construction
	NDEA Title III
	Other
Contracted Program Fund:	Administration
	Instruction
	Plant Operation
	Other

Figure 3.12—Examples of Revenue Fund Elements Classified by Revenue Fund Components

The Program Dimension

The third and final basic dimension of the revenue model is the program dimension. The dimension attempts to classify revenue according to its intended purposes.[15] This requires that some categorization or program structuring be developed by the school district. The program dimension and the fund dimension create compatibility between the revenue and the expenditure models. Program categories, definition of program, and other structural features will vary from school district-to-school district. For the illustrative purposes of this paper, only the program categories are utilized for the revenue model while the total program structure is utilized for the expenditure model. However, a district considering the development of budgeting subsystems similar to those presented here may further consider the informational utility of applying the program structure to the revenue model.

The preceding development completes the revenue model for the PPBS budgeting subsystem. The integrated dimensions of the model are presented in Figure 3.13 relative to the second order of complexity. Inputs and outputs of the model will be examined subsequently in this chapter.

The Expenditure Model

The expenditure model for the school district must identify and classify all expenses incurred by the district. The multidimensional model may include expenditures classified by:

1) target populations;
2) specific services and/or products;
3) function;
4) program and/or project;
5) location; and
6) other schemata.

The criteria for selecting dimensions to be developed for the expenditure model are, like the revenue model, information and control. Cost-accountants can incorporate fiduciary features into a multiplicity of expenditure schemata. Therefore, the emphasis here will be directed toward the information output of the expenditure model of the budgeting subsystem. For the purpose of this paper the following three basic dimensions have been identified for the expenditure model.

1) Location
2) Fund
3) Program

The Location Dimension

The location dimension of the expenditure model will identify each

[15] The degree of complexity will be determined by whose intended purpose it is, i.e., will it be that of the source agency or the operating school district.

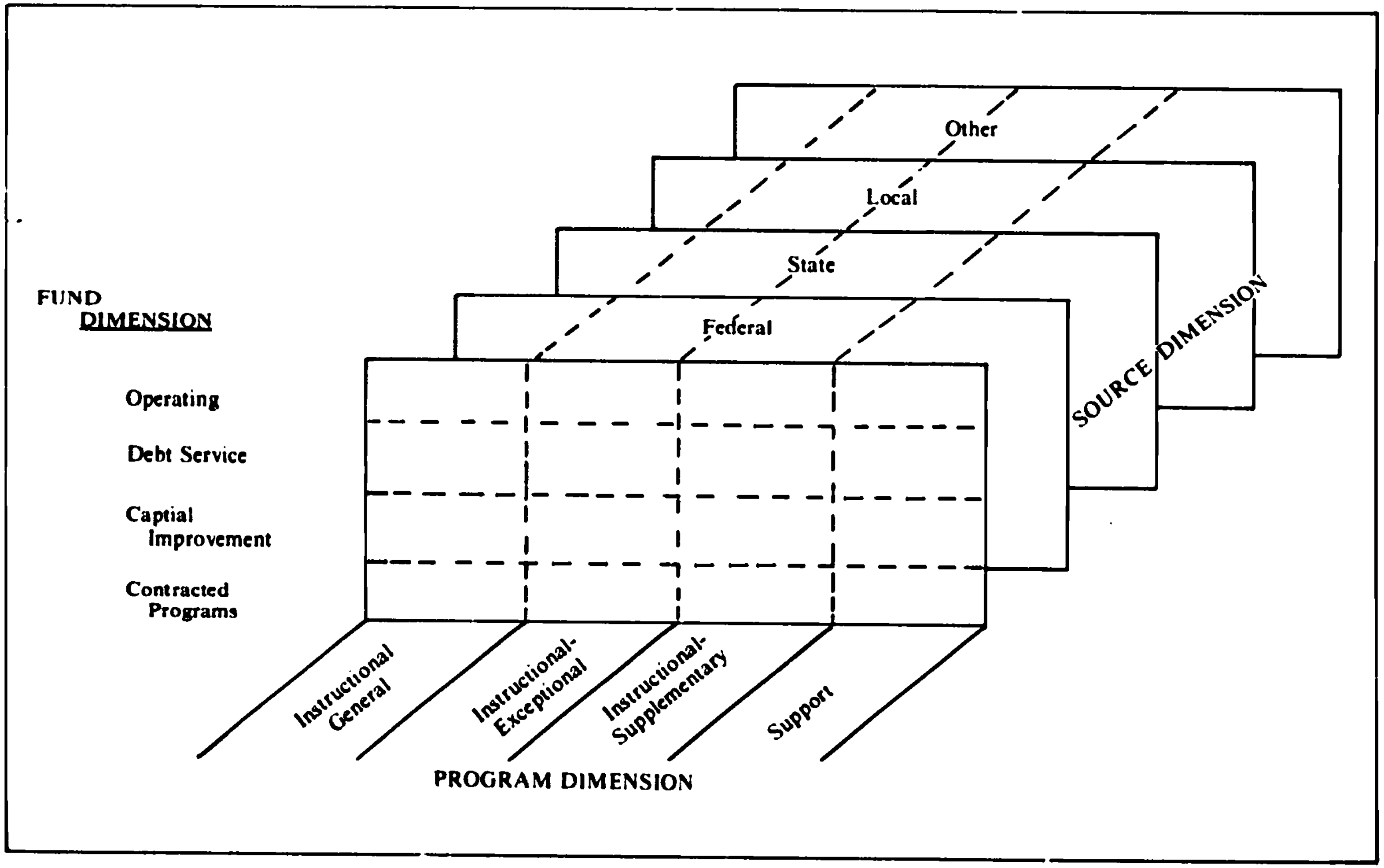

Figure 3.13—Revenue Model of a PPBS Budgeting Subsystem

operating unit that encumbers the school district's resources. The second order of complexity of the location dimension consists of six location components into which the third order of complexity—responsibility centers—may be classified according to definitions which provide the rationale for each of the six components. Hierarchically, the functional relationships are:

Location
    Location Components (six categories)
        Location Elements (responsibility centers)

Schematically they may be perceived as in Figure 3.14, where it is demonstrated that each component is discrete and that responsibility centers classified within one component may not be classified within another component. This does not imply, however, that the physical location of two or more responsibility centers may not be identical. Quite the contrary, the central administration configuration may provide many responsibility centers of which several may be housed within the same building.

Classification of responsibility centers is accomplished according to the following definitions:

I. Elementary Education Centers
   A responsibility center which
   1. Provides instructional-general and/or instructional-exceptional programs normally designed for students in the early childhood and pre-puberty stages of development.
   2. Provides instructional-supplementary and/or support programs designed to meet the program requirements in number one above, only within the classified centers.

II. Middle Education Centers
   A responsibility center which
   1. Provides instructional-general and/or instructional-exceptional programs normally designed for students in the early stages of adolescent development.
   2. Provides instructional-supplementary and/or support program requirements in number one above, only within the classified centers.
   3. Cannot be classified as an Elementary Education Center.

III. Secondary Education Centers
   A responsibility center which
   1. Provides instructional-general and/or instructional-exceptional programs normally designed for students in the final stage of adolescence.
   2. Provides instructional-supplementary and/or support programs designed to meet the program requirements in number one above, only within the classified centers.
   3. Cannot be classified as an Elementary Education Center or a Middle Education Center.

IV. Adult Education Center
   A responsibility center which
   1. Provides instructional-general and/or instructional-exceptional programs designed for students who are not normally

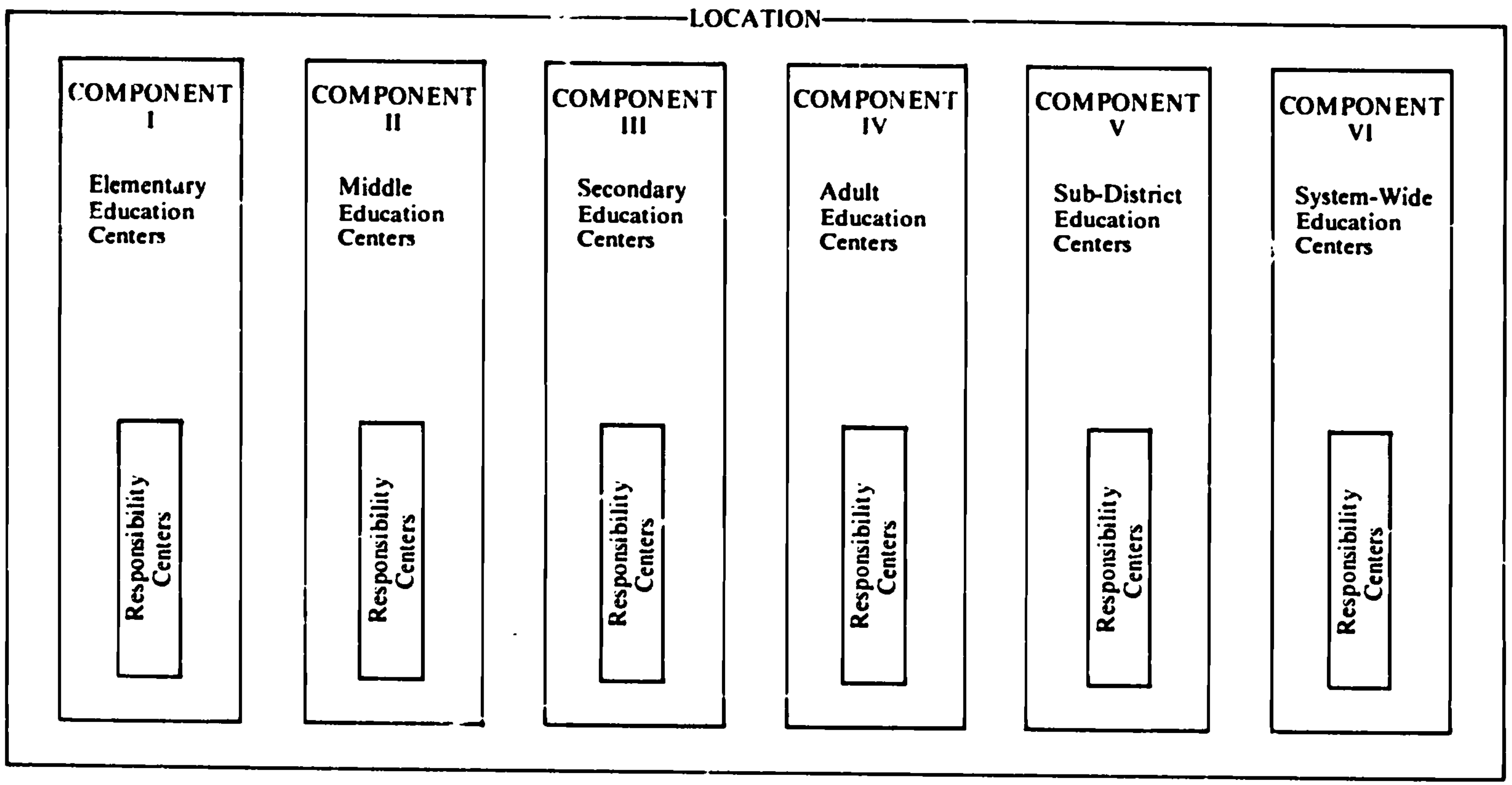

Figure 3.14—Relationship of the Location Dimension

enrolled in an Elementary, Middle, or Secondary Education Center.

2. Provides instructional-supplementary and/or support programs designed to meet the program requirements in number one above, only within the classified centers.
3. Cannot be classified as an Elementary, Middle, or Secondary Education Center.

V. Sub-District Education Center

A responsibility center which

1. Provides instructional-exceptional and/or instructional-supplementary programs located in other responsibility centers (within an administratively defined geographic area).
2. Provides support programs designed to meet the requirements of responsibility centers within a specified geographic area.

VI. System-Wide Education Center

A responsibility center which

1. Provides some instructional-general, instructional-exceptional, and/or instructional-supplementary programs located in other responsibility centers.
2. Provides support programs designed to meet the requirements of all responsibility centers.

Location Elements

The foregoing rationale provides discrete placement of responsibility centers (elements) into one of the six location components as described in Figure 3.14. The developmental psychology constructs of puberty and adolescence are an integral part of rationales I, II, and III because they represent essentially the procedure employed by school districts to group children for common educational experiences. The middle education centers are relatively recent phenomenon consisting of various grade-level grouping patterns, such as (5, 6, 7), (5, 6, 7, 8), (6, 7, 8, 9), etc. The rationale suggested for this category provides for any such grade-level configurations, including the traditional junior high school. In school districts which group students by some scheme which may conflict with the categories provided above (e.g., grade-levels 7-12), the responsibility center identification would be determined relative to the highest developmental stage of the student population. Thus, the example used would be classified as a secondary education center.

The Fund Dimension

The fund dimension of the expenditure model follows the same sequencing as did the revenue model with the exception of the taxonomy of accounting categories. Also, instead of asset accounting, the fund dimension of the expenditure model represents liability-satisfaction accounting.

The fund dimension is first differentiated into the second order of complexity consisting of the following components.

1) Operating Fund
2) Debt Service Fund
3) Capital Improvement Fund
4) Contracted Program Fund

All encumberances engaged by the school district are charged to one or more of the above expenditure funds. On the accrual basis of accounting assumed for this paper, the appropriate account is charged at the time the school district becomes legally liable for the expense. For the monthly financial statement, a fund balance is determined for each fund by computing the difference between each asset fund and its encumbrances to date. Appropriate accounting practices will allow for the distribution of any expense over more than one expenditure fund or the transfer of a liability or asset from one fund to another.

Fund Elements

The taxonomy of accounting categories used to identify and control expenditures will vary from one school district to another. The degree of specificity required for informational purposes will be determined largely by local preference. Other sources, such as, the U.S. Office of Education Handbook II and the Midwestern States Education Information Project (MSEIP) provide examples for a school district interested in designing its own system. Many certified public accountants and management consulting firms will also provide this service.

The fund dimension for the expenditure model is given in Figure 3.15. The primary difference between this expenditure dimension and the revenue dimension is the revenue funds are asset accounts whereas expenditure funds provide for liability accounting against assets. Also, the taxonomy of accounting categories identifies different objects—especially with regard to degree of specificity.

DIMENSION	DIMENSION COMPONENTS	DIMENSION ELEMENTS
FUND	Operating Debt Service Capital Improvement Contracted Program	Taxonomy of Objects-of-Expenditure

Figure 3.15—Fund Dimension of the Expenditure Model

PPBS BUDGET PLANNING DOCUMENT NO. __________ Program: NO. ________ TITLE __________	Page ____ of ____ Pages DATE PREPARED: __________ PREPARED BY: __________ COST CENTER NUMBER: __________ TERM: From ____ Thru ____

Account NO.	ACCOUNT DESCRIPTION	*NO. EMP.*	*BUDGET*
2212.10	SALARY-PRINCIPALS	____	____
2212.20	SALARY-ASST. PRINCIPALS	____	____
2213.00	SALARY-TEACHERS	____	____
2214.10	SALARY-LIBRARIANS	____	____
2216.10	SALARY-SUBSTITUTE TEACHER	____	____
2221.10	SALARY-CLERKS	____	____
2221.12	SALARY-CLERKS (SUB)	____	____
2221.20	SALARY-LIBRARY CLERKS	____	____
2221.30	SALARY-TEACHER/TV AIDES	____	____
2241.00	AUDIO VISUAL SUPPLIES		____
2242.00	PERIODICALS/NEWSPAPERS		____
2243.00	OTHER LIBRARY EXP.		____
2251.00	TEACHING SUPPLIES		____
2263.00	OTHER EXP-SUPPLIES		____
2264.00	OTHER EXP-MISC.		____
2310.20	SALARY-OPER. WORKERS	____	____
2330.00	HEAT FOR BUILDINGS		____
2341.00	UTILITIES-TELEPHONE		____
2342.00	UTILITIES-ELECTRIC		____
2343.00	UTILITIES-GAS		____
2344.00	UTILITIES-WATER/SEWER/WST		____
2350.00	SUPPLIES-OPER.		____
2420.00	CONTRACT SERV-MAINT.		____
2542.00	OTHER EXP-HEALTH SERV.		____
2844.01	NEW EQUIP-OTHER (LCIF)		____
2854.01	REPLACE EQUIP-OTHER (LCIF)		____
2860.11	LIBRARY BOOKS-EXIST (LCIF)		____
2870.01	AUDIO VISUAL OVER $25 (LCIF)		____
PROGRAM BUDGET TOTAL:			____

Figure 3.16—Program Budget Planning Document

The Program Dimension

The rationale for program structuring was given attention with the development of the planning model and each of the constructs have been previously defined. It would be well to reiterate that the program structure is a dynamic system. Much debate preceded the development of a program structure for the Dade County Schools PPBS project. Dade's partner in the project, the Association of School Business Officials (ASBO), at first adopted a variation of the Dade Structure but then proceeded in a totally different direction. This makes the ASBO structure unique. Dade has since modified its program structure. Insights gained from observing and participating in these debates helped the author to identify the program structure criteria presented earlier in this paper.

