A SYSTEMS APPROACH TO CURRICULUM DEVELOPMENT AND INSTRUCTION FOR OCCUPATIONAL EDUCATION IN ETHIOPIA

By

YOSEPH BEFECADU

Bachelor of Science
Haile Sellassie I University
Addis Ababa, Ethiopia
1967

Master of Science
Oklahoma State University
Stillwater, Oklahoma
1972

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
May, 1975

A SYSTEMS APPROACH TO CURRICULUM DEVELOPMENT

AND INSTRUCTION FOR OCCUPATIONAL EDUCATION

IN ETHIOPIA

Thesis Approved:

Robert Terry
Thesis Adviser

James P. Key

Robert R. Price

Kenneth St. Clair

N N Durham
Dean of the Graduate College

ACKNOWLEDGMENTS

The writer wishes to express sincere appreciation to Dr. H. Robert Terry, who served as Chairman of his advisory committee, for his invaluable counseling, assistance, and guidance in writing this dissertation. Appreciation is also expressed to the other committee members, Dr. James P. Key, Dr. Robert R. Price, and Dr. Kenneth J. St. Clair for their council and assistance.

Special acknowledgment is expressed to Dr. William E. Segall for his constant advice and assistance.

Special recognition is extended to my parents, Mr. Befecadu Wolde Michael and Mrs. Aster Workineh, for their continued support and encouragement.

Acknowledgment would be incomplete without my sincere gratitude to my wife, Theresa Befecadu, for her interest, assistance, and encouragement in my graduate study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure | Page

CHAPTER I

INTRODUCTION

The application of a systems approach to educational planning in Ethiopia can provide for a scientifically-derived methodology for planning and managing change. Unlike in the past when decisions were generally based more on opinions than on results of scientific investigation, currently, with the limited resources available--funds, personnel, facilities, etc.--and with the need for education, not only growing continuously, but also changing rapidly, systematic planning as a rational base in the decision-making process in education has become inevitable. Educational planning can supply curriculum planning models, effectiveness measures, prediction techniques, allocation of resources, and systematic evaluation. Tanner (63) alludes to this by stating:

> Educational planning provides a network of logical procedures for thinking and solving problems. Such planning utilizes various approaches to curriculum modification by providing a set of alternatives for each program in terms of effectiveness and cost. The elements of choice provided by planning present the decision maker an opportunity to assess the degree of achievement of educational objectives through systematical investigation, evaluation, and prediction of outcomes (p. 9).

Curriculum building in occupational education is also rapidly incorporating the systems approach. Tracey, Flynn, and Legere (64) suggest that systems thinking as applied to the improvement of military training programs can be used to upgrade curriculum and instruction in vocational education. They point out that the systems approach, which attempts to combine human and material resources, requires a control model for proper management. According to these authors, this model had reduced, over the four-year period of refinement, on-the-job training time, cut academic failures, improved teaching efficiency and lessened the overall training time. The cycle starts by analyzing market needs and ends by evaluating the student after graduation.

It is, therefore, the thesis of this study that judicious use of systems analysis techniques by decision makers can contribute toward a more practical approach to educational planning. To this effect this study is to provide an insight as to how curriculum planners can make use of the systems approach in developing curriculum, and thereby design a conceptual model for systematic curriculum development in occupational education for educational institutions in Ethiopia.

Need for the Study

Much of the literature on educational research being conducted in Ethiopia seems to point out the lack of certain rationales or guidelines by which individuals concerned could arrive at intelligent decisions on educational policies. Illustrations of such deficiencies are found in the writing of an American professor of education who taught for many years in Ethiopia.

> It seems past time for the Ethiopians to quit jumping from one idea to another and approach education in a much more scientific manner--through careful research procedures, (and) conclusions as to how the public can be best served with the educational funds available (30, p. 14).

Similarly, Habte (24), former President of Haile Sellassie I University, observed that:

> Ethiopia's education is harassed by the absence of carefully worked out educational policies . . . the patchwork character of the school curricula; the inadequate supply of suitable textbooks . . . ; the hasty and uncritical acceptance of recommendations from foreign advisors--or their equally uncritical rejection; . . . (p. 49).

Both of the above studies indicate the need for a scientific and rational approach in educational planning in the Ethiopian system of education. They point out the need for a systematic approach in the educational decision-making process--the need to isolate and identify problems, to study and select the optimal strategy of solving these problems, with due consideration "as to how the public can be best served with the educational funds available;" and to evaluate both their effectiveness and their effects on the working of the overall education or training system, instead of the "patchwork character" thus far exhibited.

Occupational education is as much a victim of such discrepancies as any other discipline in the system. In spite of the fact that occupational education in any society should as much as possible be geared to jobs available currently and in the near future, in Ethiopia, because of implementation of programs without adequate planning, it has consequently resulted in training and employment being too far apart. A recent manpower study conducted in Ethiopia reveals:

> At present there is a variety of standards, backgrounds, and levels of training in some of the occupations, depending on the agency or the management that provides the training facilities. The result is that many young persons on the conclusion of their training find themselves unsuited to meet the requirements of employers or the demands of the employment market. Unemployment and a general lowering of efficiency of the labor force are the result, not to speak of the wastage of effort, and the expenditures involved in the training process (27, p. 46).

The report does not only call for improved coordination between training and employment, but also for standardization of training content in respect to the various occupations in which training is provided.

The Education Sector Review (18) Task Force on Manpower also presents this same problem.

> Shortages of manpower in some skills exist side by side with surpluses in others. Similarly, while there may be no shortage in numerical terms in an occupation, those available are often not able to match the requirements of the job, since the job-seekers do not possess what the jobs require. Both these problems demand that adjustments should be made in the educational training system in order to ensure that the products of the system match the needs of the employment market both in regard to quality and numbers. For this purpose it is necessary that studies should be undertaken, in cooperation with industry, regarding the current and future requirements of the economy for skilled manpower in qualitative and quantitative terms and the results used to modify vocational training programmes from time to time (p. 1).

According to this study (Task Force on Vocational Education) there are, currently, different sponsors and organizational patterns of occupational education in Ethiopia. These groups of sponsors have different motives and varying degrees of interests in occupational education and training. To make their contributions more productive, however, ". . . they should follow a standard procedure of curriculum development. Fragmented efforts resulting in plowing the same ground are economically inefficient and ineffective" (p. 89).

These reports indicate the need for a standard procedure of curriculum development. They also point out the fact that most of Ethiopia's educational problems converge from "fragmented efforts" attempted by both private and governmental agencies concerned with occupational education, which have proved to be not only inefficient and ineffective, but also, uneconomical. Again, from these studies the same needs described earlier prevail--the fact that "isolated parts can rarely provide adequate information about a system, but a system can provide valuable information about the functions fulfilled by each of its components" (15, p. 13). This same context is described by Lave and Kyle (38) as:

> . . . usefulness is not determined by the elegance of the theories or the degree of sophistication of the methods, but by how well the method integrates all potentially useful factors into a practical decision-making structure. This integration of complex factors into an analytical framework to aid practical decisions is the essence of the Systems Analysis Approach (p. 39).

However, the task of curriculum development does not only require the "integrated" or the "whole concept" approach, but also the cooperative effort of professional educators and public leaders. It also requires the establishment of rationales, or guidelines, on which various aspects of curriculum decisions, including those on selection and standardization of training content, can be made. To this effect, Pfeiffer (51) describes the systems approach as:

> The systems approach can be regarded as a disciplined way of using specialists in a variety of fields to analyze as precisely as possible sets of activities whose interrelationships are very complicated, and of formulating comprehensive and flexible plans on the basis of the analysis. The frame of reference is unequivocally the real world (p. 2).

The intent of the foregoing discussion has been to establish some concrete reasons for the application of the systems analysis approach to the current problems of Ethiopia's educational system, particularly to those concerned with curriculum development in occupational education. In the discussion the need for a scientific approach to educational planning, the integrated and/or the Gestalt concept in such planning, and the need for a standard procedure for curriculum development in occupational education have been identified.

Statement of the Problem

In education, as well as in other spheres, systematic research and development are required to arrive at solutions better than those achieved hitherto. To this effect, the central problem of this study is to develop a model based on an analytical framework for the application of a systems analysis approach to curriculum development in occupational education for educational institutions in Ethiopia.

Purpose of the Study

The purpose of this study, therefore, is to design a model for curriculum development in occupational education using systems analysis approach. Curriculum planners of both government and private sectors of the Ethiopian educational system may learn how and when the use of systems analysis approach to curriculum development will be helpful and often necessary, and be cognizant of those factors suggesting need for change.

Definition of Terms

The following terms are operationally defined in order to maintain consistency throughout the paper.

System: the set of components, or subsystems, that are brought together to function as an integrated whole for the purpose of the accomplishment of its objective.

Subsystem: a part of a system, comprised of two or more components, with a purpose of its own and designed to interact with its peer subsystems in order to attain the overall purpose of the system.

Components: parts which comprise a system and which are selected to accomplish specific functions required for the attainment of the objectives of the system.

Suprasystem: a larger entity, designed for a specific purpose, which is comprised of two or more systems.