Coding Considerations

For an urban school district it would seem imperative to have electronic data processing (EDP) capability.

District size aside, coding techniques have been practiced for objects-of-expenditure and revenue source accounting by accountants as a shorthand notation for some time. Each of the elements in each dimension of each model must be identified through some coding scheme. This is the forte of the management systems analyst. The MSEIP study previously cited offers an extensive presentation of a coding scheme. The purpose here is only to recognize the need, as a discussion of various coding schemata is beyond the scope of this particular presentation. A form is provided (Figure 3.16) which identifies a coding structure for program budgeting of instructional programs. It is only for illustrative purposes and is not assumed to represent an exhaustive taxonomy.

This completes the development of the expenditure model for the budgeting subsystem. The integrated dimensions of the model are presented in Figure 3.17 relative to the second order of complexity. Inputs and outputs of both revenue and expenditure models will be described presently. Taken together, the revenue and expenditure models represent the output needed to provide one conceptualization of information and control requirements.

The budgeting subsystem was developed more fully than other subsystems, ostensibly to demonstrate the integration function of the planning subsystem and the budgeting subsystem through a programming model that will provide specific information for decision makers. The information (output) available from the above models will now be discussed briefly.

Output

The purpose of this section is to demonstrate the kinds of information which may be derived from the revenue and expenditure models. It was previously stated that Planning-Programming-Budgeting systems are output oriented. This is probably true of any operational system. However, one should not minimize the potential benefits which may be realized as a re-

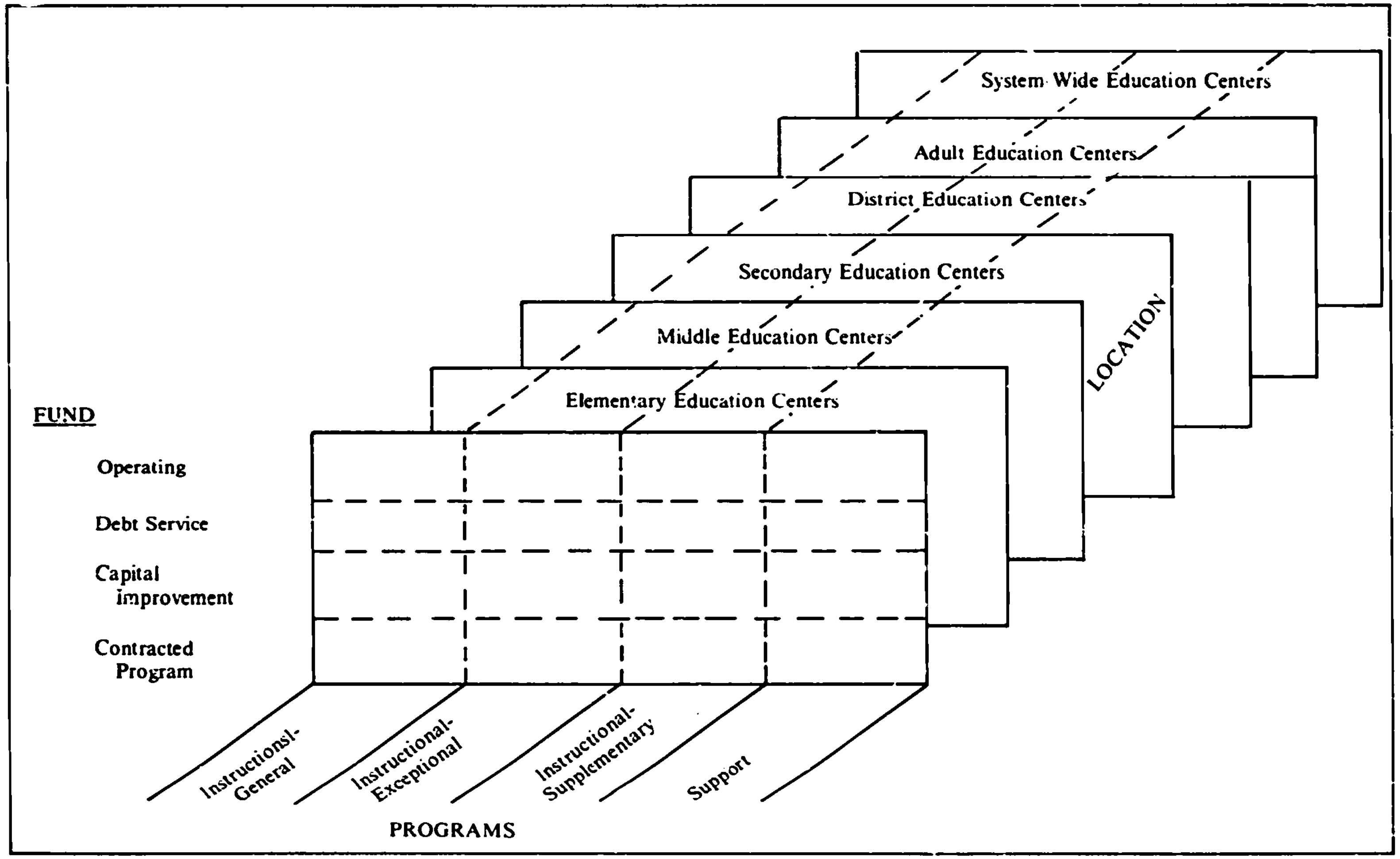

Figure 3.17—PPBS Expenditure Model

sult of the rational organization of multiple concepts which is facilitated by a systems model. For example, the program structuring that was developed to facilitate the program budgeting subsystem, although given only minor treatment for the purposes of this paper, represents a comprehensive curriculum model.

Revenue Model Output

The revenue model contains three basic dimensions: Source, Fund, and Program category. The elements of the Source dimension were classified at the second order of complexity as Federal, State, Local, and Other. Each of the second order Source classifications was further differentiated by identifying funding categories. The elements of the Funding dimension were classified at the second order of complexity as Operating, Debt Service, Capital Improvement, and Contracted Program. Each of the second order Funding classifications was further differentiated by identifying funding categories. The Program dimension was differentiated only to the second order of complexity by identifying the four Program Categories: Instructional-General, Instructional-Exceptional, Instructional-Supplementary, and Support.

If one considers only the second order of complexity of each dimension, the output matrix would consist of four Sources, four Funds, and four Program Categories. The combinations of data available is shown by the equation: $C = \frac{N!}{r!\,(N-r)!}$ where C is the number of possible combinations, N is the number of dimensions and r is the number of dimensions to be taken each time. Applying the above equation where r = 1,2,3, ... 12 and N = 12:

$$C = \frac{12!}{1!\,(12-1)!} + \frac{12!}{2!\,(12-2)!} + \frac{12!}{3!\,(12-3)!} + \frac{12!}{4!\,(12-4)!}$$

$$+ \frac{12!}{5!\,(12-5)!} + \frac{12!}{6!\,(12-6)!} + \frac{12!}{7!\,(12-7)!} + \frac{12!}{8!\,(12-8)!}$$

$$+ \frac{12!}{9!\,(12-9)!} + \frac{12!}{10!\,(12-10)!} + \frac{12!}{11!\,(12-11)!} + \frac{12!}{12!\,(12-12)!}^{*}$$

C = 12 + 66 + 220 + 495 + 792 + 495 + 220 + 66 + 12 + 1
C = 4,095

* (12-12)! = 0! and by definition 0! = 1

It can readily be seen that an information explosion is in the offing. Four thousand ninety-five separate data sets have been identified from the revenue model using only the second order of complexity. However, many of the data sets (individual combinations) are empty (contain no element) and many of them have no utility for management purposes. For example, an empty data set may result from the combination of a second order element from the Source dimension and a second order element from the Fund dimension. At the second order of complexity, the Federal Source and the Debt Service Fund intersection are discrete and integration of the two elements would produce an empty set. If this should occur, it shows that no federal funding is available to the school district for Debt Service. It should be noted that, although the data set is empty, the information may or may not be relevant. In the accounting model demonstrated in this paper, Debt Service would not be apportioned to any Instructional category because it is provided in the Plant program under the Support category. Therefore, any integral combination of Debt Service with any of the three Instructional categories is non-relevant for operational purposes.[16]

The issue of relevant vs. non-relevant data persistently confronts school administrators in their pursuit of effective decision-making. However, the problem of having no information relative to certain decisions would appear to be even more frustrating as well as potentially damaging to the effectiveness of the decision-making process. As demonstrated above, the revenue model does indeed have the potential to provide a plethora of data. The relevance of that data can only be tested in terms of its operational utility—whether for reporting, decision-making, planning, research, etc.

One of the constructs of a Planning-Programming-Budgeting System identified earlier was that the system provides for multi-year revenue forecasting. Although Mitchell (1962) (E) discussed revenue forecasting in some detail, he did not include program planning as a function of revenue forecasting. Planned change among both Instructional and Support programs may have significant impact upon future resource allocations. Therefore, it seems clear that the interface of the Program Planning and the Program Budgeting subsystems is of great importance. Indeed, the PPBS model requires that they be dynamic interacting sets.

Expenditure Model Output

The expenditure model provides for three basic dimensions: Location, Fund, and Program. The elements of the Location dimension were classified at the second order of complexity as: Primary, Middle, Secondary, Adult, Sub-District, and System-wide Educational Centers. The elements of the Fund dimension (object-of-expenditure account class) were classified at the second order of complexity as: Operating, Debt Service, Capital Improvement, and Contracted Program. The elements of the Program dimension were classified at the second order of complexity as: Instructional-General, Instructional-Exceptional, Instructional-Supplementary, and Support. The Program categories were further classified into

[16] Some may prefer to apportion indirect cost to instructional programs. That issue will not be debated here.

elements by identifying 16 Instructional-General programs, seven Instructional-Exceptional programs, 12 Instructional-Supplementary programs and six Support programs.

If one considers only the second order of complexity of the expenditure model, six Location dimensions, four Fund dimensions, and four Program dimensions may be identified. The formula, $C = \frac{N!}{r!\,(N-r)!}$, could then be applied where N = 14 and r varies from 1 to 14. If, however, one wishes to consider the third order of complexity for the Program dimension, then 41 elements must be added to the six Location and four Fund dimensions with the result that N = 51 and r varies from 1 to 51. If one were also to consider the third order of complexity for the Fund dimension, this would add over 150 elements to the input and the theoretical output becomes virtually astronomical. As before, however, not all combinations are relevant. "Recognizing where information is unnecessary is nearly as important as recognizing where necessary information is not being provided." (Dearden, 1962) (E).

One output of the expenditure model which does appear to be relevant is the program budget document. Adoption of the model discussed here would produce 220 Program Budgets representing all the schools[17] in a particular urban school district, as well as program budgets for each of the approximately 50 logistical support centers. When integrated, these would provide a Program Budget for the total School District for a given year.

For systems analysis purposes, the program dimensions would seem to be most relevant. The model develops program costs by developmental level and sub-district. Such questions as "What is the cost of the middle school music program?" could be answered with certainty and ease on a continuing basis. One is tempted to explore other interesting avenues, such as sub-programming costs and curricular alternatives, but these must remain outside the scope of this paper. The author would encourage other students of educational administration to explore these topics, perhaps using the Kershaw-McKean (1959) (A) model as a starter.

It should be noted that the object-of-expenditure classification presently used under the function-object accounting system is not lost in the model demonstrated in this paper. The taxonomy of accounting codes comprising the third order of complexity of the Fund dimension is indeed object-of-expenditure accounting and may be accessed from the model if such information is desired.

Evaluating Subsystems

An excellent review of literature addressed to educational evaluation was published by the American Educational Research Association (Glass, 1970) (F) with each of the five authors providing an extensive bibliography related to their esoteric dimension of evaluation. That organization pre-

[17] It seems at this writing that U.S.O.E. will require individual school budgets for purposes of establishing that Title I allocations are "excess" funds.

viously published a comprehensive review of vocational-technical education program issues which included a chapter on program evaluation (Coster and Ihnen, 1968) (F). Further, Eidell and Piele (1968) (B) developed an annotated bibliography on the evaluation of educational programs covering 64 entries (including vocational programs) published between 1964 and 1968. Recognizing the popular demand for qualitative program assessment, *Kappan* devoted the December 1970 issue to eight articles on accountability.

It would seem redundant to review the literature on educational evaluation in this paper. Therefore, the approach here will be simply to establish the role of evaluation within the PPBS context, briefly discuss the issues and strategies of evaluation, and demonstrate a strategy currently being applied to vocational-technical education.

Evaluating subsystems propose to provide the program assessment functions of the PPB system that determine the qualitative impacts of programs. Although the processes of educational organization are replete with fugitive data and much of the available data simply cannot withstand the weight of ponderous logic (Gross, 1964) (A), extensive efforts abound to bring rationality to the evaluation process.

Evaluation is no stranger to education, although criticism proliferates both within and without the profession as to both appropriateness and quality of existing and proposed paradigms. Debates concomitant to evaluation processes will not be elucidated here as to form or content. One suspects that the complexity of the issues encompassing evaluation paradigm constructs will continue the endemic feudality *ad infinitum*.

Provus (1969) (F) described evaluation as the process of:

1) agreeing about program standards;
2) determining whether a discrepancy exists between some aspect of the program and the standards governing that aspect of the program; and
3) using discrepancy information to identify the weakness of the program.

Provus' first construct, agreeing about program standards, may suggest that program evaluation criteria are best established in concert with the establishment of program objectives. It would seem that those who propose and demonstrate behaviorally stated objectives (Mager, 1962; Smith, 1964; Popham, 1967) (F)[18] would agree to the foregoing condition *pro forma*. It would further seem that if one is to develop program standards it becomes incumbent to establish several administrative levels of evaluation and to clearly articulate the roles of both process evaluation and product evaluation at established levels, for it seems that the program ob-

[18] The Complete Mager library consisting of (1) Analyzing Performance problems, (2) Preparing Instructional Objectives, (3) Developing Vocational Instruction, and (4) Developing Attitude Toward Learning is currently being offered by Fearon Publishers, 6 Davis Drive, Belmont, California 94002.

jectives are conceptually different between administrative levels of programming. For example, a state-level objective for vocational training may be:

> O_n : To provide training programs in electronics for 80 percent of the ambulatory physically handicapped young adults who express interest in becoming electronics technicians.

At the electronics program administration level, the Technical-Vocational Institute (T.V.I.) which provides training in electronics becomes encumbered with a whole set of operational objectives to meet the illustrative state-level objectives. The T.V.I. must establish recruiting objectives (to meet the state goal of providing for 80 percent of the target population). establish program training objectives (skill expectations), and certain facilitating objectives programmed to meet the special needs of handicapped persons (e.g., wheelchair ramps, special workbench, etc.) Further, given that the electronics training program covers multiple sub-programs, each of those must be programmed both in terms of process efficiency and product efficacy.

Several administrative levels of program evaluation are currently practiced. The regional Associations of Secondary Schools and Colleges accredit secondary schools and colleges relative to programmatic assessments conducted by peer groups. States have attempted to assess program quality through standardized achievement testing (e.g., New York and Florida), through state accrediting investigations, through sample surveys of school districts, and through special legislation which require program assessment as a condition of resource allocations (e.g., Florida's Educational Improvement Expense). School districts have long practiced standardized testing programs with varying sophistication in designs and individual teachers have long puzzled over the internal validity of their esoteric program assessments. Attention will now be given to three levels of program assessment relative to Vocational-Technical education—state, school district, and programs. This is not to diminish the work of Tyler and others relative to National Assessment, the three levels discussed here may be couched within a PPB system and serve the esoteric purposes of this paper.

State-Level Assessment

Extensive federal funding of vocational education throughout the United States has brought with it varying requirements for program assessments. Currently the U.S. Office of Education requires each state to submit for approval a State Plan for Vocational Education as prerequisite to receiving federal funds for programmatic purposes. Included in the state plan is provision for reporting certain statistical data relative to program needs and development (various state reports are available through ERIC). Examples of current state level evaluation studies include Minnesota's report of program activities (Horowitz, 1967) (F) and Utah's Project Follow-Up (Cox, 1969) (F). Although other studies are reported in

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the AERA publication previously cited and additional sources provided in the bibliography of this paper, an exemplary state level evaluation design has been developed and tested by The Center for Vocational and Technical Education. The following is a summary by the O.S.U. Center staff (Starr, et al., 1970) (F).

"An evaluation system is described whereby state divisions of vocational education, in cooperation with local school systems, can assess continuously the effectiveness of program efforts. This system developed in cooperation with several states, provides management data which enable state vocational education agencies more effectively to plan, monitor, and redirect their programmatic efforts in providing quality vocational education. The system is sufficiently flexible to permit states to meet special local and state management information needs by modifying system components."

"Evaluative data generated by the system also are useful for meeting the reporting requirements of such policy-making bodies and agencies as state boards and advisory councils, local school boards, and the U.S. Office of Education."

System Features

"The achievements of a state's programs are evaluated against objectives and specific goals set by the state for its own programs. A set of program objectives and goal statements acceptable to several states is presented, but they can be modified to meet the special needs of individual states."

"Evaluation instruments and procedures are provided which are used to collect data from local schools. The evaluation instruments provide data about: (1) program characteristics, including enrollment, and program quality and accessibility; (2) student status and characteristic information, including, equal opportunity data, special needs data; and (3) follow-up information for use in assessing the effectiveness of vocational programs in relation to training outcomes."

"Data processing routines and computer programs are made available for facilitating data interpretation and management decisions. Data are summarized for individual schools, for regional areas of the state and for the state as a whole. Local schools can be supplied with a feedback of evaluative information useful for their program planning needs."

"An evaluation and program-planning methodology is suggested, and the evaluation system is designed to permit articulation with other program planning systems such as Planning, Programming, Budgeting Systems (PPBS) and manpower."

System Advantages

"State divisions of vocational education have available a core of evaluative data for use in formulating annual and long-range program plans. Goal achievements are assessed quantitatively and without heavy investments of staff time in local school visitations. Duplication of requests for information from local schools is substantially reduced. Data are available whereby special studies can be conducted to answer important questions concerning program effectiveness. Local school personnel have available to them evaluative data for developing annual and long-range local program plans and for improving instruction."

A more comprehensive system of state-level evaluation of a particular programmatic dimension (vocational in this case) has not been identified. The O.S.U. Project is both comprehensive in design and flexible in application. One should not underestimate the potentialities described above by the developers—their modesty must not be interpreted as another developmental misadventure: this one works!

District Level Assessment

The Ohio State University Project provides the quantative data normatively required by local decision-makers relative to programmatic planning of vocational education programs. Given the program structure established for a PPB system demonstrated in Figure 3.4, one immediately recognizes that vocational education is only one evaluation requirement of a school district.

Kershaw (1965) (F) stated that "until we define output, we can never know whether we are combining our resource inputs in an optimum way," and Blaug (1968) (F) surmised that we must somehow evaluate output and that every type of valuation implies the existence of some "objective function" that one is trying to maximize. Given that the "objective functions" of a school district are structured relative to the design explicated in the above section on program planning, with goals and objectives clearly articulated, one now must design evaluation criteria that measure the relative attainment of established objectives. More often than not, the designs take the form of various sample testing procedures or departmental statistical reports describing programmatic efforts.

The intent of the local evaluation design is crucial to its development and interpretation of generated data. If the design provides for sampling responses to academic achievement (as do standardized achievement tests), then one may only interpret the results as relative measure of the organizations curricular health. That is to say, that standardized testing only points to areas which one might further investigate given the propensity to manage by exception. However, if the local school reports are developed relative to program objectives, one gets a clearer, more comprehensive assessment of program outputs. It seems that school districts are moving to the latter design; however, one must not be impatient with the resultant sophistication—any new programmatic development (evaluation in this case) takes time to test and modify and the complexities and pervasiveness of this dimension will be no exception.

Program Level Assessment

Given the evaluation by objectives design, one must identify evaluation criteria for each program and sub-program and criteria must assess both process and product. Process assessment may include such dimensions as student gains per instructional hour, aggregate student gains related to alternative instructional strategies, cost per student gain, etc. Product assessments may include such dimensions as changed student behavior, changed student attitude, changed student skill, support services provided, etc. Evaluation criteria development and program assessment procedures are no mean task, and it seems that educators generally would rather spend their energies along other programmatic efforts. However, it also seems certain that the public is demanding measures of output and educators no longer have a choice in that regard; yet, evaluation attempts to substantiate needs quantitatively, which would seem to provide substantive persuasion when asking voters for increased support.

Figure 3.6 demonstrated the programming of a program structure throughout a school district's operational centers. Conceptualization of the evaluation dimension may be facilitated if one were to establish assessment criteria along the vertical dimension of that figure. In that regard, programs (horizontal dimension) interest with appropriate program evaluation criteria and assessment procedures (vertical dimension) at the location where operational programs exist. The program level evaluation being structured in this regard provides for district level evaluation simply by summating program level assessments.

Summary

PPBS is a management subsystem. Each of the PPBS subsystems were conceptualized to be within the framework of an integrated system. Extensive attention is given to the development of a program structure because the program structure is the sinew that binds the PPB subsystems together. The budgeting dimension was used to explicate the integration process and the extensive development given to that dimension should not be interpreted to indicate relative priorities—it simply provided a demonstrative vehicle.

The often quoted definition of planning enunciated by Dror (1963) (H), to the effect that planning is the process of preparing a set of decisions for action in the future and directed at achieving goals by optimal means, was not considered. The omission was purposeful because the direction of synthesis was primarily aimed at epistemology as opposed to decision-making and the author's bias relative to optimal models. That bias is clearly reflected in several sections of this chapter and is expressed as "relative myopia" or "satisficing" models as opposed to optimization schemata.

Programming is the process of arranging a sequence of operations to be performed. The key contract of programming is that of determining alternative activity configurations to attain planned objectives.

Program budgeting was articulated in terms of revenue and expenditure models. The designs are used to demonstrate integration of both the planning and programming subsystems without regard to decision-making and systems analysis which accompanies most literary expositions. Some attention to those concepts is given in a subsequent chapter.

The evaluation subsystem clearly reflects a bias toward evaluation-by-objectives although other designs clearly have relevance when properly interpreted. Some evaluative techniques will be explicated further in the chapter on management tools.

Finally, in keeping with the emphasis of this paper on synthesis as opposed to classical review, a word of caution seems appropriate. Synthesis allows reflection of bias—as it should—however, the extensive bibliography accompanying this paper should be accessed to the extent that one might develop a totally different perspective than that presented here. Epistemology demands such scrutinty.

MANAGEMENT INFORMATION SYSTEMS

Someone once made a statement to the effect that too much informa- is as dysfunctional as not having enough information. Anyone who has observed central data processing centers of large urban school districts regurgitative thousands of reams of printed matter must certainly consider the propriety of the foregoing statement. And, more than one administrator has reluctantly observed data processing systems consuming a larger portion of his already constrained school district budget. Thus, two central questions are immediately apparent from the contemporary literature which critiques educational data processing systems. The first question is "What are the parameters of information needs?" And the second is "How much of the available resources can one afford to allocate to data processing systems?"

Neither of the above questions seems to be answerable in absolute terms. The parameters of information needs change as a function of program development, resource allocation formulae, requirements of a myriad of regulating agencies, and esoteric evaluation assessments. Thus the management information system (MIS) is a never-fully-developed dynamic system. The question of what portion of a school district's resources should be allocated to the structured information system is often countered by a question to the effect as to how much can a school district not afford to allocate for informational purposes. The latter argument generally rests upon observed constraints and inefficiencies resulting from decisions based on inaccurate or incomplete information sources. These questions are not limited to school districts—regional educational agencies, state departments of education, and the U.S. Office of Education are confronted with similar questions and concomitant issues.

Evans (1970) (G) recently provided an excellent review and overview of issues, concepts, developments, and applications of electronic data processing (EDP) systems related to educational organizations. He very clearly differentiates the concepts of management systems, management information, management information systems, information systems, and educational management information systems. Johnson (1971) (G) addresses many of the same topics as does Evans but from a hardware and software perspective and thus adds the operational dimension to Evans' abstract conceptions and organizational dimension. Kenney and Rentz (1970) (G) provide a more extensive demonstration of EDP applications for specific purposes in that they explicate operational systems for control and processing of public school records. Although all three of the foregoing citations tend to intersect at various points of explication, the conceptual levels and esoteric developments in each seem to be complementary. Thus, it is recommended that one might avail himself of all three sources. Also, Evans and Johnson each provide an extensive bibliography while the Kenney and Rentz work is unfortunately limited in that respect. Similarly, Grossman and Howe (1965) (G) provide no bibliography and seem to take the conceptual approach of Kenney and Rentz, but like Evans they provide an extensive glossary of terms appropriately referenced to a 1964 U.S.O.E. publication by Putnam and Jaukaud.

The concept of educational management information systems transcends hardware and software considerations. Hardware and software simply speak to the question "how" when one considers much broader questions such as what is to be communicated; to whom; and when? Obviously the latter series of questions are contingent upon the organizational level (federal, state, regional, local educational agencies) and structure of particular organizations. Accordingly, Evans (1970) (G) describes an educational management information system as one which converts "data into information of use to managers at different levels, places, and times in the decision-making process" (p. 258-259). Therefore, one would need to address information needs of each organizational level in terms of decisions, data sets, and devices. Figure 4.1 demonstrates a prototype classification matrix which may be used to conceptualize and program information requirements within the foregoing context.

ORGANIZATIONAL LEVEL	DECISION	DATA SETS	DEVICES
FEDERAL	1. 2. 3.	1. 2. 3.	1. 2. 3.
STATE	1. 2. 3.	1. 2. 3.	1. 2. 3.
REGIONAL	1. 2. 3.	1. 2. 3.	1. 2. 3.
LOCAL	1. 2. 3.	1. 2. 3.	1. 2. 3.

Figure 4.1—Information Needs Classification Matrix

Obviously each organizational level places constraints upon other organizational levels. For example, federal reporting requirements initiate information development strategies among state, regional and local educational agencies. And, given the dynamic nature of information requirements (some might say vascillating) it is small wonder that program managers approach comprehensive information system proposals with cautious optimism.

For the purposes of this paper only three organizational levels will be addressed relative to issues and developments of educational management information systems. Those units include: (1) state educational agencies, (2) regional educational agencies, and (3) local educational agencies.

State Educational Agencies

Head (1967) (G) perceived state educational agency information needs to center around policy management as it relates to strategic planning decision-sets and Evans compared various dimensions of those decision characteristics as articulated by Simon (1960) (G), Drucker (1954) (G), and Dearden and McFarlen (1966) (G). Immediately following the first order of complexity of a decision-making structure one is confronted with data needs for information that relate to first order decision processes. Thus, it is at that juncture that Figure 4.1 may afford unity for conceptualizing state-level information needs and processes programmed that accommodate those needs.

Generally, the literature assesses educational management information systems in terms of various task dimensions rather than organizational levels. For example, the Florida Information System (state-level) is discussed in terms of automating state records and reports (e.g., pupil enrollment projections and attendance reports, teacher certificate files and retirement records, etc.), the Iowa Educational Information Center in terms of services offered school districts (e.g., class scheduling, test scoring, payrolls, etc.), and the California Educational Information System in terms of decentralizing and coordinating service functions offered by regional agencies (Johnson, 1971)(G).

Data generation for information purposes relative to the Vocational-Technical Division of State Departments of Education is a major task of a state's Vocational-Technical Research Coordinating Unit. The Vocational Education Act of 1963, as amended, recognized the functional relationship between research capability and program planning and development by allocating 10 percent of all appropriations for research purposes.

For purposes of illustration of state department of education information system designs, problems, and utility, The Vocational-Technical Education Center's (VTC) "System for State Evaluation of Vocational Education" will be utilized as it relates to data generation for management information purposes (Starr, 1970) (F). Although the Center's evaluation system was discussed in Chapter III (evaluation subsystems) relative to the program assessment dimension and how it relates to state objectives, the system provides much more information utility in that data sets include comprehensive pupil characteristics, program characteristics, and employment data that may serve a myriad of esoteric information purposes.

Figure 4.2 represents a first order conceptualization, by the author, of the above evaluation system in terms of data flow and information feedback.

Given the above conceptualization it would seem instructive to explore issues and problems by following a data set that moves through the data flow and subsequently produces information.

Figure 4.3 represents a student program enrollment record which is part of the student data file generated at the school district level. The student program enrollment record is checked against the state's pupil personnel file for changes of program, address, etc. If the enrollment record data does not match the state's file, a query is made of the reporting school for verification. Upon verification, the state's pupil data bank is updated. Given compatible enrollment record files, the data then provides input for central data processing (CDP). Ernst (VTC's systems analyst) has programmed decision rules which convert the enrollment data into information. For example, grade level (#9) data may be accumulated relative to ethnicity (#10) or ethnicity (#10) compared to program enrollment (#2). Other decision rules may be accommodated both within the student data file and the program data file depending upon management's information needs. The resultant comparisons generate management reports and research information inputs. One management report might exhibit the ethnic distribution of students by programs.