Constraints: known limitations and restrictions in the capabilities of human and material resources involved in the design, development, and maintenance of a system.

Environment: the larger context in which a system operates, from which it receives its purpose and resources and to which it is responsible for the use of resources and for the adequacy of its output.

Systems Approach: the application of analysis and synthesis to a system.

Mission: is the statement of the goal of a system. It states what is to be accomplished, when, and by whom.

Function: is the statement of major jobs that are necessary to perform inorder to accomplish the mission.

Task: is the most discrete performance undertaken to complete a function.

Evaluation: is the assessment of progress in the achieving of a previously stated goal.

Model: is an analogy.

Curriculum: all the learning experiences provided the learner under the guidance and direction of the educational institution through which it expects to achieve its objectives.

Curriculum Development: is the structuring and restructuring of the interaction that takes place in the curriculum.

Occupational Education: is the instruction that is given in a curriculum designed to meet the employment objectives of an occupational area.

CHAPTER II

REVIEW OF LITERATURE

In this review of literature, an analysis of theories, techniques, and principles fundamental to a systematic design of a curriculum model to develop a theoretical framework is presented. Accordingly, the following issues were considered:

1. Systems Concept.
2. Systems Approach: Principles and Procedures.
3. Models.
4. The Application of Systems Approach in Education.
5. Limitations of Systems Approach in Education.
6. Basic Considerations in Curriculum Design: An Approach to Systems Analysis.
7. Curriculum Design in Occupational Education.
8. Systems Approach Applied to Curriculum Design.

Systems Concept

The terms system and system approach are quite popular in the literature of education today. The system concept is not new, however, like every other concept, man's present understanding, interpretation, and application of the concept reveals an evolution in its meaningful utilization. The concept has been expanded during the course of its evolution and has been validated through historical use and subsequent appraisals.

Historically, man has utilized the concept of systems in his interpretation of his environment. Miller (47) traces back the concept of systems, ". . . to ancient civilizations who viewed the universe as a system of interacting phenomena" (p. 1). He further points out that it was man's curiosity and his desire to understand and predict the behavior of theoretical and natural systems that prompted his quest for knowledge. As the dimensions of the universe and knowledge were widened, the system concept expanded and became dynamic. The system concept, subsequently, can be regarded as a functionally relevant logic construct for use in studying any given context.

At this point, a short explanation of the derivation of the systems approach might enhance the understanding of the concept of systems. E. B. Montgomery (5), like many other system analysts, traces the derivation of systems to the World War II days. He writes:

> Historically the systems approach arose in the early days of World War II when it was necessary to design stability into systems which were inherently unstable in their operation. Examples of this are aerodynamic structures in flight, missiles, and data reduction systems. Since World War II the systems approach has come to be applied to almost all areas of human activity (p. 367).

According to Feyereisen, et al. (21):

> The origin of systems, as we know them today, can be traced to the work of the engineers, particularly electrical engineers, in developing what we call automation. As they developed automated systems such as telephone dialing systems or computer-controlled assembly lines, they originated terms and concepts which described the processes and equipment they were using. Through its evolution from engineering, to the biological sciences, and finally to the social sciences, the systems approach has retained many of the terms used by the engineers (p. 39).

Systems concepts can also be traced back to the Gestalt psychologists of almost fifty years ago, who helped popularize the observation that the whole is greater than the sum of its parts. Accordingly, a definition of systems has been stated by Miller (47) as: "A system is the gestalt which results from the sum total of the separate parts working independently and in interaction to achieve previously specified objectives" (p. 3).

The stated definition incorporates the idea of Gestalt and thereby, the idea that the effect created by the sum total of the separate parts working independently and in interaction is greater than one could predict based upon an examination of the individual parts.

Kaufman (32, p. 419) elaborates this definition by viewing education as a system and identifies some of the components of this educational system as teaching and instruction, management and administration, facilities and support, community and learners. Each of these components, when considered alone, may be classified as an individual system, working independently and in interaction to achieve the desired educational objectives.

A similar definition to Miller's is one proposed by Feyereisen, et al. (21). They define a system as ". . . a set of components organized in such a way as to constrain action toward the accomplishment of the purposes for which the system exists" (p. 38).

An operational definition of systems is presented by Knezivich (33). He writes:

> A system can be defined simply as any collection of persons with resources, a plan, and a goal. The various elements within it are ordered and arranged to accomplish a stated mission in a particular way. A system may be pictured as a device for converting inputs (such as manpower, machine power, space, and money) into desired outputs. All this

> is done according to a plan and any constraints that apply must be spelled out. Components within a system are interactive and interdependent (p. 8).

He further states that every system has boundaries. There is an environment that surrounds it--a kind of a skin that separates the unique entity called a system from factors outside it. If there is interplay between factors within and those outside the system, it is called an open system. If there is no interchange, that is, the boundaries of the system are impervious to exogenous forces, it is called a closed system.

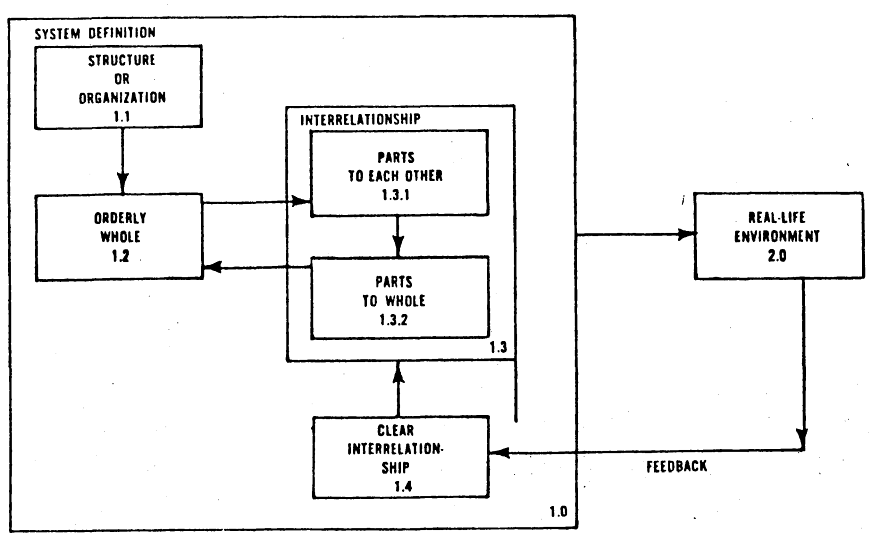
Further, all systems except the very smallest have subsystems, and all except the very largest have a suprasystem. For example, an amoeba, in spite of its minute size, has subsystems which allow it to sustain life and propogate the species. A school system, however large, is part of the total educational system of the state or country. Therefore, we can say that virtually all systems have subsystems and are part of a suprasystem.

Incorporating most of the ideas presented above, Banathy (2) provides a comprehensive definition of systems, as follows:

> Systems are assemblages of parts that are designed and built by man into organized wholes for the attainment of specific purposes. The purpose of a system is through processes in which interacting components of the system engage in order to produce a predetermined output. Purpose determines the process required, and the process will imply the kinds of components that will make up the system. A system receives its purposes, its input resources, and its constraints from its suprasystem. In order to maintain itself, a system has to produce an output which satisfies the suprasystem (p. 12).

Banathy's description of systems provides for the Gestalt theory, as well as the working of the system components, independently and in interaction to produce specified objectives. It also mentions the presence of an environment (suprasystem) that dictates the purpose of the system--which determines the process and the process determines the kinds of components that make the system--the input resources and constraints of the system. In reciprocity the system has to produce output that will satisfy the environment.

Silvern (50) provides a different perspective to the concept of systems. According to him, the most critical aspect of system is the key word "interrelationship" and not "interdependence" and/or "interaction." His rationale is that, it is possible to have a relationship even where the elements are not dependent. Moreover, "interaction" is not a better term, since elements in certain systems interrelate, but do not necessarily "interact."



Source: Silvern (5, p. 367).

Figure 1. Interrelationship of System Components

Thus, his definition of a system reads: "A system is the structure or organization of an orderly whole, clearly showing the interrelationship of the parts to each other and to the whole itself" (p. 367). A flow chart model of his definition helps describe more clearly the interrelationship of the concepts in it (Figure 1). From this model and the above definition, the following criteria of a system emerge (58, Figure 1):

> (a) there must be a structure or organization;
> (b) the structure or organization must be conceptualized as a whole;
> (c) the whole must be orderly;
> (d) the whole may have parts;
> (e) parts can be shown clearly relating to each other;
> (f) parts can be shown clearly relating to the whole (p. 13).

Another concept of systems is offered by R. E. Corrigan Associates (52), who propose that:

> . . . for purposes of clarification, the term 'performance system' be substituted for the term 'system' when considering the fields of education and training. A performance system is defined as:
> 1. A whole composed of independent parts or components;
> 2. working independently and in interaction
> 3. to achieve, predictable, pre-specified performance requirements
> 4. in the achievement of an established final or terminal performance objective(s) (p. 11).

This definition includes both categories: product and process. The characteristics of a performance system demand accountability for terminal achievement of present performance standards.