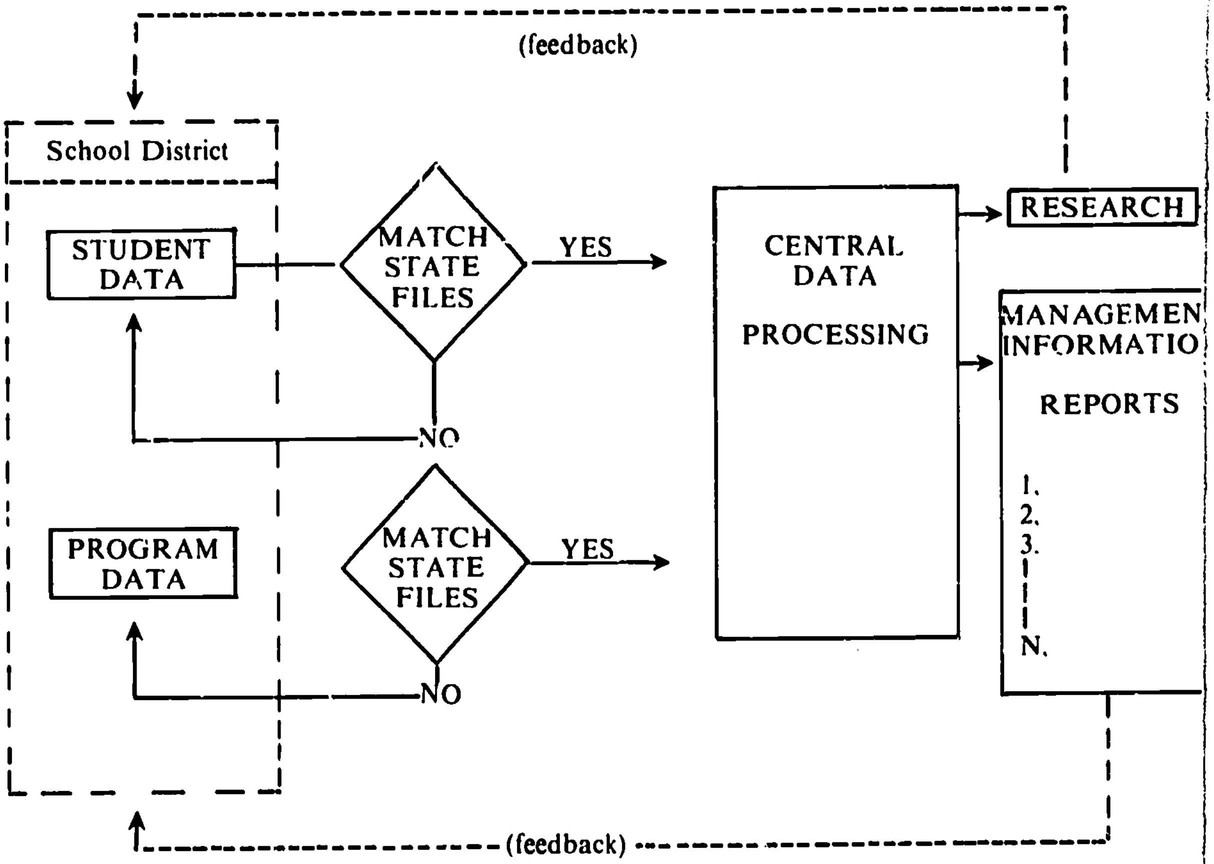


Figure 4.2—Data-Flow and Information Feedback for State Level Program Evaluation System

Another dimension of the student data file is the student status report (Figure 4.4). Assume a student completes a certain program. The school forwards a pre-coded student status report indicating the requested data. These data provide additional management information (e.g., number of completions per program) and activate a research sequence which provides for periodic follow-up of students who terminate programs. A sample of items from the student follow-up survey instrument is illustrated in Figure

4.5. The survey data then generates additional management information [e.g., beginning wages (#9) of graduates of each training program]. Subsequent feedback of management information relative to students and programs and follow-up information provides program planning inputs for local school districts. Other regional, state, and federal reports are also generated concomitant to state level program planning information.

DF-5 A **VOCATIONAL STUDENT INFORMATION CARD**

Please Print

1. ____ name of school
4 ____ school code
2. Date: __ __ month __ __ year
3. ____ instructional program title
18 ____ instructional program code
4. 25 ____ Your social security number
5. 34 ____ Last Name of Your Teacher
6. 44 ____ Your Last Name ____ First and Middle Initial
____ Number and Street or Rural Route
____ City, Town, or Post Office ____ State (abbreviated) ____ Zip Code

7. Age: __ __ 8. Sex: ☐ Male ☐ Female

9. What is your marital status? ☐ single ☐ married

10. Are you a student from a private school? ☐ Yes ☐ No

11. If you use public transportation (Bus, etc.) to get to school, what does it cost each day? 55 $__ . __

12. If you drive to school by car, how many miles do you travel to and from school each day? __ __ __ 70

13. What is your grade level at this time? (check only one) 71 – 72

A. Secondary
- 0 ☐ 9th
- 1 ☐ 10th
- 2 ☐ 11th
- 3 ☐ 12th
- 4 ☐ Special or Ungraded

B. Post-Secondary
- 5 ☐ 1st year
- 6 ☐ 2nd year
- 7 ☐ Special Ungraded

C. Adult
- 8 ☐ Preparatory
- 9 ☐ Supplementary

DF-5 A **EQUAL OPPORTUNITY INFORMATION** (DF-5A Revised 1971)

NOTE: The following information is needed to aid in establishing and maintaining quality vocational education programs with equal opportunity for all groups. This information need not be supplied by you if you do not wish to provide it.

14. I consider myself to be:
73
- 1 ☐ American Indian
- 2 ☐ Black, Negro, Afro-American
- 3 ☐ Latin American, Spanish Surname
- 4 ☐ Oriental American
- 5 ☐ White
- 6 ☐ Other (specify) ____

SPACE BELOW FOR ADULT AND POST-SECONDARY PROGRAM ENROLLEES ONLY

15. What was your employment status just before starting this vocational training program? (check only one)
74
- 1 ☐ I was employed full time (30 or more hours per week)
- 2 ☐ I was employed part time (less than 30 hours per week)
- 3 ☐ I was unemployed

16. Are you now employed full-time? ☐ Yes ☐ No

17. If you were unemployed just before starting this training program, did you receive public assistance? ☐ Yes ☐ No

18. If you were employed full time before starting this training program, what was the wage per hour you received? ☐ $1.59 or less per hour ☐ $1.60 or more per hour

19. What was the highest grade you completed in school before you entered this program? __ __ 79

Figure 4.3—VTC's Student Enrollment Record

DF-5 B

VOCATIONAL STUDENT STATUS REPORT

READ INSTRUCTIONS ON THE REVERSE SIDE BEFORE COMPLETING ANY ITEMS BELOW

5. CURRENT STUDENT STATUS:
58
1 ☐ Completed the requirements of this program—not in school.
2 ☐ Completed the requirements of this program—Still in school.
3 ☐ Still in school—in different vocational program.
4 ☐ Still in school—no longer in any vocational program.
5 ☐ Transferred to another school.
6 ☐ Left school before completing program requirements.
7 ☐ Unknown.

6. DATE OF COMPLETION OR TERMINATION:
mo. day year

7. Was an EXIT INTERVIEW conducted with this student?
☐ Yes ☐ No

8. EMPLOYMENT STATUS OF STUDENT:
66
1 ☐ Will not seek employment.
2 ☐ Will seek employment.
3 ☐ Status unknown.
4 ☐ Already employed fulltime

CONDITIONS OF TERMINATION:

9. 1 ☐ Voluntary 2 ☐ Involuntary

10. 1 ☐ Graduated 2 ☐ Terminated

11. REASONS FOR TERMINATION:
☐ Transportation unavailable.
☐ Unable to afford transportation.
☐ Unable to afford instructional & related costs
☐ Other (specify)
73 ☐ Unknown or no interview.

DF-5 B

INSTRUCTIONS

(OF-5B Revised 1971)

WHENEVER THERE IS A CHANGE IN ENROLLMENT STATUS FOR THIS STUDENT, COMPLETE THE APPROPRIATE ITEMS BELOW AND ON THE REVERSE SIDE OF THIS CARD.

OR

IF THIS STUDENT IS STILL IN THIS PROGRAM AT THE END OF THE CURRENT SCHOOL YEAR CHECK THIS BOX ☐ AND COMPLETE ITEMS 1, 2, 3, and 4 BELOW. DO NOT MARK ITEMS ON THE REVERSE SIDE OF THIS CARD. 46

AND

FORWARD THIS CARD TO THE STATE OFFICE WITHIN TWO (2) WEEKS AFTER COMPLETING EITHER OF THE ABOVE STEPS.

1. Do you consider this student to be:
☐ Educationally disadvantaged
☐ Socio economically disadvantaged
☐ Physically handicapped
50 ☐ Mentally retarded

2. This student has participated in:
☐ Cooperative work experience (Co-op Part B)
☐ Cooperative work experience (Co-op Part G)
☐ Vocational work study
☐ Vocational work experience
55 ☐ Apprentice program

3. Did this student receive any specialized remedial instruction?
56 ☐ Yes ☐ No

4. Is this student a referral from a special Department of Labor program? ☐ Yes ☐ No

Figure 4.4—VTC's Student Status Report

6. If you got a **full-time** job when you left this vocational program:

What was your job? ______________

54 For State Use Only

7. How closely did your first full-time job (30 or more hours per week) after leaving this vocational program relate to the training you received?

60 Check only one box

- [ ] 1 I was employed in the occupation for which I was trained by this vocational program
- [ ] 2 I was employed in a related occupation
- [ ] 3 I was employed in a completely different occupation

8. Did this vocational training program adequately prepare you for your first **full-time** job after leaving this training?

- [ ] Yes
- [ ] No

9. What was your **beginning hourly wage** on your first **full-time** job since leaving this vocational program?

62 Check only one box

- [ ] 1 $1.59 or less per hour
- [ ] 2 $1.60 to $1.99 per hour
- [ ] 3 $2.00 to $2.49 per hour
- [ ] 4 $2.50 to $2.99 per hour
- [ ] 5 $3.00 to $3.99 per hour
- [ ] 6 $4.00 or more per hour

10. How did you get your first **full-time** job after leaving this vocational training?

Check appropriate box or boxes below

- [ ] I got the job myself
- [ ] My family or friends helped me get the job
- [ ] The job placement services provided by the school helped me get the job
- [ ] The state employment service helped me get the job
- [ ] A private employment agency helped me get the job
- [ ] Other (specify) ______________

11. What is the **most** you have earned on a **full-time** job since leaving this program?

69 Check only one box

- [ ] 1 $1.59 or less per hour
- [ ] 2 $1.60 to $1.99 per hour
- [ ] 3 $2.00 to $2.49 per hour
- [ ] 4 $2.50 to $2.99 per hour
- [ ] 5 $3.00 to $3.99 per hour
- [ ] 6 $4.00 or more per hour

12. If you have held two or more full-time jobs (30 or more hours per week) since you ended this vocational training, check one box below.

70

- [ ] 1 I was trained in school for my last job
- [ ] 2 My last job was related to this vocational training
- [ ] 3 My last job was not at all related to this vocational training

13. Indicate below the **location** of your present or most recent full-time employment.

______________ Village, Town, City

______________ County

______________ State

71 For State Use Only

14. If you are presently working, what is your job?

____

29 For State Use Only

15. What **wages** are you presently earning?

35 Check only one box

- [ ] 1 $1.59 or less per hour
- [ ] 2 $1.60 to $1.99 per hour
- [ ] 3 $2.00 to $2.49 per hour
- [ ] 4 $2.50 to $2.99 per hour
- [ ] 5 $3.00 to $3.99 per hour
- [ ] 6 $4.00 or more per hour
- [ ] 7 I am unemployed

16. What is your **current employment status?**

Check the appropriate box or boxes below

- [ ] I am employed
  - [ ] **full-time** (30 or more hours per week)
  - [ ] **part-time** (less than 30 hours per week)
- [ ] I am **unemployed,**
  - [ ] **but looking** for work
  - [ ] and **not looking** for work
- [ ] 42 I am in the **military service**

Figure 4.5—Sample Questions from VTC's Follow-up Survey Instrument

79

Another dimension of state-level information systems currently developing sophistication and of interest to vocational-technical education management is in the area of vocational guidance and counseling of which Campbell (1966) (G) reported on several thrusts. Others reporting on this area include: Cooley (1964) (G), Friesen (1965) (G), Grossman (1966) (G), and Super, *et al.* (1970) (G) and *The Personnel and Guidance Journal* (November 1970) (G) devoted an entire issue to technology in guidance.

Generally, two goals of state-level vocational guidance information systems for vocational education are evident. The first is to develop computerized data banks of career information and the second is to disseminate timely career information to educational agencies relative to industry needs and occupational training programs. One such model is demonstrated in Figure 4.6 and provides that employers will be surveyed relative to job descriptions (taxonomy of behaviors requisite to positions), concept needs of positions (e.g., cognitive, affective), and technical skills relative to position behaviors. These data are processed into five information reports which are disseminated periodically to operating vocational-technical educational agencies. The strength of the system is found in that the projected employer needs allows time for training. Thus it is also a weakness in that extrapolated manpower projections are not infallible; especially over extended timeframes.

The obvious impact of state-level vocational guidance systems is its effectiveness in matching youth with employment positions. However, inasmuch as manpower projections may fall within acceptable limits for program planning purposes, it would seem that training curricula could benefit substantially from the guidance information system.

State-level information systems are much more complex than the dimensions selected for discussion here. Control and analysis of state-aid allocations to operating school districts is in itself a comprehensive information subsystem requiring extensive managerial talent. However, that subsystem and others (e.g., Florida's self-evaluation system) are, for the most part, for "in house" purposes.

Regional Educational Agencies

Regional educational agencies (sometimes called intermediate educational agencies) are generally focused in their activities. For example, Wisconsin's 19 Cooperative Educational Service Areas (CESA) have seemingly identified their role as providing cooperative services (purchasing, research, pilot demonstration programs, and multiple data processing routines—accounting, class scheduling, enrollment projections, etc.). New York Boards of Cooperative Education Services (BOCES) have, due to provisions of state funding of target populations, operationally developed regional vocational education centers and administer some programs for exceptional children. Several BOCES have developed computer capability for providing electronic data processing (EDP) services for school districts. Those EDP services include functions normally found in urban school dis-

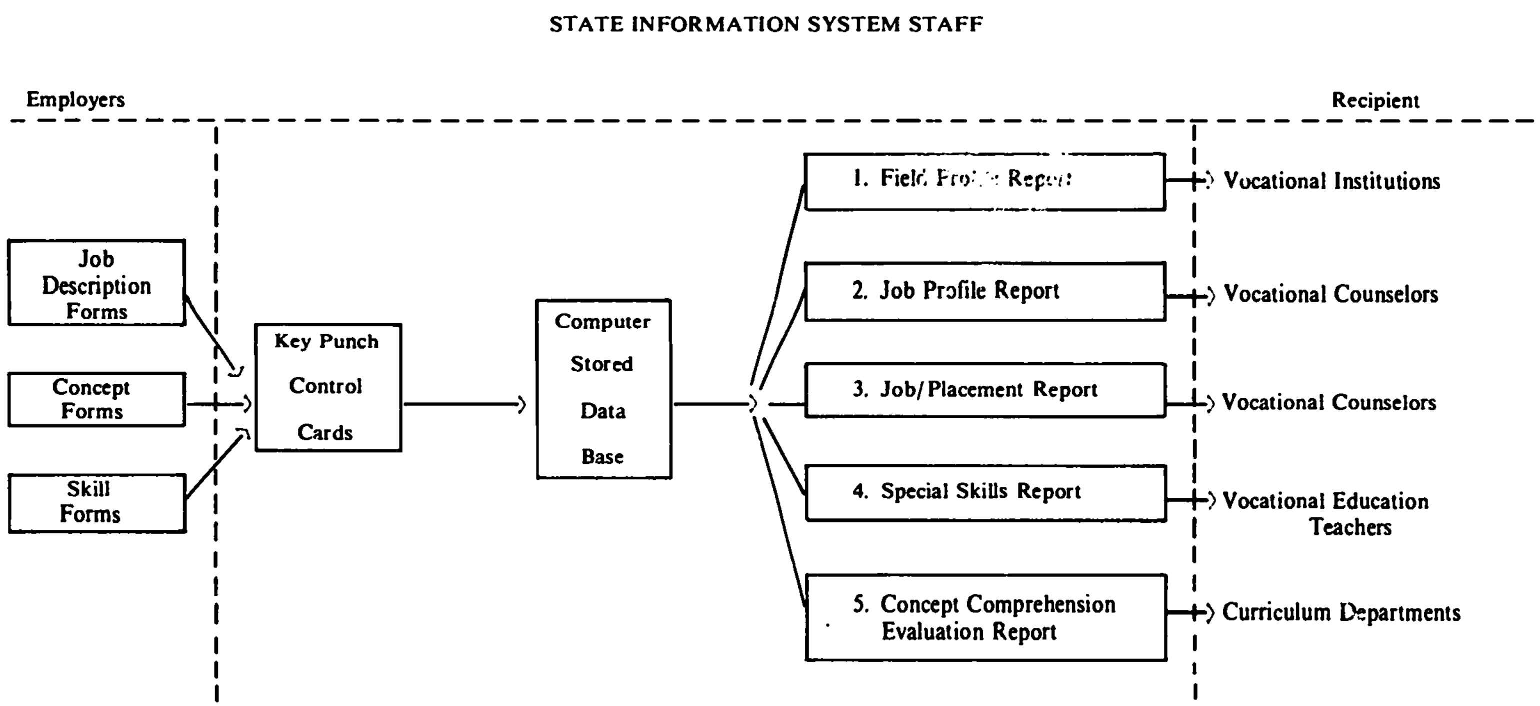


Figure 4.6—State-Level Vocational Guidance Information System

tricts, e.g., payroll, general accounting, class loading, test scoring and analysis, student enrollment, grade reporting, etc. Similarly, several California cooperatives operate much like the New York BOCES although some California county educational agencies have established operational programs in vocational and special education and have developed information systems to serve their private needs. One California county, Santa Clara, recently reported development of a vocational guidance information system similar to the one described above.

Generally, the intermediate agency provides services, on a multi-school district basis, that are more efficiently provided through a consortium and their information systems vary in development from specific management needs to cooperative management information services.

Local School Districts

Fox (1966) (G) described the state-of-the-art of *Automated Data Systems in Florida Schools* in a paper for the Florida Educational Research and Development Council (FERDC). The FERDC monograph assesses EDP applications at the school level (e.g., grade reports, student records, scheduling, testing services, attendance reporting, and miscellaneous services) and administrative applications (e.g., personnel records, payroll, and financial reporting). Several papers assessing esoteric applications are referenced in the bibliography of this paper, e.g., Allen's (1966) (G) article in *Nation's Schools* on "Stanford's Computer System Gives Scheduling Freedom to 26 Districts" and Woods' (1970) (G) "Recent Applications of Computer Technology to School Testing Programs."

Another incipient use of EDP systems for instructional management purposes and as an instructional strategy is computer-assisted instruction (CAI). Although that particular dimension is beyond the scope of this review of MIS, bibliography is provided (e.g., Engel's bibliography, Coulson (1962) (G), Dick (1965) (G), Suppes (1966, 1968, 1969) (G), and others). And, vocational guidance information systems are becoming a reality in some of the larger urban school districts as well as evaluation of vocational guidance systems.[1]

The Kenney and Rentz work was previously cited as providing operational guides to developing EDP data files for information purposes. The Midwestern States Educational Information Project (MSEIP), also recognizing the need for timely, accurate information for decision-making purposes, developed an integrated educational information system applicable to local school districts. The 1968 report is exhaustively documented with accompanying coding structures to generate a myriad of management reports and provides an alternative conceptualization to Chapter III's development of a program budgeting subsystem. MSEIP's system is generally demonstrated[2] in Figure 4.7 and may be perceived for various organi-

[1] Personal communications with Jack Whitsett, Division of Vocational-Technical Education, Miami, Florida.

[2] See MSEIP, V. 1, p. 4-3.

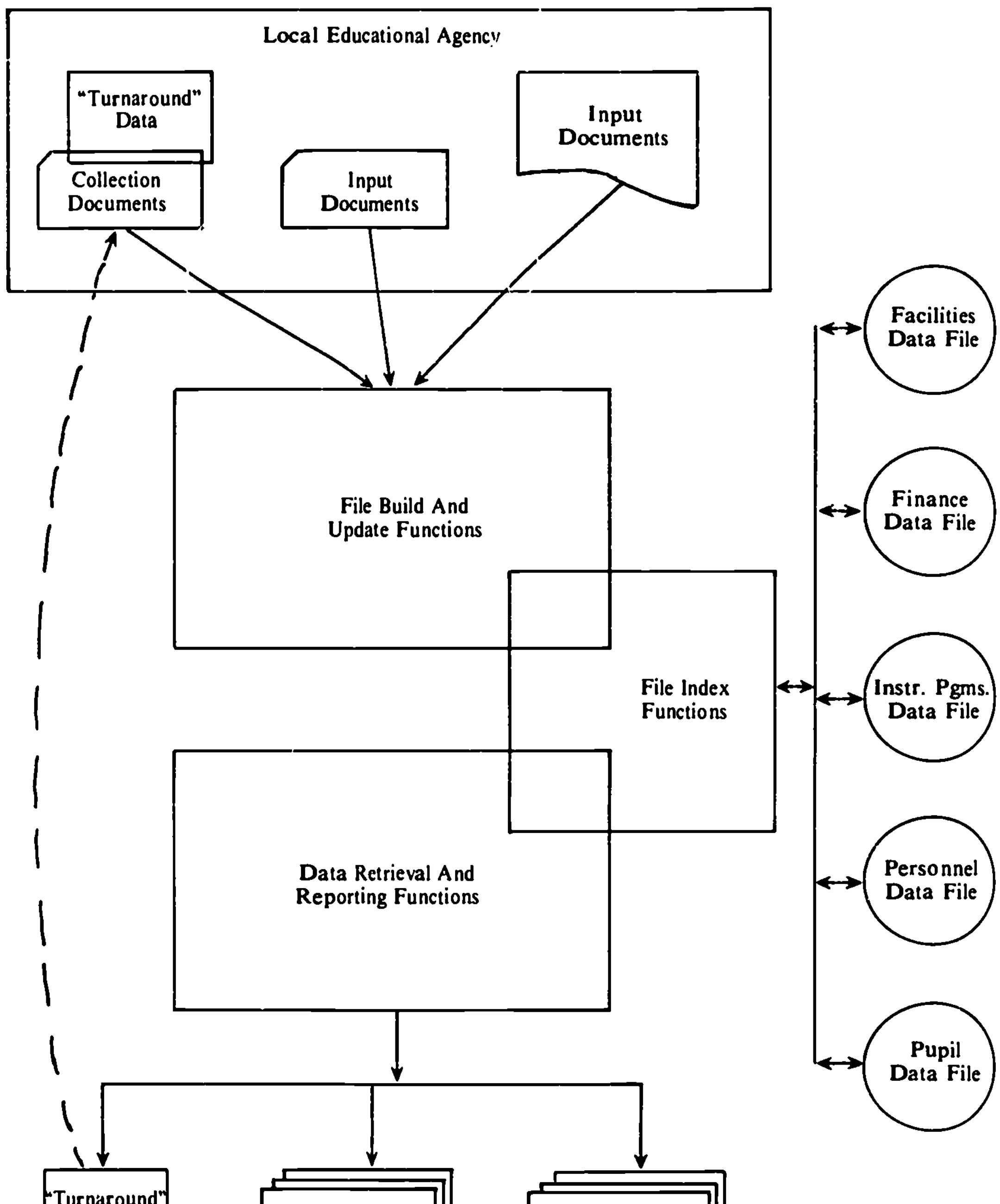


Figure 4.7—Midwestern States Educational Information System

zational levels—state, regional, or local. It was MSEIP's intent to develop an information system that would be compatible among school districts within states and between cooperating states. Finally, the five files are subsystems which may be accessed to generate information contained in the separate files or accessed in conjunction with other files. For example, data within the pupil data file and data within the facilities file may generate a building-load report. Obviously the information grows exponentially as demonstrated in Chapter III.

An information system of particular interest to vocational-technical education management[3] is the work of Whitsett and his colleagues at Dade County, Florida. Outside the PPBS model Dade is building for their K-12 program, Whitsett has been developing PPBS structures and concomitant management strategies for Dade's Adult Vocational-Technical Sub-District since 1967. That work has preceded beyond program budgeting of direct instructional cost and accommodates most of the budgeting notions proposed by Lindman (1970) (G) in his study for the National Educational Finance Project. Whitsett's current strategy seems to be directed toward teacher involvement in resource allocation and teacher assessments of program relevance and quality.

Management information systems among local school districts are much like instructional programs—that is developmental sophistication varies from the laggard to the innovator. Time-sharing strategies have assisted the smaller and the less affluent school districts to capitalize upon EDP innovations in various areas of educational management. However, the two issues identified at the beginning of this chapter remain—what are the parameters of information needs? and How much of their limited resources can a school district devote to generating information?

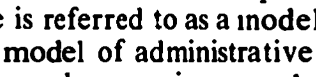
[3] Also see, Richard H. P. Kraft and Susan Padro, "Decisions, Data Needs and Manpower Planning Operations," *Educational Technology*, V. II, No. 3, (March 1971).

MANAGEMENT TECHNIQUES AND RELATED TOOLS

The purpose of this chapter is to synthesize several management tools and related techniques currently receiving attention both within and without the educational profession. This is not to say that the planning-programming-budgeting-evaluating subsystems of Chapter III and the management information systems of Chapter IV are not management tools and their several processes related management techniques. Indeed, they are management processes but conceptualized within an esoteric framework. The tools and techniques presented in this chapter are individually more discrete and situationally applicable.

In the interest of time and space (each tool and technique could develop into a major thesis) an attempt will be made to identify constructs, issues, and processes and to briefly exemplify the processes utilizing educationally related illustrations. To that end, many of the examples of this chapter will refer to figures and illustrations of previous chapters. A technique, as used in this writing is defined as a method of accomplishing a desired aim; a tool is defined as an instrument of production. For example, statistical tools (e.g., discriminate functions, multivariate analysis of variance, simple means, arithmetic ratios) support various dimensions of managerial techniques (e.g., cost-effectiveness, manpower forecasting, operations research, modeling, etc.)

Modeling

The concept of models, as explicated in educational literature, is almost as fugitive as the constructs of PPBS. Most writers seem to prefer a limited notion of models since almost any figure is referred to as a model—a noted exception is Gore's (1964) (H) heuristic model of administrative decision-making. This writer's bias lies with those who perceive a model to be a system of postulates, definitions, data, and inferences presented as a description of an entity or state of affairs. However, the writer readily acknowledges the varying complexities of models and therefore makes no value judgments relative to another's conceptualization of models. However, it seems somewhat unfair to attempt to communicate a system of complex constructs with a simplistic diagram where it would seem totally acceptable to communicate a simple notion with a simple representation. For example, the expenditure model of a program budgeting subsystem presented in Chapter III is only generally communicated through the accompanying diagrams. That model is structured in terms of the postulates and definitions that accommodate data and inferences concomitant to each dimension. However, the notion of a line segment would seem to be clearly modeled through a simplistic diagram such as: 

, and would seem to require only limited explication. For the purposes of this paper only data-based, information producing models will be assumed.*

* This section is generally based upon the notions in *Guidebook for Systems Analysis/Cost Effectiveness.* (prepared for the U.S. Army Electronics Command by ARINC Research Corporation, 1969) AD688154.

The adequacy of a model is normatively tested through its representativeness and its validity. Representativeness may be tested along several dimensions. First, the assumptions of the model (postulates) must be believable. Believability is enhanced when supported by factual evidence, widely accepted principles and/or common phenomonology. To be representative the model must accommodate all situational variables and not accommodate antithetical anomaly producing variables. Although no model may be expected to totally replicate reality, it must "suffice" when confronted with technological and operational uncertainties.

The ARINC publication offers five tests of model validity. These are:

1) Consistency—Are results consistent when major parameters are varied?
2) Sensitivity—Do input variable changes result in output changes that are consistent with expectations?
3) Plausibility—Are results plausible for special cases where prior information exists?
4) Criticality—Do minor changes in assumptions result in major changes in the results?
5) Workability—Does the model require input or computational capabilities that are not available within the data boundary?
6) Suitability—Is the model consistent with the objectives, i.e., will it answer the right questions?

Although a taxonomy of model types has not been identified during this iew, three will be considered.

Mathematical models are uniquely characterized by their use of equations to abstract systems characteristics. The revenue source dimension of the program budgeting model demonstrated in Chapter III was initially modeled mathematically. Another example would be the neoclassical economic expressions of National Income and Gross National Product. Although mathematical models often provide extensive flexibility it is generally at the expense of oversimplifying reality which therefore inhibits model representativeness. A common modeling technique is to develop mathematical sub-models of appropriate sub-routines within more complex models.

Simulation models are situational abstractions of reality designed to pretest the effects of hypothetical alternative conditions. Probabilistic functions characterize the operationally oriented simulation models. The University Council for Educational Administration has developed simulation models for use in training school administrators that employ a variety of input methods to situationally engage students in problem solving. One technique for developing simulation models is to begin with a data base and generate normative expectations for each of the model's dimensions.

Operational models are conditional abstractions of designated functions. They are conditional in the sense that they are functionally related to their real-world utility and in the real-world are subject to incremental as well as dynamic changes. The more pervasive the operational model the more susceptible it is to modification. For that reason a note of caution was expressed during the discussion of the revenue model in Chapter III since state funding formulas to school districts often change with each legislative session.

Finally, a model defines a systems boundary of reality and through its representation of that reality supplies numerics or information related to the model builders needs. Ideally the model would be error free and accommodate all uncertainty; that would seem impossible and thereby forces one into the normative pattern of accepting relative satisfaction.

Systems Analysis

An immediate application of the popular notion "systems analysis" will be to differentiate between systems analysis, cost-benefit analysis and cost-effectiveness analysis. Conceptually, systems analysis may be interpreted as a study of problem structure and cost-benefit analysis and cost-effectiveness analysis as subsystems of systems analysis; however, that conceptualization is not entirely accommodating just as it would be inappropriate to identify systems analysis (S/A), cost-benefit analysis (C/B) and cost-effectiveness analysis (C/E) as problem solving techniques because C/B and C/E are approaches of systems analysis.

In Chapter II it was stated that systems analysis is an attitude of mind. To the extent that mind-attitude structures problem solving, that statement may suffice. But, as a function, systems analysis takes the form of investigations utilizing a myriad of modern analytical designs. Those designs include techniques associated with cost-benefit, cost-effectiveness, trade-off, optimum-mix, interaction analysis, input-output and other assorted titles of esoteric strategies. Therefore, one may conclude that systems analysis is a functional approach to problem solving that integrates, differentiates and/or defines relationships of problem elements utilizing techniques and methodologies functionally appropriate to generic classes of problems. Generally, the sinew of systems analysis studies is found in the common feature of systematically examining data through appropriate models for the specific purpose of generating information. Although some would hasten to add a next step by directing information toward alternative operational strategies and decision-making, those extrapolations are not incumbent upon all systems analysis goals. As pointed out in Chapter II the social scientist (e.g., demographer) may employ systems analysis to define selected attributes of a system.

Although the above conceptualization represents the bias of this author it does not seem to be universally held. *Ipso facto*, current trends are diametrically opposite to the above notions. Associates at RAND who popularized systems analysis (Kershaw, McKean, Quade, Hitch, Novic, *et al.*) in military studies for the Department of Defense (especially Hitch who was with the DOD during the early McNamara years) seem to have initiated post World War II scientific management (Taylor, 1947) (H) approaches that have spread significantly beyond the DOD. Quade, in an earlier discourse[1] described the concept of systems analysis utilizing very

[1] E. S. Quade, *Analysis for Military Decisions*, (AD 453887), 1964, p. 7.

broad constructs. However, in a subsequent writing[2] Quade was more restrictive and preferred to operationalize the concept by directing it toward decision-making, which is certainly the most popular notion found in contemporary literature. However, for epistemological purposes it seems more defensible to utilize the more pervasive conceptualization; especially when one considers strategies such as: operations research, resource management, systems engineering, cost-effectiveness, cost-benefit, and other analyses which are generally described under the umbrella of systems analysis. The relationships between the systems analysis model and the cost-effectiveness dimension are displayed in Figure 5.1.

Cost-Benefit Analysis

Cost-benefit analysis has a long history among social-political philosophers. Plato in *The Republic* recognized general social benefits by investing in the education of prospective state rulers. Similar notions are present throughout writings on economic philosophy[3] although the Aristotlian approach of basing philosophical constructs upon observations of reality is of recent vintage as applied to cost-benefit analysis of investments in education. Generally, the literature addressing itself specifically to the economics of education is less than 15 years old[4] and has preceded from Becker's and Schultz' notions of investing in human capital through internal and external rates-of-return analysis (e.g., Hansen, Weisbrod, and others) to various educational planning, manpower forecasting, and productivity and efficiency analyses.

Cost-benefit analysis of investments in education, whether general education or vocational-technical training, are "long-run" analyses. The analyst structures costs relative to both social and individual investments in education appropriately adjusted over the expected life-time productivity of recipients relative to alternative investment strategies (e.g., highways or hospitals on the social dimension and business investments on the private dimension). Quantification of social benefits is no mean task. Such issues as how one quantitatively measured the value of "an informed electorate" or "competent community decision-maker" seemingly defies analysis. Therefore educational benefits are generally measured as long-run private rates-of-return with concomitant analytical arguments demonstrating various hypothesized external effects.