Thus far, the review of literature discussed has presented the historical background, the derivation and operational definitions of systems. A system is usually considered to be a human enterprise of a complex nature which serves a purpose valued by man. It is not a new concept, but one that has been used by mankind in interpreting his environment. Regardless of the definition used, everyone is aware of many examples of contexts which have, or can be, regarded as a system. Certainly, the universe is a system; our environment can be regarded as a system; human bodies can be regarded as systems; a problem can be studied as a system, etc.

Systems have been defined in various ways by many analysts. The sum total of most of these definitions include:

(1) A whole composed of independent parts or components; or the sum total of separate parts; or the gestalt which results from the sum total of the separate parts;

(2) working independently and in interaction; or showing the interrelationship of the parts to each other; or the whole staff;

(3) to achieve previously specified objectives.

Despite the difference in terminology, in essence the content remains, to a large extent, the same. Every system has boundaries. There is an environment that surrounds it. The environments can be conceived as the suprasystem of a particular system, and subsystems as the part of the system. The environment provides for the input of the system, and receives the products of the system as outputs.

Systems Approach: Principles and Procedures

System analysis is a state of mind or point of view plus concepts organized in a logical pattern. It is an attitude of mind--a way of seeing the world. Its concerns are with interrelated parts and how these parts together accomplish the purpose for which the system exists. "In the most general sense systems analysis," according to Meals (45), "can be characterized as the application of scientific methods and tools to the prediction and comparison of the values, effectiveness, and costs of a set of alternative courses of action . . ." (p. 200). Thus, since the system approach is based upon and utilizes the methods of science and logic, its basic assumptions can be assessed using the same rationale as used in these disciplines.

Regarding the role of the methods of science in establishing a system approach, Miller (47) quotes from E. S. Quade's Analysis for Military Decisions, the following:

> This means in essence that it strives for the same traditions. Scientific tradition holds that: (1) results are obtained by processes that another scientist can duplicate to attain the same results; (2) all calculations, assumptions, data, and judgments are made explicit and thus subject to checking, criticism, and disagreement; (3) the scientific method is objective; its propositions do not depend on personalities, reputations, or vested interests; where possible it is quantitative and experimental (p. 4).

In relating the scientific method, based on the above, Miller further points out that the system approach is also (47):

- More method than magic.
- More explicit than implicit.
- More objective than subjective (p. 5).

Its application can produce results which are:

- Honest in terms of the problem context.
- Practical in terms of solution to the problem.
- Objective in terms of how the problem is solved (p. 5).

Systems analysis thus, is a highly rational and scientific way of looking at things. "The systems approach is nothing new," writes Lehmann (40). "It is what we have called in the past 'the scientific method' and is a logical step-by-step approach to problem solving. . ." (p. 144).

Explanation of systems approach and its origin is best presented by Pfeiffer (51). He writes:

> The system approach arose in response to the same demands which brought about the development of radar, rockets, nuclear weapons, and antibiotics. It is an outgrowth of procedures developed by professional teachers for professional fighters during the early days of World War II . . . biologists, mathematicians, and physicists were mobilized . . . to help design software instead of hardware, plans instead of equipment . . . . They used their methods of learning . . . in the cause of improving military tactics and strategies (p. 16).

The whole concept of using persons from different and varied backgrounds and disciplines to make crucial decisions became the norm. "As the systems approach comes into prominence, educators and others will have increasing occasion to consider it in somewhat great detail" (p. 21).

Coupled with Pfeiffer, a summary of R. E. Corrigan Associates (52) discussion is presented for introduction, clarification, and application purposes:

> The terms "system" and "system approach" when originally conceived related to applied methods for increasing the efficiency of (a) overall planning, (b) organization, and (c) performance in the development and implementation of our national defense systems (weapons). The "system approach" viewed the many individuals and groups developing a particular weapon system as individual components, like cogs in a machine, working together to achieve a common goal. This approach required the statement and completion of the following planning requirements:
>
> (1) The mission objective(s) of the system stated in precise measurable performance terms.
> (2) Specification of performance requirements and operational constraints in achieving mission objectives.
> (3) Specification of functions to be performed, associated tasks, and means employed for implementation.
> (4) Performance specifications for each person.
> (5) Specifications of interactions and communications to be carried out among groups and individuals; and the units of measurement indicating successful performance at all levels.
> (6) Specifications of final or terminal products to be produced by the system (p. 9).

In this context the word "system" suggests "an organized plan" carried out in detail to achieve a pre-established performance objective. Moreover, the quality of system performance is measured by the degree of compatability or efficiency within and among those components making up the system (subsystem interaction) while they proceed to the successful achievement of the mission objective(s). The concepts describing the "system approach" place primary emphasis on quality specifications defining "products to be produced by the system." The system designer starts by stating what is to be produced by the system and expresses it in measurable terms; he then proceeds to plan, organize, and assign resources (people, equipment, dollars, facilities) to achieve controlled, predictable performance outcomes in meeting the terminal system performance objectives.

Another approach to what has been presented by R. E. Corrigan Associates is one provided by Knezevich (33). In essence, the underlying principles are the same, but Knezevich explicitly points the required specifications for system analysis. He writes:

> The system approach demands at least the following:
> (1) both long and short-range objectives must be identified, specified and described with the preciseness necessary to serve as guides for operational activities and evaluation; (2) alternative plans or means must be developed for utilizing resources available to attain various missions within the known constraints; (3) models must be generated to better understand the key elements and relationships within the system or subsystem; (4) interdisciplinary teams of specialists must be organized as needed to resolve complex problems; (5) quantitative analysis techniques must be mastered and related to the problem situation; and, in general, (6) decisions are based on scientifically oriented procedures . . . (p. 9).

Thus, the system approach is a highly rational and scientific way of looking at things, a method of asking questions of certain types, as well as a team effort or set of quantitative analysis techniques.

An innovative figure in the field of systems is Leonard G. Silvern. His approach in systems analysis is of a different perspective than most discussed above. Silvern (5) writes:

> A systems approach to any real-life problem is the application of analysis and synthesis to a system. The iterative, high-speed, mental process of ANALYSIS . . . SYNTHESIS . . . ANALYSIS . . . SYNTHESIS . . . ANALYSIS . . . SYNTHESIS . . . may be termed ANASYNTHESIS and this is, in fact, the <u>real meaning</u> of systems approach (p. 368).

In further expanding this definition, he writes:

> Analysis consists of identifying, relating, separating and limiting. These are steps in the process of breaking down a whole into parts showing the relationship of the parts to each other and to the whole itself. Analysis is used for systems which are known or which exist. Once analysis has produced an output, it should be possible to perform synthesis, the process of combined non-related elements into a meaningful relationship such that the new product is a whole system. It consists of the elements of identify, relate, combine and limit. Synthesis is used fundamentally with elements which have no apparent or clear relationship. A relationship is created or induced, based partly on information obtained through analysis and partly by a mental insight or discovery. This produces a new whole which has not existed prior to synthesis. At least, it has not existed for the synthesizer and not in the new configuration or gestalt (p. 368).

A similar discussion on systems approach is presented by Miller (47). According to him:

> . . . the system approach requires application of rigorous logical analysis and synthesis methods and other scientific procedures. Thus, the approach requires a commitment of acceptance regarding the use of these scientific methods and procedures before its potential benefits can be achieved (p. 17).

He then describes what is meant by system analysis, system synthesis, and systems approach as follows:

System analysis is:

> a generalized and logical process for identifying and breaking down, into as many carefully distinguishable parts as possible, the structure, parts and interaction of a system (p. 14).

System synthesis is:

> a highly specific and logical process for combining separate elements into a desired orderly system after first identifying and determining the required actions, patterns and structures necessary for system performance (p. 16).

A system approach is:

> a 'closed loop' analytic and developmental process which can be utilized to continuously: (1) assess the results of performance; (2) maintain sensitivity to performance requirements; and (3) provide for the self correction of performance in order that the specified objectives can be met (p. 17).

A discussion of Miller's system content as presented above reveals that the "systems analysis process" seeks to determine how the parts are related to each other within the characteristic actions, patterns, and structures of the system. The primary purpose of analysis is to secure valid information. Systems synthesis process, on the other hand, "seeks to create alternative solution methods and strategies which are based upon the valid information gained through system analysis." Systems approach, hence, is the systematic application of these analysis and synthesis processes in order to achieve the pre-specified objectives for which the system exists.

A basic operational discussion on systems approach is one presented by Kaufman (31). According to him a system approach is:

> A process by which needs are identified, problems selected, requirements for problem solution are identified, solutions are chosen from alternatives, methods and means are obtained and implemented, results are evaluated and required revisions to all or part of the system are made so that the needs are eliminated (p. 2).

Systems approach, as used here by Kaufman and for most of the other resource people presented in this review of literature, is a type of a logical problem solving process or technique which is applied to identifying and resolving important educational or other problems.