Cost-benefit analysis seems more appropriately applied to conditions where costs and benefits are measured in similar units (dollars); especially if one is reluctant to accept subjective interpretations of social costs and benefits. Also, cost-benefit constructs seem more appropriately applied to

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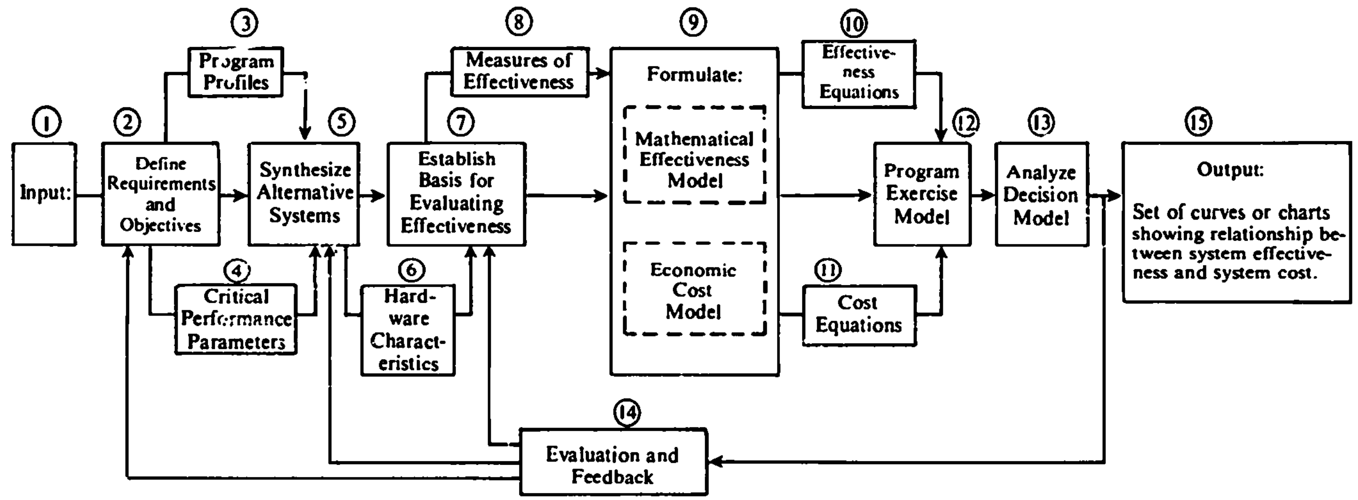
[2] E. S. Quade and W. I. Boucher (eds.), *Systems Analysis and Policy Planning*. (1968).

[3] For a capsulized view of economic philosophies see George Soule, *Ideas of the Great Economists*, New York, New York Viking Press, 1952. Also available in paperback through Mentor Books.

[4] For an excellent collection of reading see M. Blaug (ed.) *Economics of Education*, Vol. I and Vol. 2., Baltimore, Maryland: Penguin Books, Inc. 1968 and 1969.



Block Number	Subject	Guidebook Section	Cognizant Personnel		Block Number	Subject	Guidebook Section	Cognizant Personnel	
			Decision-Maker	Analyst				Decision-Maker	Analyst
1.	Input information	2.1	X		8.	Define measures of effectiveness	2.8		X
2.	Define requirements and objectives	2.2	X	X	9.	Formulate models	2.9	X	X
3.	Develop profiles	2.3	X	X	10.	Generate effectiveness equations	2.10		X
4.	Obtain critical performance parameters	2.4		X	11.	Generate cost equations	2.11		X
5.	Synthesize alternative systems	2.5	X	X	12.	Exercise the model	2.12		X
6.	Develop hardware characteristics	2.6		X	13.	Develop decision model	2.13	X	X
7.	Establish basis for evaluating effectiveness	2.7	X	X	14.	Evaluate results and feedback information	2.14		X
					15.	Output results	2.15	X	X

Figure 5.1—Systems-Analysis/Cost-Effectiveness Process

macro-economic analyses of aggregated data since, philosophically, statements of normative expectations are not collaterally sensitive to observable deviations.

With all its difficulties, cost-benefits studies of education must be evaluated relative to their short history. Obviously philosophical discourses of educational benefits dating to pre-fourth century B.C. have been better defined for measurement purposes during the last 15 years. And, determination of measurement needs would seem to facilitate development of quantification techniques. Finally, even partial measures of benefits provide information to decision-makers who will continue to make educational expenditure decisions with or without data-base information.

Cost-Effectiveness Analysis

Cost-effectiveness analysis is a systematic problem solving strategy which relates input costs to criterion referenced outputs. Although some writers seem to relate cost-benefit and cost-effectiveness as synonymous methodologies, it would clearly seem inappropriate to do so. Where C/B is long-run oriented, C/E may be oriented to either the long- or short-run where the economic rationale of C/B is at the macro-level, the economic rationale of C/E may be either macro or micro; where C/B employs methodological emphasis to rate-of-return (internal and external), C/E employs methodological emphasis upon alternative strategies relative to criterion referenced output. Thus, it may be seen that differences between C/B and C/E go beyond a semantic skirmish. Except for methodological emphasis, C/B and C/E differences are primarily associated with differential levels of abstraction which concomitantly require differential data-sets. Although it is not completely honest to preclude short-run benefit analysis, it seems appropriate to do so, given the propensity of economists to relate benefit theory to long-run analyses and the body of current literature depicting education C/B analyses.

Cost-effectiveness studies are of two general types—*post hoc* and simulation—whose major differences lie in the data-sets utilized. *Post hoc* analyses utilize existing "hard" data-sets generated from a completed program(s) or project(s). For example, one could determine cost of a skill development program (e.g., electronics technician) and also determine the extent to which participants acquired skills as a result of given sets of instructional strategies. Although the cost dimension generally "satisfice" in simulation studies the effectiveness dimension often rest upon hypothetical or probabilistic outputs. However, given reliable probabilistic determination the simulation design offers excellent *a priori* information to decision-makers, especially under conditions which allow for analysis of incremental cost inputs and marginal productivity.

The two dimensions of cost-effectiveness analysis (cost analysis and effectiveness analysis) are generally directed toward intra-system tradeoffs, i.e., C/E studies evaluate alternative strategies for realizing known or anticipated output. Before demonstrating C/E methodologies it seems appropriate to discuss the relationships between systems analysis and cost-effectiveness analysis. The general S-A/C-E model is given in Figure 5.1.[5]

The S-A/C-E process demonstrated in the upper-half of Figure 5.1 abstracts, in an input-output format, a systems analysis of a particular problem area utilizing C/E methodology to generate information about the problem area. The lower-half of Figure 5.1 keys each processing unit (block) in the abstraction to the appropriate section of an accompanying guidebook that explicitly explicates the parameters, analyses, and computations to be performed for each processing unit and further relates to the organizational personnel providing controlling influences upon the processing unit parameters.

An attempt will now be made to demonstrate the process. Assume that over a period of months the Director of Adult Vocational-Technical Education of a metropolitan school district has observed from newspaper want-ads, employment service listings, etc. that the demand for home-appliance servicemen seems strong enough to initiate a training program. Acting upon his hypothesis, further assume that he surveys local organizations which sell and/or service home-appliances and determines an initial demand for (x_i) persons skilled at servicing (a_i) separate types of home-appliances and other survey data. A systems analysis/cost-effectiveness guidebook is developed to study the problem area. The first section of the guidebook delineates general notions and perceptions about the problem area and survey data, all of which gives rise to the need for a C/E study of alternative programming strategies to supply the indicated demand for home-appliance servicemen. Section two of the hypothetical document is now demonstrated.

Section 2.1—Input Information

Input information that leads to the development of requirements and objectives in the S-A/C-E process are normally located among the documents existing within the school district. For example, the survey information provides data on numbers to be trained (X) and the separate kinds of home appliances (a_i) to be serviced. Further, the survey data may indicate (or be used to compute) a multi-year projected need for home appliance servicemen (X_i). The program development department will provide a taxonomy of skills requisite to repairing each a_i home appliance. Generalized program aims are stated and other expected input data identified (e.g., standardized personnel cost, space requirements, suggested alternative programming strategies, anticipated material and equipment needs, etc.)

[5] Adapted from *Guidebook for Systems Analysis/Cost-effectiveness*, (Anapolis, Maryland: ARINC Research Corp., 1969) AD 688154.

Section 2.2—Define Requirements and Objectives

The purpose of this section is to provide precise measurable objectives relating to the program aims expressed in the study directives given in section one of the guidebook and section 2.1 above. Such objectives include various alternatives for the initial training of X_i persons having skills (b_i) to repair a_i home appliances. However, before getting too deeply involved in definitions, a few general observations and cautions should be made relative to the role of objectives.

The establishment of an objective defines a boundary for subsequent analyses. Care must be exercised such that one does not state the objective too broadly and thus defy definitive quantification. The recent emphasis among educators to state program objectives in behavioral terms (Mager, 1962) (F) would seem to provide a sufficient referrent for the preceding caution. Concomitant to developing definitive objectives, evaluative criteria are established which explicate both the method for measuring the extent to which the objective has been accomplished and the criteria for success. To properly define the operational requirements and objectives of a program, the analyst must rely heavily upon his experiences gained through similar studies and information provided by those knowledgeable about the problem area.

All assumptions about the problem area must be explicitly stated and supported by factual evidence. As the number of assumptions increase, the uncertainty associated with the conclusions increase proportionally. And, it would seem that the less explicit the assumptions and the paucity of factual evidence to justify the assumptions would further confound the conclusions exponentially.

Finally, one must identify each constraint associated with each system variable. For example, before one can train (X) persons in (b) skills, there must exist (X) persons desiring training in (b) skills; there must be skilled trainers available; there must be fiscal resources available to support the program; and other similar real or probabilistic constraints. Analytically applied, constraints may determine the feasibility of a set of alternatives and thereby reduce the scope of the problem.

Now for some examples of definitive requirements and objectives relative to the above hypothesized problem area.

X_i = number of persons trained in the i th year

$(X_i = X_1, X_2, X_3 \ldots X_n)$

d_i = number of trained persons demanded in the i th year

$(d_i = d_1, d_2, d_3 \ldots d_n)$

A_i = separate kinds of home appliances to be repaired

$(A_i = a_1, a_2, a_3 \ldots a_n)$

b_i = skills set required to repair the i th home appliance

$(b_i = b_1, b_2, b_3 \ldots b_n)$

To clarify the above definitions assume the following:

let $X_i = X_1$, thus the first year of training—

and let $X_1 = 2$, thus two servicemen to be trained.

Further, let $d_i = d_1$, and $d_1 = 2$, thus only two servicemen are demanded by employers the first year. We can now express our supply and demand relationship as a set of ordered pairs: $(X_i, d_i) = (2,2)$ which simply relates that the number of home appliance servicemen supplied in the first year is two and the number of home appliance servicemen demanded the first year is two. However, we have yet to express the kinds of appliances those two servicemen are skilled to repair. For purposes of simplicity let $A_i = A_1$ and A_1 = electrical toasters and let $b_i = b_1$ where b_1 = skills requisite to electrical toaster repair. Now, if we were only training electrical toaster repairmen the first year and only electrical toaster repairmen were demanded that year, then generally $X_iA_ib_i = d_iA_ib_i$ and specifically $X_2A_1b_1 = d_2A_1b_1$. One program objective may be O_i: To provide training in home appliance repair such that $X_iA_i = .8(d_iA_i)$ where b_i is the criterion variable for training.

Obviously, the above illustration is a simplified case. Home appliance servicemen must each possess skills that facilitate repairing many separate kinds of home appliances. Thus, to train four repairmen ($X_1 = 4$) to repair three home appliances (A_1, A_2, A_3) requires that they possess skill sets b_1, b_2 and b_3. Further it may be that some skills for repairing home appliance A_2 are the same skills required to repair home-appliance A_3. If that be true, a skills programming model must be developed to determine the most efficient combination skills that may be grouped for instructional purposes. The skills programming model will provide the rationale for a set of objectives for each instructional unit. Thus, the script for the C/E scenario has been outlined and now the actors must creatively improvise as they perform.

Section 2.3—Program Profiles

This section of the guidebook will address itself to translating requirements and objectives into sub-program profiles. Each of the b_i skill sets will be analyzed and alternative instructional strategies developed to successfully bring about b_i skills among a predetermined target population.

A matrix useful in skill set analysis is demonstrated in Figure 5.2. Each skill to be developed for all home appliance repair sub-programs is listed horizontally (W_i). The skill-sets for each home appliance repair task are listed

Skill / Skill-Set	W_1	W_2	W_3	-	-	W_n
b_1	X	X	X		X	X
b_2		X	X	X		
b_3	X		X	X	X	
-						
-						
b_n						

Figure 5.2—Skill-Set Analysis Matrix

vertically (b_i), which are determined: $b_i = \Sigma W_i$. From the skill-set analysis matrix, curriculum programmers may determine instructional sequences and strategies for efficiently programming trainees such that maximum numbers of skill-sets $\sum_{i=i}^{n} b_i$)may be developed within varying time modules. For example, from the matrix it is evident that skill W_3 represents a behavioral expectation for at least skill-sets b_1, b_2, and b_3 and thus may require similar instruction. It is also evident from the hypothetical matrix that skill-set b_1 requires both W_1 and W_3 and further, skill-set b_3 requires W_1 and W_3. Therefore, the analyst would determine if all skill requirements for sets b_1 and b_2 are sufficiently common to programmatically structure the curriculum such that skill-sets b_1 and b_2 may be developed concurrently within a specified time dimension.

The output realized from generating program profiles is a set of subprograms that have utilized available inputs, objectives, objective requirements, environmental influences, and instructional technologies. The subprogram profiles serve as a transfer function between objectives and performance of alternative training strategies. Therefore, we may abstractly express the hypothetical systems analysis condition at this juncture as:

$$\sum_{i=1}^{n} (O_1, O_2, O_3 \ldots O_n) = f(P_1 + P_2 + P_3 + \ldots P_n),$$ which simply states that all objectives are realized through the sub-programs (P_i) designed to meet those objectives (see Chapter III for the relationships between student objectives and organizational objectives).

Section 2.4—Critical Performance Parameters

The definitions of requirements and objectives developed during process number two inherently contain a plethora of variables, some directly related to objectives and some only tangentially related to objectives. The purpose of this section is to determine those variables which are critical to program performance, e.g., specific instructional personnel, space, equipment, time, etc. may or may not be critical depending upon a myriad of circumstances. For example, the input data may reveal that a manufacturing plant recently located within the metropolitan area employs a very high percentage of persons having the most efficient combination of entering behaviors requisite to the training program under consideration. Further, the multiple models of specific type of home applicances to be repaired may become critical when time-frame referenced. And, the lack of sufficient fiscal resources allocated to the training program may provide further constraints. Although the examples are not intended to be exhaustive they may serve to stimulate one's thinking relative to identifying critical performance parameters objectively and outside the context of alternative program profiles. This issue of separate context is itself critical in the planning and developmental stages of curriculum programming. Too often, curriculum programmers allow real or supposed constraints to confound their creative efforts. By separating program profile development and analysis of constraints one could logically expect more thorough and more creative outputs from each dimension. One should keep foremost in mind that the criticability of parameters are often time-bound, especially as they universally relate to costs and specifically as they relate to the dynamics of local factors.

Finally, each critical parameter is weighted, if possible, in terms of its probabilistic effects. Thus a coefficient of 0.75 would indicate that there is a 25 percent chance that factor will be critical. Other weighting schemata may also be used independently or collectively as long as decision rules are clearly established.

Section 2.5—Synthesize Alternative Systems

The taxonomy of critical performance parameters relative to program requirements and objectives are now interfaced with program profiles. Each P_i and its alternatives (P_{ij}) developed as outlined in section 2.3 above will now be assessed relative to programming requirements that are also critical parameters. One approach would be to develop a 2 x 2 matrix as demonstrated in Figure 5.2 by listing the critical parameters on one dimension and each P_{ij} programming requirement on the other dimension. Each P_{ij} that contains an identified critical programming requirement must be so designated since it may not represent viable alternative sub-programs. The array of P_{ij} containing no critical elements are reassessed as viable alternative sub-programs and synthesized into instructional programming packages. Those alternative sub-programs that contain critical parameters may be synthesized into alternative sets of programming configurations and may also be integrated with non-critical alternatives for synthesis. Thus, three sets of programming strategies have been identified relative to their containing critical parameters. By beginning with the set containing no critical factors, an analysis may be made to determine the extent to which the set of program objectives would be achieved assuming only that discrete set of alternatives. The procedure is reiterated for each set and if time permits each alternative programming strategy may be continued through the C/E analysis. However, decisions may be made to disregard those alternatives containing multiple critical parameters that meet the same objectives as alternatives containing non-critical parameters. And, one may prefer to develop decision rules for excluding alternatives from the totally critical set especially if coefficients of reliability have been assigned.

Section 2.6—Develop Hardware Characteristics

Among the significant factors of producing instructional sequences, especially in vocational-technical education programs, are specialized equipment requirements; also, most school districts develop a separate capital-outlay budget (generally a state requirement) for purposes of analyzing hardware requirements apart from operational needs.

Another reason for analyzing hardware needs is to determine if alternative strategies may be developed for time-sharing hardware among viable program alternatives and to assess competing equipment functions that serve multiple sub-program needs.

Section 2.7—Establish Basis for Evaluating Effectiveness

The scenario has developed to the scene where the instructional plot has been totally revealed. Criteria must now be established to measure the effectiveness of each P_{ij} and may include student behaviors, time, time-behavioral trade-offs, process monitoring, etc. Generally, effectiveness is a measure of the extent to which a P_{ij} may be expected to achieve a set of objectives over time. Several dimensions of program effectiveness were discussed in Chapter III and will not be repeated here. The output of this activity must be a set of criteria which "satisfice" program evaluation constructs for each P_{ij}.

Section 2.8—Measures of Effectiveness

Much discussion continues within educational circles relative to the appropriateness of program effectiveness measures. Certainly most educators have observed misinterpretations of standardized achievement tests. However, criteria-referenced measures of effectiveness generally avoid pitfalls of normalized output indices. Sets of behaviors may be observed and specific factual knowledge may be assessed relative to student outputs; time is specifically measurable; equipment performance may be assessed quantitatively; etc. The measures may also be indirect, e.g., reports from employers. As with all measuring techniques, one must be willing to accommodate a relative degree of myopia. It is to be hoped that measurement myopia is not so severe as to completely confound information utility.

2.9—Formulate Economic Cost and Program Effectiveness Models

The purpose of this activity is to develop a scheme for assessing each programming alternative (P_i) in terms of both effectiveness measures and cost measures. For simulation purposes the analyst must develop probabilistic expectations for each dimension but in *post hoc* analyses the factors are quantitatively known. Also, if weights are given certain measures of effectiveness then the model must accommodate those structures. For example, an effectiveness equation of a given program is illustrated below where ${}_eP_{ij}$ represents the effectiveness of P_{ij}.

$$(1)\ {}_eP_{ij} = \sum(0.15b_1, 0.20B_3, \ldots\ 0.50b_n)$$

Then, given a cost equation for P_{ij}, represented in equation (2) below, one may determine a model for comparing alternatives within a C/E context.

$$(2)\ cP_{ij} = \sum(C_1, C_2, \ldots\ C_n)$$

. The output of this section is twofold. First, cost and effectiveness criteria are related to each P_{ij} and secondly, decision rules are established for modeling costs and effectiveness of program alternatives. The latter may simply represent the least cost per objective or maximum attainment of objectives as a function of time with or without regard to cost. More about that in section 2.13.

Section 2.10—Effectiveness Equations

A simplified illustration of an effectiveness equation was given above. Each measure of effectiveness for each P_{ij} must be mathematically modeled. For simulation analyses probabilistic variable coefficients are often precarious unless a subjective experiential rationale situationally analogous can be dramatically demonstrated. For *post hoc* analyses one may employ statistical techniques (e.g., discriminate functions) to determine coefficients. However, the effectiveness equation need not be unduly complex—the sum of behaviors as a function of time may be most adequate in some situations. Generally, as one begins to discriminate more finely between competing alternatives one must rely upon more sophisticated designs to facilitate that discrimination.

Section 2.11—Cost Equations

Cost equations are also determined and assigned to each P_{ij}. Since each alternative strategy possesses at least one differentiating characteristic they may also contain differential cost variables. Cost models need not be completely expressed as summated dollars. For example, if space is a critical parameter it may be efficient to express the space component of each P_{ij} as a cost addendum—possibly expressed as a fraction of available space. The decision rules developed in section 2.9 will affect the nature of the cost equations. Generally one could expect to simply dollarize direct program inputs (personnel, material, etc.) but may provide indirect inputs (depreciation, space, administration) if the situation and penchant were thereby idealized. However, one must not be misled to think that behaviors are being individually costed. More often than not groups of behaviors plus support services and materials are being costed as an instructional package.

Section 2.12—Program Exercise Model

The purpose of this activity is to generate data in the format determined in section 2.9. If the decision rules provide for expressions of effectiveness to cost, those ratios are computed. A decision encumbent upon the analyst at this juncture is how to develop the required data expressions. Facilities range from hand computations to electronic data processing and generally the technique employed is a function of problem complexity. If discrimination must be keen, several statistical routines may be applied to single or multiple variables and those results integrated and/or differentiated prior to establishing the desired data set.

Comparative analyses are often straightforward solutions to three questions: (1) Which alternative is most effective; (2) Which alternative is least expensive; or (3) Which alternative is most effective and least expensive. The decision rules previously generated will direct the form in which the data will be presented for information purposes.

Trade-off analyses are somewhat more complex in that more variables are simultaneously assessed. Effectiveness, cost, constraints, and combinations of variables from each of those dimensions may be integrated and/or differentiated to produce data sets. The interrelationships of objectives may also serve as criterion variables. For example, a sensitivity analysis may be generated such that objectives of P_{ij} are compared within a time-effectiveness or time-cost configuration. Finally, the output of this activity is an array of comparable data sets for information purposes.

Section 2.13—Develop Decision Model

The decision model for selecting from among competing alternatives must be developed and analyzed to determine the effects of the model upon the program objectives. If the decision model were structured such that the least cost P_{ij} would be chosen, then one must determine if all program objectives have been programmatically included and further insure that encumbering constraints do not negate the possibility of operationalizing selected strategies. Decision variables should partition generated data sets such that invalid alternatives are immediately identified and recycled through the feedback loop. Again, one viable procedure for structuring complex sets of data is to array the data as in Figure 5.2 by listing decision criteria variables on one dimension and cost-effectiveness data sets on the other dimension.

Section 2.14—Evaluation and Feedback

Evaluation of the S-A/C-E process is essentially assessed relative to the perceived qualitative nature of information generated for decision purposes. Obviously, if the model does not meet management needs then alternative structures must be established. Depending upon the severity of the deficiencies, one must determine at which point (process #2 or #7) recycling will begin. If one were to view the S-A/C-E process as a dynamic subsystem for evaluating existing program strategies and continuous program development then the cybernetic loop provides continuous input for the dynamic subsystem; however, given that conceptualization, the feedback loop should intersect process #1 since data extraneous to the subsystem will also continue to influence the modeling process.

Section 2.15—Output

The process output simply documents information utilized in the decision process. If one were to conceptualize the decision process beyond the S-A/C-E process then at least two additional steps must be taken. First, the output must be arrayed as described in process block #15, but more important, each preceding assumption and each intermediate decision must be explicated and an attempt made to determine the effect of each assumption and each intermediate decision upon each output dimension.

Finally, systems analysis, cost benefit analysis and cost effectiveness analysis are essentially "managerial artforms" and as with other artforms, developed talent is generally the most productive. Care should be taken to differentiate between the three processes since each is functionally esoteric.

Program Evaluation and Review Technique (PERT)

One of the most celebrated monographs addressed to educational management is Cook's (1966) (D) explication of PERT applications in education. Although Cook's thesis is primarily directed toward research and development project management, his thorough chapter describing basic PERT characteristics provides sufficient concept development for extensive esoteric extrapolation; however, others (e.g., Handy and Hussan, 1969)[6] have differentially applied PERT to educational management problems and each of the cited publications provide sufficient bibliography.

Possibly one of the most overlooked features of PERT, at least to the exclusion of literary emphasis, is the extent to which complex activities may be readily communicated. McEnrol, among others, in his University of Wisconsin dissertation (1968) (H) developed a sophisticated network analysis for constructing a high school building. Although the complexity of issues surrounding school-plant planning is beyond the scope of this synthesis, a moments reflection by the reader in that regard should readily reveal that complex task.

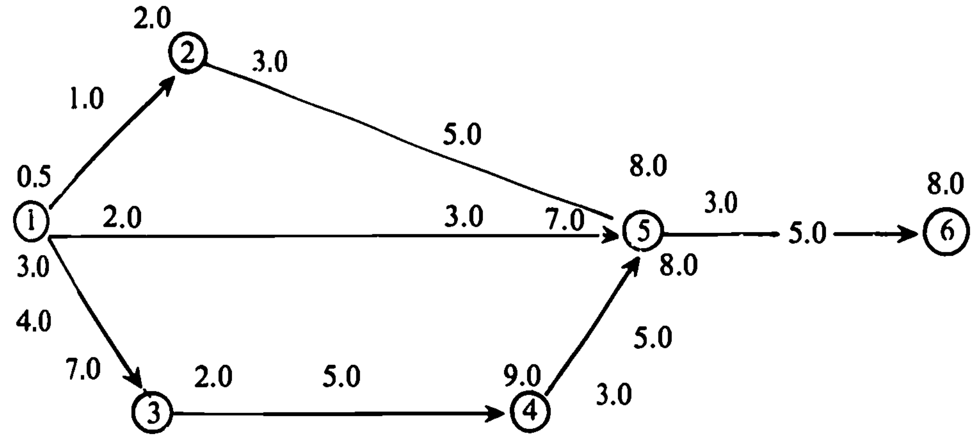
The conceptual differences observed between flow-charting and network analysis seems to be that network analysis goes beyond activity sequencing. An example of activity sequencing or flow-charting was demonstrated in Figure 5.1 which simply abstracts process sequences and interfacing. The PERT approach adds to process sequences and interfacing probabilistic time-referenced estimates to concurrent activities having different dependencies.

Figure 5.3 represents a simplified network which will be used for illustrating time-referenced determinants. First a scenario. Assume that a high school principal (Mr. P) decides to survey his students relative to vocational interests. After the student questionnaire has been developed he decides to also survey the parents of students attending his school. He wants his findings in 30 days to present to his faculty curriculum committee. Mr. P then develops the network analysis demonstrated in Figure 5.3.

Obviously, if all of the most pessimistic time-frames are realized, Mr. P will not have his report ready for the faculty curriculum committee when desired. Even if all most expected time-frames are realized he has only two days slack time. Just as obvious is the time-critical nature of the activities relating to the parential survey. Thus, Mr. P may more closely monitor those activities to ensure resources are applied to the extent that expected time-frames are maintained.

The above example assumes Mr. P operates independently for each task. That assumption is not the normative case. Generally, activities are concurrently managed and thus require more complex modeling. Assume Mr. P only manages the activities required to generate data for his report to the curriculum committee and Mr. P will be personally responsible for activity 5-6. It is evident that he is constrained by the person(s) respon-

[6] H. W. Handy and K. M. Hussan, *Network Analysis for Educational Management.* Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1969.



Preconditions: Student survey instrument developed. 30 days maximum time limit.

		—Time duration estimate in days—		
Activity	*Description*	*Least*	*Expected*	*Pessimistic*
1 - 2	survey students	0.5	1.0	2.0
1 - 3	develop parent instrument	3.0	4.0	7.0
1 - 5	develop data exercise model	2.0	3.0	7.0
2 - 5	analyze student data	3.0	5.0	8.0
3 - 4	survey parents	2.0	5.0	9.0
4 - 5	analyze parent data	3.0	5.0	8.0
5 - 6	prepare report	3.0	5.0	8.0
	Total	16.5	28.0	49.0

Figure 5.3—Illustration of Network Analysis

sible for activities 1 - 2, and 2 - 5 but pessimistic time-frames reveal that only 10 days are maximumly required for those activities. Further, activity 1 - 5 should be completed within 7 days and presents no apparent constraint. Finally, the person(s) responsible for activities 1 - 3, 3 - 4, and 4 - 5 should complete all tasks within 24 days. If the latter activities take the full pessimistic 24 days, then Mr. P may not afford the luxury of his pessimistic time-frame for activity 5 - 6 since 8 days added to 24 days exceeds his 30 days requirement. Again, the critical path for Mr. P to monitor closely is the path containing activities 1 - 3, 3 - 4, and 4 - 5.

Cook and others fully explicate techniques for developing time-frame estimates, determining critical paths (CPM), and various other computations. The process has also been programmed for electronic data processing that provides various techniques for monitoring progress and managing-by-exception.

Decision Trees

Decision trees provide another network approach to structuring complex problems. The technological emphasis is upon decision points as opposed to event emphasis found in PERT. Yet, like other network approaches, the decision tree allows one to view decision sets within the context of interacting subsystems. Although one might be tempted to equate the decision tree approach with that of ordering a given set of decisions requisite to planned activities, it would seem more appropriate to identify the decision sequencing technique as a subsystem of decision tree analysis. Decision tree analysis not only identifies future decisions predicted upon a present decision, it further identifies concomitant interrelationships of other activities and specifies decision parameters of those activities as a function of present and future decisions. Further, the decision tree method may vary from a simple qualitative branching network to a sophisticated stochastic network with accompanying probabilistic indices on both immediate and subsequent decision requirements. The decision tree uses a series of modes and branches to demonstrate conceptually interrelationships of choices and events or results at least partially affected by chance, uncontrollable circumstances, or design (Magee, 1964) (H). A generalized example is provided in Figure 5.4.

As noted in Figure 5.4, subsequent decision points may be constrained by chance or uncontrollable circumstances. The chance points may also be interpreted to be program monitoring output if one views the decision tree as a planned decision process having cybernetic capability.

For example, suppose the decision is made by the state vocational education staff to expand curricular offerings at the secondary school level in the area of health services. Further assume that these sub-programs A, B, and C are designed and staffed during the first year and field tested during the second year. The chance point at the end of year two identifies that body of knowledge generated during the two years' activities. That information includes: appropriate and inappropriate curricular content; student responses in terms of enrollments, behavioral change, marketability of acquired skills, etc.; program costs; and other qualitative and quantitative analyses. Beyond the first chance point, if one will assume for illustrative purposes that student demand dictates the program supply that will be offered, the second decision points of programs A, B, and C become inextricably contingent upon each other relative to planned and unplanned constraints. Unplanned constraints may include: budgetary changes, changes in forecasted manpower needs, adverse legislation, etc.

The sequence in Figure 5.4 is designed such that program B will follow (possibly for curriculum testing purposes) a pre-designated programmed sequence throughout the analysis period. This type of arrangement is not uncommon when a particular program has been given sufficient long-range priority for specific reasons. However, given the indicated priority does in fact constrain subsequent decisions about programs A and C and that is essentially what decision tree analysis is intended to demonstrate.