Finally, Bushnell's (9) discussion on systems analysis provides for a general description which encompasses most of what has been presented so far. He writes:

> It is difficult to imagine anything or anyone functioning apart from some kind of system. One has only to think of the human body as a series of interrelated systems and subsystems to gain a feeling for the comprehensiveness of this approach. The person or planner who applies a system approach will usually view the institution or organism as a functioning entity. The basic elements are to set the goals in quantifiable terms, plan and present the various alternatives to achieving these goals, operationalize the plan to be carried out, evaluate the results, and feed back the evaluation into the system so that the operations can be appropriately modified or revised (p. 46).

Systems approach thus presents a method for the common sense qualification and quantification of problems and the solution to problems. The use of the systems approach has been clearly manifested in industry, business, government, and defense. The systems approach is neither a new invention nor is it a miraculous discovery. It is rooted in such diversified fields as logic, philosophy, communication theory, psychology and others. It is a pragmatic application of the scientific method; it is a synthesis of successful methodologies in problem solving, planning, and development, used by many people in many fields over a long period of time. Briefly, as Banathy (2) puts it, ". . . the systems approach is common sense by design" (p. 16).

Models

A review of literature on systems and systems analysis is incomplete without the inclusion of a discussion on models. As is common in many fields, systems analysis uses formal models to aid its analyst in visualizing the components and their relationships. The object of model building is to construct a symbolic representation of a total system.

R. E. Corrigan Associates (52) present "a definition of the term 'model'":

> A model may be defined as a graphic and/or symbolic representation of reality. It is, therefore, an 'abstraction' of the real world which it is designed to represent. . . . The degree of likeness of a model to its real world counterpart is 'not' important. That which is important is its ability (a) 'to describe accurately' its real world counterpart and/or (b) 'to predict accurately' when used to represent a real world performance situation. As such we use models for (1) prediction, (2) communication, (3) planning, (4) implementation, (5) simulation, (6) analysis, (7) synthesis, (8) clarification of relationships, (9) evaluating, (10) comparing, (11) sensing, (12) controlling, and (13) correcting. Models, though abstractions of the real world, can provide the educational analysts and managers 'patterns' or 'blueprints' for predictable performance achievement (p. 12).

The term "model" over the years has had a number of different meanings. Perhaps the most succinct and frequently referred to definition of a model is given by Chapanis (13). He states, quite simply, "models are analogies." He elaborates this by commenting that models are "representatives, or likenesses, of certain aspects of complex events, structures, or systems made by using symbols or objects which in some way resemble the thing being modeled" (p. 114). He further lists the functions of models and declares them to be advantageous in the following ways:

(1) Models describe and help us understand complex systems or events.
(2) Models help us learn complex skills.
(3) Models provide the framework within which experiments are done.
(4) Models help us to see new relationships.
(5) Models help us to predict when experiments are impossible.
(6) Models assist in engineering design.
(7) Models amuse us. They are fun to design, fun to build and fun to look at (p. 119).

Chapanis also points out some limitations with models and in model building processes. He lists these as:

(1) Models invite overgeneralizations.
(2) Models entice us into committing a logical fallacy.
(3) The constants assumed in the model may be incorrect.
(4) Models are often not validated.
(5) Model building diverts useful energy into nonproductive activity (p. 126).

One of the most significant contributions made to the problem of systems analysis in education is Kraft's (34) whole concept of models. Kraft provides the following list of the advantages and limitations of models respectively:

Models provide a simplified abstraction of a complex real world problem.
Models provide a frame of reference for consideration of the problem.
Models sometimes suggest information gaps which before were not immediately apparent.
Models provide a "handle" to evaluate and study complex problems.
The construction or attempt to construct a model forces one to truly analyze as many of the real world attributes as possible. Sometimes this very process may provide insight which was otherwise camouflaged or unnoticed.
Models provide something which can be manipulated.
Models often provide the least expensive way to accomplish objectives (p. 28).

Kraft continues with some limitations in using models:

Models are subject to the usual dangers encountered in dealing with abstractions. For example, the model may be greatly oversimplified and/or not a valid model of the desired object system.

The symbolic language used to represent a model may not lend itself to being stretched to encompass a model.
Some people have a tendency to become "hung-up" or infatuated with a model; and, as a result, their effectiveness in offering a solution to the problem becomes very limited (p. 28).

Pfeiffer (51) points out that "models can be of varying types and of varying degrees of abstraction" (p. 27). In the case of physical models:

> . . . the investigator selects as his model some narrow aspect of the real world and subjects it to carefully controlled changes, which will hopefully produce effects that are significantly related to effects in the real world at large. The same expectation applies to more abstract models . . . which express simplified and formal concepts about natural phenomena. In any case a model is meant to clarify, and to yield information. That depends on how well it is designed. It will certainly be modified or superseded sooner or later in light of accumulating knowledge, which is the general fate of models. Indeed, from one standpoint the role of a good model is to speed its own obsolescence. It cannot provide final answers and is not intended to. It has served its purpose if it provides fresh insights into the working way of things (p. 27).

Pfeiffer further wrties on developing system analytical models.

> In systems approach the development of a model proceeds along with the already outlined steps leading from the definition of the problem to the synthesis of subsystems. The first version may be merely a rough flow chart indicating the sequence of these steps. . . . That versions and subsequent refinements of it, serve, among other things, to indicate gaps in our knowledge and point toward the sort of data needed to fill the gaps . . . . So the development of a model calls for and guides the collection of data (p. 27).

In sum, basic to the entire systems notion is the concept of models--a simplified but controllable replica of a real life object or situation which serves a function. Its purpose is to communicate information or actions about the real life object.

The Application of Systems Approach in Education

Despite the present trend to systematize education, the application and utilization of systems analysis to solving educational problems is relatively new. Today it is not uncommon to hear about how educational planners are attempting to bring system analytic methods to bear upon the problems of education. In essence, as in other disciplines that have promoted the use of system analysis techniques for planning, solving problems, decision making, etc., system analysis in education provides a rigorous way of asking and answering questions; it forces problem solvers and decision makers to tackle the educational problem logically and systematically, taking various perspectives offered by different disciplines. In this context Bushnell (11) writes:

> Harnessing the power of systematic inquiry on behalf of education is a relatively recent phenomenon dating back to the early sixties. Athough operations research was introduced as early as 1928, the practical application of systems analysis techniques to education was first attempted in 1959 when members of the RAND Corporation became intrigued with the problems of optimizing the transportation routes for school buses in the interests of cutting costs (p. 8).

Flanagan (22) identifies four reasons why until recently the systems approach has had so little impact on education: (1) accrediting agencies have given almost no attention to inputs and outputs of the system and to classroom procedures. Most of their interests has been focused on staff qualifications, facilities, and equipment. (2) Evaluating the quality of instruction has been difficult even with the aid of standardized achievement and aptitude tests. Methods for assessing the effects of instruction as distinct from other environmental factors and innate abilities of the student have only recently begun to emerge. (3) The development of new instructional procedures which offer alternative ways of meeting the needs of individual students has brought the need for greater precision in evaluating student progress. (4) Until recently, only some of the important objectives of education could be measured. Now a broadened base of techniques makes "performance assessment" across the board more feasible. Simultaneously modifying curriculum content, instructional procedures, teacher roles, and the administrative support systems becomes possible.

However, in assessing the significance of the systems approach to education, one should first determine if education is really a system in the sense we are using the term. According to Banathy (2):

> Education is certainly a man-made synthetic organism with a specific purpose. Its purpose is usually integrated with and influenced by the purpose of its suprasystem, society. It is society from which education receives its input, resources, constraints, and evaluation of adequacy. Education also has numerous subsystems such as the instructional subsystem, guidance, administration, and so on. Each of these subsystems has its own objective and yet each serves the overall purpose. As the subsystems function, they influence the performance of their peer subsystems. Education is furthermore, product oriented, its product being the educated man and the knowledge produced through research. Those responsible for conducting education also try to practice and promote economy. They attempt to maximize output, to improve continuously the performance of the product with the most economical use of resources. We can conclude, then, that education is a system in our specific sense of the term, and that education may therefore benefit from the application of the systems approach (p. 17).

A similar point of view of the significance and application of systems approach to education is presented by Blaschke (6):

> Its significance to education is that it forces the individual manager to define the problem precisely, note the alternatives available and their cost, and choose the most efficient alternative according to performance criteria. Today its merit lies in its conceptual approach; for the future, the need to refine implementing techniques depends on our ability to define our objectives clearly, delineate our problems accurately, and most importantly, develop criteria for measuring how much success we can get for how many dollars (p. 211).

Pfeiffer (51) illustrates the systems approach in education in citation of the Coleman Report. He states:

> The system approach is being used in a variety of different ways and, roughly speaking, at three different levels: (1) in studies which involve the school system of entire cities or states, or the entire nation; (2) in studies designed to understand the workings of individual institutions; (3) in studies concentrating primarily on individual courses and teaching methods (p. 84).

The following is a comparative analysis of several instructional systems paradigms or models for the application of the systems approach to education.

Kaufman (32) includes the following steps in the systems approach as he sees it: define "what is" define "what is required" select an appropriate process for achieving "what is required" implement the process, determine validity of solution, redo if necessary. In order to synthesize a system using these steps, these additional major level tasks must be performed: selecting solution strategy, implementing solution strategy, determining performance effectiveness and revising and correcting as necessary.

Merrill (46) states the major components in his system are the learner, the environment, and the instruction. Inputs to the system include learner traits, library inputs (all instructional materials), objectives, and feedback. The outputs from the system are knowledge of results, response record, and display to the learner.

Gagne (23) offers a dual system, the human factors track having three major parts: the design stage, the development stage, and the testing stage. Preceding the design stage are the functions of deriving a statement of the purpose of the system and arriving at an advanced operations design for the system. Included in the design stage are task description, task analysis, and job design. The development stage includes job aids, personnel selection and classification, individual training devices and performance measures. The testing stage deals with system training, system evaluation, and system operation.

Lehman (40) suggests that the systems approach to education consists of eight steps: needs, objectives, constraints, alternatives, selection, implementation, evaluation, and modification.

Lave and Kyle (38) proposed nine steps to their model: goals, scope, objective function, conceptual framework, analysis model, measurement model, testing, alternative solutions, and implementing. These steps occur in any order and may or may not be performed independently.

Erraut (19) emphasized that a course is an instructional system and that the components are the learners, the instructors, the materials, and the technicians. Input is referred to as the learner's initial knowledge, and output as the learner's final knowledge.

The mechanics involved in most of the above presented approaches to systems analysis in education is summerized by Bushnell (11). According to Bushnell the procedural steps through which a systems analysis in education must proceed include "diagnosing the problem, searching for alternative solutions, testing these solutions, implementing the alternatives selected, and providing for subsequent evaluation and feedback" (p. 8).

However, prior to any attempt to implement the systems approach--whether at the unit level or in restructuring an entire curriculum--the systems designer or user should realize that there may be more than one system or approach that will work; decide therefore what it is that he wants the system to do, and select, adopt, adapt or produce a system that will best do the job that needs to be done, with due consideration for the time and cost factors involved.

Thus, a system approach in education as presented so far, is a type of logical problem-solving process which is applied to identifying and resolving educational problems. It permits one to examine the significant variables operating in a system, to manipulate those variables, and to predict the results with a fair degree of accuracy.

Limitations of Systems Approach in Education

The system approach is an evolving science and technology and, as such, is subject to limitations and possible pitfalls. One of its obvious limitations as stated by Miller (47), "resides in the developmental states of its knowledge base and its art. Another limitation of the approach stems from the levels of understanding and expertise possessed by those who attempt to use it" (p. 5).

Hartley (25) is concerned with certain limitations which he observed with systems approach in education. He has presented a list of twenty-five limitations which are not arranged in any order of priority. The list falls into three basic categories: (1) conceptual (problems of theoretical definition), (2) operational (problems of administrative execution), and (3) societal (problems of environmental relevance). Some of the limitations may fall within all three categories, and thus no simple taxonomy is offered.

The list contained in Table II of his study is as follows:

TABLE I

TWENTY-FIVE LIMITATIONS OF SYSTEMS ANALYSIS IN EDUCATION

(1)	Confusion over terminology
(2)	Problems in adapting models
(3)	A wisdom lag
(4)	Illusion of adequacy by model builders
(5)	Inadequate impetus from states
(6)	Centralizing bias
(7)	Unanticipated increased costs
(8)	Goal distortion
(9)	Measuring the unmeasurable
(10)	Cult of testing
(11)	Cult of efficiency
(12)	Spread of instructional racism
(13)	Political barriers
(14)	Conventional collective negotiations procedures
(15)	Lack of orderliness for data processing
(16)	Monumental computer errors
(17)	Shortage of trained personnel
(18)	Invasion of individual privacy
(19)	Organizational strains
(20)	Resistance to planned change
(21)	Antiquated legislation
(22)	Doomed to success
(23)	Imagery problems
(24)	Defects in analysis
(25)	Accelerated social change rate

Source: Hartley (25, p. 519)

Even though the purpose of Hartley's article was to identify a number of current shortcomings in the methodology of systems analysis, it also illustrates how the systems approach may be applied to education. He writes that there are four major areas of educational application: (1) policy formulation; (2) management; (3) instruction; and (4) research.

Other insights concerning limitations of the system approach are evident in the following quotations from Miller (47):

> Systems analysis . . . is still largely a form of art . . . we have to do some things that we think are right but that are not verifiable, that we cannot really justify, and that are never checked in the output of work. Also we must accept as inputs many relative intangible factors derived from human judgment, and we must present answers used as a basis for other judgments whenever possible, this judgment is supplemented by inductive and numerical reasoning, but it is only judgment nonetheless (p. 5).

Thus, the system approach is subject to certain limitations and shortcomings. The recognizance of these limitations by educational planners will provide a more realistic understanding of the advantages of system analysis.

Basic Considerations in Curriculum Design: An Approach to Systems Analysis

With the advent of new approaches in education, it has become evident that the process of curriculum development and instruction could be approached from a more systematic, scientific point of view. Outcomes could be measured, results could be more exact and predictable. However, in order to deal effectively with the various approaches of system analysis in curriculum development and instruction, it seems appropriate that a preliminary discussion of the fundamental concepts, theories, and processes involved in curriculum planning be presented to provide a base for the application of the systems approach to curriculum development and instruction.

The Theory and Concept of Curriculum Development

Curriculum, it seems, was much more clearcut in Plato's days, when the requirements of a small aristocratic ruling class could be satisfied by the simple formula, "Music for the soul, gymnastics for the body" (54, p. 4). For many centuries the term "curriculum" has been used to mean a pattern or listing of subjects or courses. Presently, educational planners voice their concerns that curriculum be studies in its entirety and with a unifying theoretical base.

Alberty (1) is one of many that takes this position of looking at curriculum development in its larger context. He states:

> It is time to examine the 'total' curriculum. What is needed now are new ways of looking at the curriculum 'as a whole' and new frameworks for developing curricula appropriate for modern living in a democratic society (p. 205).

Faunce and Bossing (20) relate this same context of a total curriculum, to the learner and his entire environment, and finally take a practical position on how it can be used in the educational establishment. They write, ". . . the curriculum consists of all the experiences the child has irrespective of the character or when or where they take place" (p. 50). This concept does not lend itself to practical use in the school. Therefore, to these authors, a curriculum for the school ". . . consists of all the experiences the child has under the guidance of the school" (p. 50). Krug's (35) discussion also seems to more or less comply to the above conceptions. According to him, a curriculum should take into account two factors, ". . . the environment and the individual" (p. 4). In the case of the school ". . . it includes all the means employed by the school to provide students with opportunities for desirable experiences" (p. 4).

Smith et al. (61), further expanding this context of a "total curriculum" from the individual and his environment's point of view, take a sociological and cultural approach in developing their curriculum theory:

> An institution--the school charged with the responsibility for teaching certain things--is created. A sequence of potential experiences is set up in the school for the purpose of disciplining children and youth in group ways of thinking and acting. This set of experiences is referred to as a 'curriculum.'
>
> The curriculum is always, in every society, a reflection of what the people think, feel, believe, and do. To understand the structure and function of the curriculum, it is necessary to understand what is meant by culture, what the essential elements of a culture are, and how these are organized and interrelated (p. 3).

Thus, contrary to the common tendency to equate curriculum with the "syllabus," a "scheme of work," a "course of study," or quite simply "subjects," the concept of curriculum seems to encompass the overall educational environment of the pupil based on a sequence of learning experiences which will enable him to develop the necessary knowledge, skills, and attitudes to cope with that environment.

The Process of Curriculum Development

In the past, curriculum development was within the competence of eminent scholars, working independently, with the printed text as the main source of information. Today, with a wider range of media opening up new possibilities and with the needs of pupils other than "scholars" to be taken into account, several persons in the field are advancing ideas to solving curriculum problems. Draper (16) specified that curriculum planning

> . . . involves developing general objectives; selecting and validating specific objectives; determining and organizing the content of the course; selecting a method suitable to one's personality and scholarship, the needs of the students, and the teaching materials; and planning and developing a testing program that will enable one to evaluate the results of teaching (p. 3).

Krug (35) classified these activities of curriculum planning into groups:

> (1) Identifying and stating educational objectives;
> (2) developing the all-school program;
> (3) teaching and learning;
> (4) providing curriculum guides; and
> (5) providing instructional aids and materials (p. 4).

He further classifies participants in curriculum planning as belonging to one or more of the following general groups:

> (1) statewide leadership groups;
> (2) local leadership groups;
> (3) classroom teachers;
> (4) the general public; and
> (5) the learners--children, youth, and adults in school (p. 8).

Tyler (65) states that four fundamental questions must be answered in developing rationale for any curriculum and instruction development. The questions are:

> (1) What educational purpose should the school seek to attain?
>
> (2) What educational experiences can be provided that are likely to attain these purposes?
>
> (3) How can these educational experiences be effectively organized?
>
> (4) How can we determine whether these purposes are being attained (p. 1)?

Tyler also suggests the sources of information which should be consulted when developing significant educational objectives. These sources are as follows:

(1) The learner,

(2) Contemporary life outside school, and

(3) Subject matter specialists.