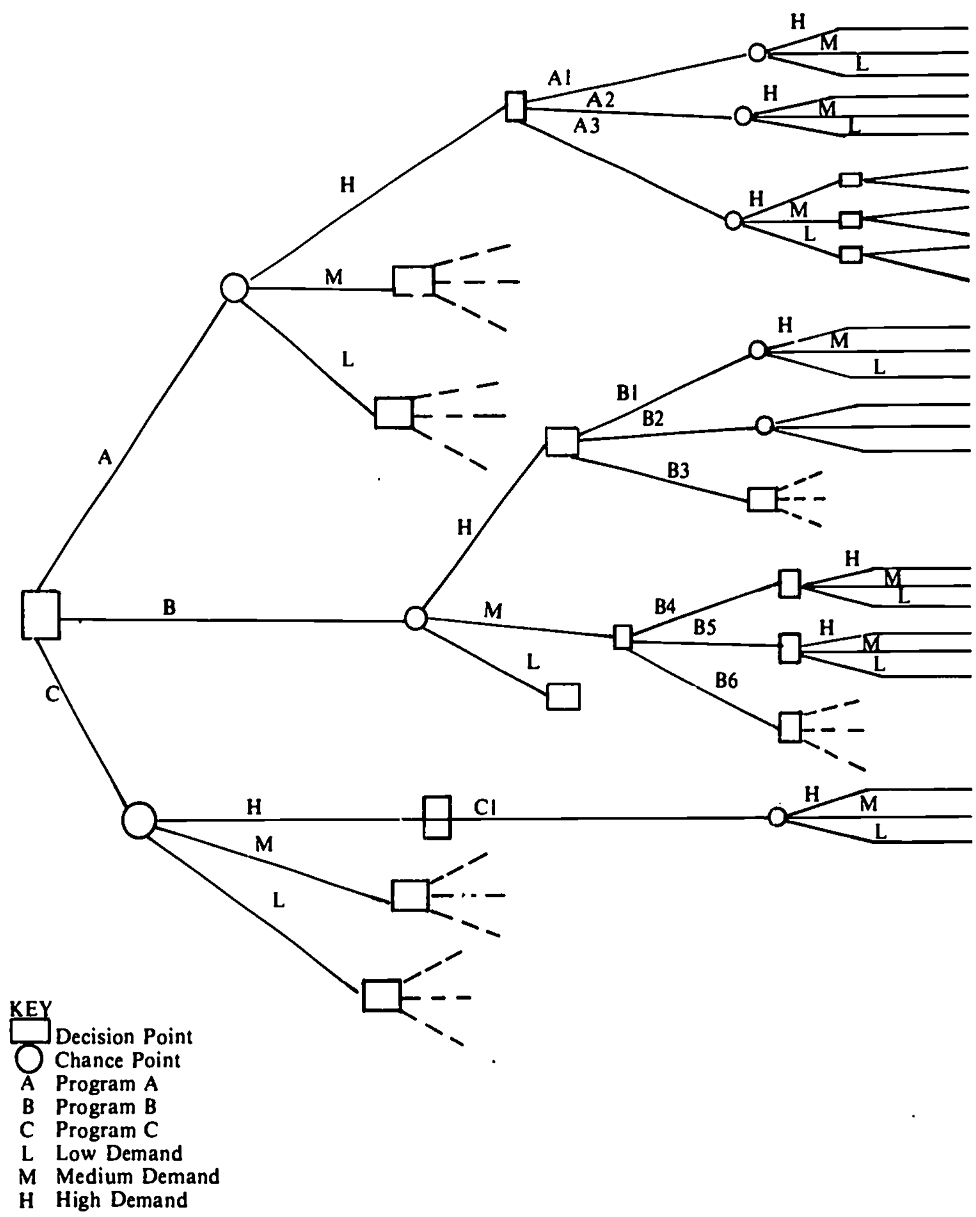


Figure 5.4--Decision Tree

Other Techniques and Tools

Trend analysis is a time-honored management technique for making predictions about future conditions and is no stranger to educational program managers. Student enrollment and revenue forecasting are normative administrative functions throughout the nation's school districts. However, without sufficient data bases or given dynamic change conditions, trend analysis may rapidly be reduced to an exercise in futility. Several tools will be discussed relative to insufficient data bases and change conditions.

Faced with an insufficient data base, educational managers may employ several techniques to bring knowledge to a given condition. The most direct and most widely used method is to sample opinions of one or more persons recognized as knowledgeable in the specific area under consideration. "Consensus" management, identified with the democratic leadership notions of the 1950's, often may bring authoritative weight to bear upon a set of problems. It may also bring to bear pooled ignorance.

Individual forecasting is accomplished by temporarily employing an expert in the specific problem area. Expert opinion can often prove valuable in that knowledgeable individuals possess training and experience that specifically qualifies them to adequately deal with certain sets of problems. If conditions are such that it is not considered efficient to engage one individual, then a panel may be assembled or polled. The two primary differences between an assembled panel and a panel poll are the relative locations of the experts and the interaction among experts. An assembled panel will discuss the problem area and attempt to agree upon preconditions, processes, and post-conditions in their report to the sponsor. If the panel is polled, survey instrumentation must be developed that stimulates the individual experts to address a clearly communicated problem area. As with the assembled panel, consensus is sought.

There is however a more systematic technique for soliciting expert opinion—the delphi technique. The delphi technique avoids committee activity and its concomitant psychological inhibitions such as spacious persuasion, unwillingness to abandon previously communicated positions, and the bandwagon effect. Direct debate is replaced by carefully designed sequential interrogations of individuals which are interspersed with information and opinion feedback derived from computed consensus of previous interrogatives. The technique has been described by Helmer and Rescher (1960) (H) and one broad study utilizing delphi methods reported by Gordon and Helmer (1964) (H).

Given certain data bases, the trend forecaster may employ several managerial tools. Simple extrapolation does not consider causative factors but linerally projects historical data. Student enrollments are often projected linerally based upon historical data. Dynamic factors, such as a road construction crew moving into a community for one-year's duration, often confound simple extrapolation utility; but, it is more often than not the best tool available. However, given certain qualitative judgement modification, curve fitting may produce high quality results. Tools for systematic curve fitting include: method of least squares, regression analysis, correlation analysis, and others discussed in both high school and college level statistics texts.

Effective management bases decisions upon available information and/or upon best intuitive judgment in the absence of data. A purpose of this chapter was to synthesize some of the techniques and tools available to educational manager to bring knowledge (information) to bear upon complex management problems. If one is to manage-by-objectives or manage-by-exception then data are prerequisite.

TRAINING OF ADMINISTRATORS AND NEEDED RESEARCH

The sixty-third yearbook of the National Society for the Study of Education (Part 2, 1964) was devoted to perspectives, issues, concepts, research, and training implications for educational administration. Culbertson's chapter addresses itself specifically to the preparation of administrators by reviewing the management efficiency thrust at the turn of the century, the human relations movement following World War II and into the early fifties, and into the scientific emphasis that characterizes administrator training programs today.

The scientific emphasis of educational administration rests upon the assumption that administration requires an objective understanding of phenomena without confusion between facts and values (Simon, *et al.*, 1950) (J). Thus, the contemporary movement places a premium upon theory and data generated from "what is" and holds little regard for "what ought." Culbertson clearly binds administrative orientation to social orientation which is more thoroughly assessed by Gross, Callahan and Button, and Haskew in other chapters of that publication.

Gulick and Urwick's often quoted POSDCORB, maintains that administrative behavior is focused toward the functional activities of Planning, Organizing, Stimulating, Directing, Coordinating, Reporting, and Budgeting. Given that orientation training institutions would then set about developing curricula that taught techniques and tools for administrative tasks. However, task developed strategies do not now permeate administrative training programs. Culbertson observed emphasis upon decision-making, communicating, maintaining morale, and effectively coping with change. Those concepts are not contemporarily viewed as tasks but as data generating theoretical models and are researched as such.

The above is not to imply a minimum regard for skill development among administrative training programs. Skill development, knowledge, and socialization appear to represent the tri-dimensional approach to training administrators.

A time-honored argument of beginning teachers and administrators has been that training instructions provide little in the vein of practical experience (except internships) and knowledge that a practitioner may draw upon when initially placed in educational employment. As noted, the exception being the internship (a socialization process) which is perceived by many beginning practitioners as being the most significant experience in their training program. Subsequently, many training programs now include the internship experience as a major dimension, and alternative experience configurations currently are being tested (e.g., teacher internships during the third program year as opposed to the fourth program year, full-year experiences as opposed to one semester experiences, etc.).

It has been established that significant experiences may be gained from a well organized and administered practicum. Further, it seems just as obvious that other planned socialization experiences could likewise provide significant inputs to one's professional growth. And, it seems that given an extended time dimension, professional socialization experiences multiply into what is commonly known as "an experienced professional." Given the sum of the above rationale as a conceptual base, one may attempt analysis to explicate role expectations for a given position incumbent; thus, role study has developed with marked sophistication among students of educational administration.

Given the research base that currently exists and the training emphasis upon communication, analytical abilities, and socialization, it would seem that a training program for educational administrators should be designed to enable each trainee:

1) to develop skill in working with individuals and groups in planning and administering programs;
2) to acquire competence in the use of research skills and techniques as well as to become an avid consumer of education research;
3) to gain understanding of concepts, theories, and methodologies of administrative behavior as it relates to program management;
4) to sharpen skill in written and oral communication;
5) to broaden knowledge of the organization and operation of public schools and of the teaching and learning process; and
6) to engage on-the-job administrative experiences under supervision of university and school district personnel.

The above postulated training objectives would seem to provide significant formal experiences to insure professional growth and development for aspiring directors of vocational-technical education programs. One could hardly take exception to the postulates at the conceptual level for which they are established. However, it is at the second and third order of complexity that instructional strategies must be evaluated and at that juncture incongruent perceptions proliferate.

Finally, institutional role expectations, personality characteristics, training experiences, and professional socialization experiences all seem to influence the role-behavior of position incumbents. Getzels, *et al.*, (*op. cit.*, 1968) (A), have articulated with exceptional clarity the nomothetic constructs of role expectations and the interacting idiographic constructs of personality characteristics. Unlike the vocational-technical training model which prepares an individual to perform a given task, the educational training model must provide a theoretical base from which and through which innovation and creativity of individuals are facilitated.

Finance and Administration

Lindman and Kurth[1] have recently assessed the need for vocational education, the role of the federal government in vocational education, and some implications for financing vocational education. Their report was one dimension of more than a dozen studies conducted by the National Educational Finance Project which probably represents the most comprehen-

[1] Erick L. Lindman and Edwin L. Kurth, "Dimensions of Need for Vocational Education," in *Dimensions of Educational Need*, Johns, Alexander and Rossmiller (eds.). Gainesville, Florida: NEFP, 1969.

sive fiscal survey of American education ever undertaken. Lindman's second report, *Financing Vocational Education in the Public Schools* (1970) (G), contains a well documented thesis on the fiscal needs of vocational education projected into the 1980's. The final chapter of Lindman's report explores five issues he feels to be critical to the development of a satisfactory system for financing vocational education.

Early in Lindman's study it was determined that public school accounting schemata was inhibitive to generating program costs analyses and the need for program accounting was reiterated at several instances. Based upon Lindman's national findings and other developmental activities in the area of PPBS identified in Chapter III, it would seem productive to develop a systematic cost accounting scheme for measuring program inputs for vocational education. The following areas of research and development seem cogent:

1) Develop a system for allocating federal support to vocational education based upon program needs and the fiscal capacity of states to support vocational education. Program need variables may include differentials associated with: (a) the nature of individual programs—class size, equipment, etc., (b) national manpower projections (training incentives), (c) program enrollments, and (d) other operational varibles. The fiscal capacity index may include differentials associated with: (a) personal income, (b) property value, (c) industrialization, (d) sales, (e) other tax bases, and (f) propensity to tax.
2) At the state level, alternative program allocation structures need to be researched and developed based upon program needs and the fiscal capacity of school districts, regional vocational schools, and junior colleges to support training programs. Criterion variables may be similar to those expressed in #1 above.
3) At the program operational level, common charts of accounts must be established to measure programmatic inputs. If funding decisions are to be based upon relative educational priorities then measures of inputs are prerequisite. Also, if cost-effectiveness analyses are to be performed to provide decision-makers with qualitative information then inputs must be explicitly measured. Given the conceptualizations in Chapter III, it would not seem to be prohibitive to develop sub-program accounting within the vocational-technical dimension of the established program structure.
4) The cost differentials of various vocational programs need to be developed by each state agency. Lindman's indices of excess cost factors need to be tested by individual states to develop a more narrow margin for allocation purposes (Wilsey has done this for New Mexico acting independently of Lindman).
5) The fiscal relationships of alternative programming strategies need quantification. Given that on-the-job-training may produce some economies (salaries, equipment, etc.), those economies that exist among and between training configurations need to be revealed.

6) The whole area of public vs. private vocational education needs data based analysis. For example, in what areas may the public employ such notions as "educational vouchers" as an alternative to financing public programs?

The Psycho-Social Dimension

Psychologists and sociologists have long cautioned industry that fiscal remuneration is not the only reward sought by employees. Such problems as high turnover rates, absenteeism, alcoholism, etc., are symptomatic expressions of incongruent individual need-dispositions and role. The following areas for research would seem productive:

7) A determination of the need-dispositions of individuals who seemingly accommodate role expectations of various occupations may provide insights for both employment practices and recruiting. For example, a position that is characterized by ambiguity may be most successfully accommodated by individuals possessing a high tolerance for ambiguity—other role-need dispositions held constant.
8) Research describing occupation mobility would seem appropriate at both the national and state levels. Technological innovations readily transform occupational requirements and subsequent training demands. Previous research and development cited in Chapter IV relative to task analysis and vocational guidance information systems seem appropriate.
9) The testing of many conceptual issues relative to program evaluation need data base explication (Weisbrod, 1966) (I) as well as citations afforded as a result of previous research (Nelson, 1969, Neubauer, 1967, Law, 1968, Boyle, 1965, Dillion, *et al.*, 1967, and others) (I).

Occupations and Programs

If vocational-technical education is to be effective, it is necessary that the time between demand and supply of skilled labor pools be shortened within geographical areas. Manpower surveys must continue to develop sophistication if employment service agencies are to respond effectively to demands. Curriculum development within existing training programs is in need of reassessment utilizing as a criterion variable—employability.

10) Alternative instructional strategies based upon taxonomic skill development will continue to be an attractive area for research—both in terms of costs and time.
11) Given the national emphasis upon college matriculation, investigations by teams of sociologists, psychologists and educators need to be addressed toward the psycho-socio implications of that national syndrome. Such a broad survey would surely identify a myriad of areas needing quantification prior to national policy making.
12) The whole area of program accountability needs investigation. The

input studies identified above take on a totally different dimension when coupled with output assessments. Models may follow Tyler's *National Assessment in Education* or program evaluation notions developed in Chapter III. Cost effectiveness strategies demonstrated in Chapter V are without relevance unless the effectiveness dimension produces qualitative information.

13) Educationally, manpower forecasting reduces to program enrollments. The linkages between national and regional surveys and forecasts need articulation in terms of local program demands for guidance and program development purposes. It is misleading to demonstrate to a candidate the need in a given occupational area without revealing geographical and other employment constraints.
14) The Vocational-Technical Center's State Program Evaluation System should be evaluated and improved over at least a five-year period of operation. If common data are ever to be generated nationally from state departments, a system such as the V-T Centers must be demonstrated nationally as the trend in state vocational evaluation systems. Establishment of incentives in terms of grants and technical assistance to achieve the latter should be considered by the U.S. Office of Education.

Each of the citations in the bibliography contain explicit or implicit directions for research and development in the vocational-technical area. Model building, such as Uxer's for locating area vocational schools, is new to the educational scene but offers excellent potential for developing sophisticated management techniques. Finally, research is a creative activity limited in scope only by the imagination of the researcher. However, data limitations confound the best research designs and it is for that reason that most of the above recommendations are directed toward systematically developing data bases as a normative operational procedure.

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[1] Bibliographical entries followed by an ED or MP number in parenthesis are generally available in hard copy or microfiche through the Educational Resources Information Center (ERIC). This availability is indicated by the abbreviations, MF for microfiche and HC for hard copy. Order from ERIC Document Reproduction Service (EDRS), P. O. Drawer O, Bethesda, Maryland 20014. Payment must accompany orders totaling less than $10.00.

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