Although there are numerous approaches to curriculum development, the most prevalent decision-making theory is one characterized by the following:

(1) Formulation of educational objectives,

(2) Selection of learning experiences,

(3) Organization of learning experiences, and

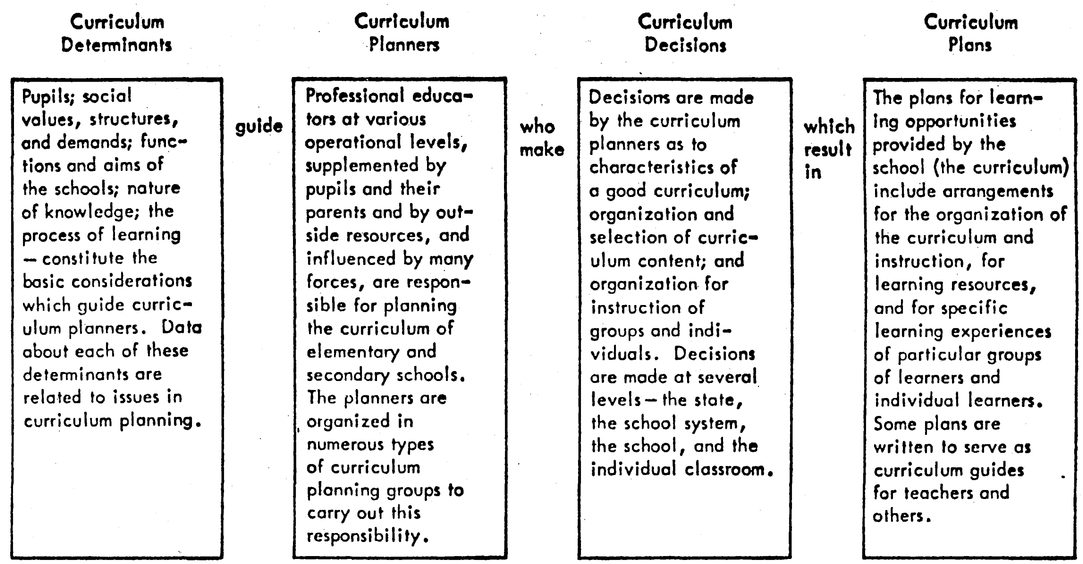
(4) Evaluation of the outcomes.

The more clearly and completely the various subcomponents of these factors are identified, described, and ordered, the more likely that a rigorous curricular design will result.

Finally, Saylor and Alexander (55) provide a summary (in a chart form) of their theory of the process of curriculum planning (Figure 2). This model is inclusive of much of the discussion on curriculum development presented so far. It deals with the question of what and who the curriculum determinants are as well as the forces and resources which influence them, and with the nature of curriculum decisions and planning.

Curriculum Design in Occupational Education

The fundamental principles in curriculum development and instruction are basic to all education, whether it is vocational, avocational, or academic education. The same decision-making processes in curriculum



Source: Saylor and Alexander (55, p. 6).

Figure 2. A Model of the Process of Curriculum Planning

development of formulating educational objectives, selecting and organizing of learning experiences, and evaluating outcomes hold true in occupational education as in any other type of education. Moreover, in occupational education the curriculum must meet the skill and knowledge requirements of the objectives prescribed by educational program for training workers for that specific occupation. Here again the knowledge and skill of the school administrator, subject matter specialists, and the curriculum experts must be supplemented with the advice and assistance of representatives of the business-industry community who have access to a wealth of knowledge growing out of their personal involvement in the occupational area as employers, managers, and workers. To this context Walsh and Selden (66) write:

> Knowledge acquired of what a worker must know and what he must be able to do, supplemented by advice from occupational advisory groups, will provide the raw materials and ingredients for the several courses that will make up the occupational skill and knowledge development program. The involvement of the business-industry representatives provides additional insight into the equipment and paraphernalia needed to provide effective instruction (p. 91).

A comprehensive discussion on curriculum development in occupational education is provided in the recommendation of a national conference, conducted by the Division of Vocational Education of the University of California at Los Angeles (67) to explore the need and feasibility for a national guideline for curriculum development. Participants at the National Conference represented a broad cross section of interests in the public and private sectors and included business, industry, and labor; state and local government; chamber of commerce; state and local school boards; the Armed Forces; private schools; vocational educators; commercial publishers; representatives of a number of levels of public education; and the public at large. From this broad background of interest and concern in curriculum development in occupational education, it was possible to construct a concensus representing national, state, and local program needs.

The conference made the following recommendations for curriculum development standards:

> Standards should be formulated immediately for the development of curriculum, broad in scope and covering basic factors, so as to permit a maximum of feasibility in meeting geographical, occupational, and technical variations throughout the fifty states.
>
> Development of curricula must be based upon occupational analyses and on preparation for entry into the labor market and/or successful placement in employment on a career-ladder basis.
>
> Curriculums must be oriented to the individual needs of the diverse groups they will serve and must provide for entry into employment at different occupational levels.
>
> Advisory groups must be involved in the planning of curriculum and in validating content material.
>
> Curriculum must provide for the social and economic needs of the students as well as the necessary skills and related knowledge.
>
> Subject content in curriculum must be determined by the demands of the occupation for which the training is provided and must be appropriate to the learner's abilities and needs.

Curriculum should include information as to requirements for physical facilities, equipment, and instructional aids.

Mager and Beach (41) approach the whole concept and process of curriculum development and instruction from a relatively different perspective. According to these authors, ". . . the object of occupational instruction is to send the student away (1) capable of performing satisfactorily on the job, and (2) capable of improving his skill through further practice" (p. 2). They further discuss how to go about achieving these goals. They write:

> To achieve the first goal, it is necessary to know what the job consists of, what one needs to do to perform each of the tasks, and how frequently each of the tasks is performed. The student must be provided with practice in performing these tasks under conditions as much like the job as possible. To reach the second objective (improving skill through performance), it is essential that the student be taught enough about each task so that he can tell the difference between doing it right and doing it wrong (discriminate between perfect performance and imperfect performance), so that he can evaluate his own attempts to perform each of the job tasks. . . .
>
> The strategy of developing effective instruction then, is one that calls for performance orientation, rather than subject matter orientation. The strategy is to use the job as the basis for deciding what will be taught and in what order and depth, rather than simply to present as much subject matter as possible in the allotted time (p. 2).

The real thrust, therefore, of building curriculum for occupational instruction is found in analysis of occupations. Requirements of the employers are essential to identifying content for occupational and vocational education. Interpretation of the employer's present and future needs is necessary to construct a program of vocational education to meet the requirements of the employers in a complex and technological world.

A review of literature in the types and techniques of occupational analysis supports the contention that there are two main types of occupational analysis for curriculum development: job analysis and task analysis. The ultimate purpose of both types is the same, the generation of occupational curriculums geared to the needs of students so that entry-level requirements of employment positions will be satisfied. The sources of information are the same for either type of analysis. The differences lie in the definition of the terms and the interpretation of the size of the unit used.

The techniques involved in occupational analysis are similar to those of job and task analysis, except that the scope of the research problem is much greater. "Occupational analysis" has been described by Borow (7) as:

> . . . . the application of a systematic method of obtaining information focused on occupations and industries as well as on jobs, tasks, and positions. Occupational analysis focuses on occupations--duties, requirements, and environments (p. 285).

Job analysis is the collection and interpretation of information about the work performed. It is an essential part in developing effective programs in occupational education. Larson (36) states that:

> Job analysis is needed to describe the job toward which training is directed and to determine the effectiveness of training as reflected in job performance. The most frequent use of job analysis in curriculum development is to obtain information as to the basis for decisions on content for the curriculum. Analysis is a technique of making an inventory of all the learning activities associated with a specific instructional area (p. 20).

A review of a number of studies, thus, indicates that, while job analysis has different meanings, applications, and implications, it is a fundamental step in determining curriculum content for occupational education.

Task analysis is a method or process by which a task is examined and its characteristics are identified. "Task analysis," according to Butler (12), "determines the knowledge and skill content of each task" (p. 23). The operation, the standard method for performing it, and the technical information required may be detailed precisely in a task breakdown. Butler further indicates, "a task description is usually developed in three stages. First, the duties of each job are outlined; second, the tasks for each of the duties are listed; and third, the task analysis identifies standards of performance" (p. 23).

A task description is a list of job activities, whereas a task analysis is the identification of the kinds of performance capabilities demanded by the tasks. Each task must be analyzed to determine the basis for all decisions. The selection of appropriate objectives, content, sequence, method, media, and evaluative criteria depends on the correct identification of the capabilities needed to perform the tasks (29). There are a variety of techniques and procedures used in task analysis; while considerable variation exists, common procedures include identification, inventory, classification, and in some cases, validation.

Finally, as a summary and as a transitional discussion to systems analysis in curriculum design, an innovative approach, described as the "organic curriculum" by Morgan and Bushnell (50) would be appropriate at this point. This proposal calls for radically modifying the system in order to design an educational program which will be responsive to the present-day needs of students. Such a program would include academic and occupational training, personnel development, real work experience, personal and vocational counseling, and social and recreational activities. The integration and interaction of these components would be a result of careful system design. The curriculum would be learner oriented, and each activity would be related logically to all other activities and lead to the efficient attainment of behavioral goals. The investigators suggest that the first step in building such a student-centered curriculum is to study those behavioral attainments needed by the individual for entry into a variety of post high school activities. They emphasize the importance of describing specifically and precisely the learning experiences that would lead to the desired behavioral outcomes. This denotes careful analysis.

Systems Approach Applied to Curriculum Design

Beauchamp and Beauchamp (3) present a comprehensive discussion of systems analysis in curriculum development. They describe curriculum as being a system, and using systems terminology and the overriding principles associated with systems analysis they design a model of a curriculum to supplement their rationale. They write:

> A 'curriculum system' is a system for decision-making and action with respect to curriculum functions which are regarded as a part of the total operations of schooling. The system has three primary functions: (1) to produce a curriculum, (2) to implement the curriculum, and (3) to appraise the effectiveness of the curriculum and the curriculum system (p. 4).

Figure 3 is a model of a curriculum system as designed by these authors. This model depicts how the language of systems analysis is useful in describing the basic characteristics of a curriculum system.

In discussing the model, they write:

> The function of input data is to provide energy for the content and processes that maintain the steady state of the

system. Inputs are illustrated by knowledge acquired from educational foundations, human characteristics, experience with curriculum affairs in schools, the human knowledge stored and categorized in the disciplines and other schools subjects, social and cultural values, and school laws. Input data are the sources of ideas and authority for curriculum decision making.

A curriculum system, like any other system, is characterized by a body of activities that make the system work and maintain itself. Sequentially, they are the choice of arena for curriculum processes, selection of personnel to be involved, selection and execution of working procedures, the establishment of implementation procedures for appraising and revising curriculum.

Outputs are the result of the functioning of the curriculum system. The most obvious and necessary output of a curriculum system is the curriculum, and it is the only immediately visible one. Other outputs may be changed attitudes of teachers and other participants in the system, increased knowledge acquired by the participants, and a commitment by teachers and school leaders to implement and to appraise the curriculum (p. 5).

Input	**Content and Processes for System Maintenance**	**Output**
Educational foundations Community characteristics Personalities of persons involved Curriculum experience The subject matters from disciplines and other subjects Social and cultural values School laws	Choice of arena for curriculum processes Selection of personnel Selection and execution of working procedures for: determining curricular goals selection of curriculum design planning and writing Establishing implementation procedures Establishing procedures for appraising and revising the curriculum	A curriculum Increased knowledge by participants Changed attitudes Commitment to act

Source: Beauchamp and Beauchamp (3, p. 5).

Figure 3. A Model of a Curriculum System

Another innovative figure in the field of curriculum development is Bushnell (10). He emphasizes the fact that all goals should be clearly understood and defined in measurable behavioral objectives if the potential of a systems approach in curriculum development and instruction is to be fully realized. He writes:

> One of the first and most important tasks to be undertaken in systematically building a total curriculum with the necessary variety of materials and pathways for individual learning required by the schools of the 70's would be to convert where possible broad educational goals into observable behavioral specifications, i.e. a catalog of appropriately classified performance objectives that would describe with greater precision the levels of performance that each high school graduate should be able to achieve . . . it would define the minimum skills, knowledge and attitudes the educational program ought to develop in each student (p. 46).

Why performance objectives? Bushnell discusses the importance of performance objectives as follows:

> First, in using the systems approach to curriculum design, the goals or objectives for the program must be stated in terms of 'output specifications.' In education, these specifications can often be stated in terms of behaviors, without them there is little basis for deciding which learning intervention or teaching strategy would be most effective. When decisions on the selection of teaching strategies have been made without performance objectives, there are no empirical means of determining the degree of effectiveness.
>
> A second reason relates to the need for 'longitudinal validation' of the effectiveness of public education in preparing young people to cope with their social and economic environment after they leave school.
>
> A third reason for requiring performance objectives is the need to assess the cost-effectiveness of educational programs. With more precisely stated educational goals, it should be possible to associate behavior change with program costs (p. 47).

Emphasis on performance objectives in curriculum and instruction is also supported by Mager and Beach (41). These authors further point out that the systematic development of curriculum and instruction

> . . . involves detailed specifications of the desired result (in the form of a course graduate); development of an instrument by which success will be measured; development of procedures, lessons, and materials designed to achieve the specified result; and steps to insure the continual improvement of course effectiveness (p. 1).

Borow (7) explains how systems analysis has similarities to both group and organizational analysis. "With the growth of the systems concept, the term system analysis is being used with increasing frequency and often as a replacement for group and organizational analysis" (p. 289). He further explains how systems analysis is performed. "A list of all tasks is compiled, specific tasks are grouped optimally, a model may be constructed and simulators may be constructed" (p. 289).

A Job Corps manual developed by Butler (12) describes the concept and the use of the systems approach in occupational curriculum. This approach involves the accurate identification of the requirements and problems, the setting of specific performance objectives, the application of logic and analysis techniques to the problems, the development of methods for the solutions of the problems, and the rigorous measurements of results in comparison to the specific performance objectives. According to the manual the same systems engineering techniques so successfully applied to the development of hardware have also been applied to training course development problems. It is used to describe a training system as a series of interrelated, interacting, precisely controlled learning experiences that are designed to achieve specific training objectives, but organized into a unified, dynamic whole which is responsive and adaptive to the individual trainee while fulfilling specific job-relevant training criteria.

Crawford (14) discusses a seven-step approach for designing a relevant training program. The seven-step approach consists of:

developing human factors systems analysis models, developing job models, constructing training programs, developing proficiency tests, and evaluating training programs. If the portion of students who meet the performance standards is not satisfactory, it is "back to the drawing board" for a redesign of the curriculum.

Not a great deal has been done concerning systems analysis in occupational education at this time. Therefore, the literature is scarce. A few vocational educators, psychologists, and investigators have devoted considerable effort in developing a systems approach to building occupational education curriculums. The initial step usually consists of analysis of the job requirements or the determination of the systems requirement. This is followed by systems development and systems evaluation.

CHAPTER III

DESIGN AND OPERATION OF A SYSTEMS APPROACH FOR CURRICULUM DEVELOPMENT AND INSTRUCTION

A system has been defined as the set of components, or subsystems, that are brought together to function as an integrated whole for the purpose of the accomplishment of its objectives. Two characteristics of systems are: (1) all systems can be viewed as subsystems of another system and (2) it is always possible to determine whether or not a system has functioned or is functioning properly. Figure 4 represents a typical system with its interacting parts, environment, inputs, and outputs.

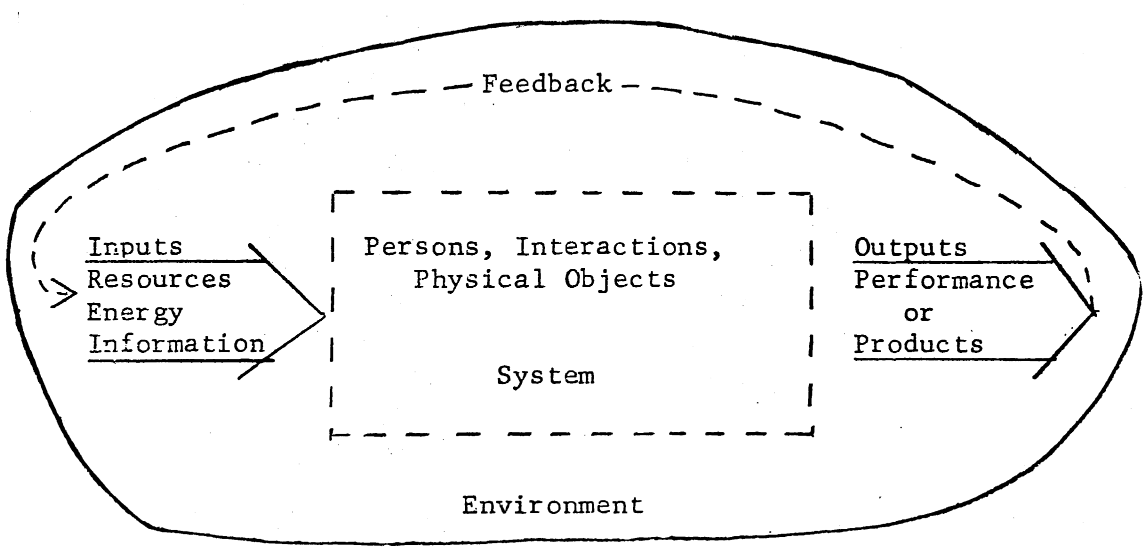


Figure 4. A Model of Basic System--Environment Relations

The environment is a complex of physical, biological, cultural, societal, organizational, and ecological factors which surround the system, interact with it, and influence its behavior. Accordingly, an instructional system consists of interactions and interrelations between and among six critical components: (1) the learner, (2) the teacher, (3) the curriculum, (4) the relevant methods-means media, (5) the learning environment, and (6) the learning.

Outputs are goal-oriented products, services, and/or benefits that the system produces and/or effects as a result of its performance. Inputs, on the other hand, are resources, energy, and information which are used to maintain the system or are transformed into instructional outputs. Feedback control refers to a preferred type of a regulatory mechanism that establishes a means by which the system and each individual in it may exercise self-direction, self-evaluation, and self-correction relative to instructional purposes, practices, performance, and outputs.

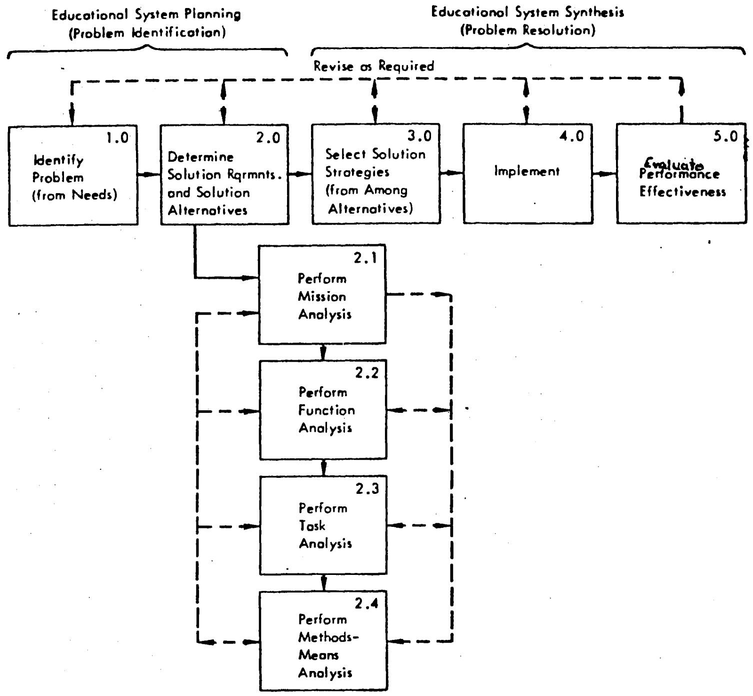
As applied to curriculum, the overriding principle associated with systems is the same, the accomplishment of purpose. All of the subsystems or components of the system have a direct relationship to the accomplishment of the purposes of the system. The reason for the existence of the system is the achievement of its purposes or objectives. The purposes or objectives are what give the system its internal integrity.

Curriculum as defined in this study is all the learning experiences provided the learner under the guidance and direction of the educational institution through which it expects to achieve its objectives. A quick comparison between this definition and the previous definition for systems shows a striking similarity. Considering the word "components" for learning experiences, and thinking of guidance and direction implying organization, both functioning for the purpose of achieving objectives, then, it is easy to conceptualize the curriculum of a school as a system. If, indeed, courses within the curriculum and units within the courses also function to achieve learning goals or objectives, it can readily be seen how they, too, may be viewed as systems, or more properly, as subsystems within larger systems.

The definition of a system implies that organization is an essential characteristic of the system. Organization presupposes the existence of parts or components. The components must interact. If they do not interact, there is no organization, but instead, a group of independently functioning components. In order for interaction to take place, there must be information transferred from one component to another.

Because of the nature of systems, then, if one is to view the curriculum as a system, he is forced to take an overall view, that is to view the whole configuration. This means that the curriculum can be viewed not as consisting of subject matter alone, but also of scope, sequence, methods, media, evaluation, and any other component or subsystem which makes up the whole curriculum.

A systems approach is the application of analysis and synthesis to a system. A model for educational system management which details the steps of "systems analysis" and "system synthesis" is presented in Figure 5.



Source: Adapted from Kaufman (31, p. 21).

Figure 5. A System Approach: System Analysis and Synthesis

This model for educational system management presupposes that education be placed into a measurement/performance context. Relevant and practical educational management, then, begins with the determination of educational needs; states feasible and measurable objectives (goals/end products); applies system analysis to determine the "whats" (functions and tasks to achieve the objectives); then progresses to the selection of feasible and required "hows"; the development and implementation of the "hows"; and finally to the evaluation and revision of the total process. It is to be noted that these processes represent a "closed loop" sensing and self-correction model for planning, design, and implementation for every phase of system analysis and system synthesis.

Needs-Assessment

Educational planning using a system approach starts with an assessment of needs. A "need" is here defined as the discrepancy between "what is" and "what is required"--a definition that indicates that a need is a measurable difference or distance between a present state or condition and what is required to be accomplished. Need-assessment, therefore, is a type of discrepancy analysis, which helps to tell us where we are now and where we should be going--measurable discrepancies between a "current situation" and a "required or desired situation." Thus, the first step of an educational management process is to identify problems based on documented needs. These problems should be stated in measurable, performance items.

System-Analysis

System analysis proceeds from the identification of a problem based on documented needs. The tools of an educational system analysis include:

Mission Analysis.

Function Analysis.

Task Analysis.

Methods-Means Analysis.

The system analysis process is designed to determine the feasible "whats" for system planning and design by analyzing requirements and identifying possible alternatives in successive levels of increasing detail.

Mission Analysis

A mission is an overall job--a product, a completed service, or a change in the condition of something or somebody that must be accomplished. Mission analysis in education consists of four elements:

1. mission objective,
2. mission performance requirement,
3. constraints,
4. mission profile.

Each of these four elements will now be described.

Mission Objective

Mission objective is a precise statement expressed in performance terms which identifies the overall intent of a mission (or the job to be done). The purpose of framing a mission objective is to translate an intent into the measurable, most general--yet inclusive statement of the outcome (mission) that can be made.

Mission objectives are performance objectives. As such, they require the same degree of specificity as any other performance or behavioral objectives. Therefore, a mission objective must state precisely: (1) what is to be done; (2) where it is to be done; (3) when it is to be done; and (4) how much or how well it is to be done.

The mission objective sets up the goal. It designates exactly where we are going, WHAT we are going to do, and/or WHAT we are going to produce.

The last characteristic of a mission objective which is of concern to curriculum objectives, is the requirement to "focus on the learner."

Performance Requirements

A performance requirement is comprised of the measurable criteria that describe the product of the mission or the outcome from performing a function. They may include such things as how the product is to perform; conditions under which it is to perform; product design characteristics; and performance specifications and restrictions or rules placed on the development of the product. They specify what the product will look like and/or do and the "given" conditions for its development.

Performance requirements for the mission not only provide the exact specifications by which success (or failure) of the mission may be measured, but also serve to specify further the "how much" or "how well" of the mission objective. When stated in precise, objective, measurable terms, performance requirements will provide the criteria for determining the reality and feasibility of accomplishing that which has been requested.

Constraints

Constraints are a list of the obstacles (real world boundaries) that already exist, and which may jeopardize in whole or in part the successful accomplishment of the mission and its specified performance requirements. Monetary resources, personnel, laws, biases, and politics are just some of the kinds of entities which might operate in a constraining manner.

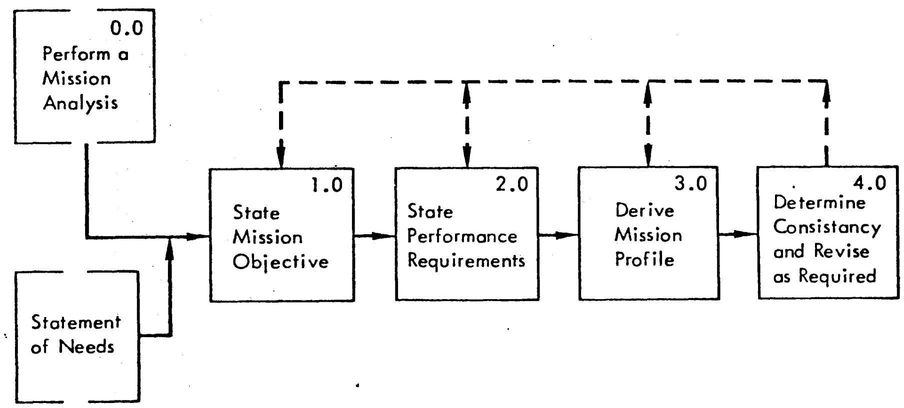
A constraint is resolvable in several ways: (1) it may be possible to change the mission objective and/or the performance requirements; (2) it is possible to reconcile the constraint by creating a new or different way to meet the requirement, and thus to remove the constraint operationally; (3) it is possible to reach a "compromise" relative to the performance requirement and its achievement; and (4) it is possible in dealing with a constraint, to stop--if you can't get there from here, why go further?

Mission Profile

Having analyzed the mission objective, the performance requirements for the mission, and the constraints, the planner has a known entity. He now must address himself to proceeding from where he is to where he should be. This involves "what" is to be done, not "how" and not "who will do it." The "things" that must be done to accomplish the overall job regardless of how it gets done are termed "functions." When the major functions of a mission are identified and placed in a logical sequence, they constitute the mission profile--a management plan identifying the outcomes that must be completed to accomplish a mission. Thus, the mission profile represents the central path for achievement of the end product.

When all the major functions in the mission profile have been identified, they are reexamined in relation to the needs, the mission objective, and the performance requirements in order to assure internal consistency among the functions and external validity based on needs. It should be pointed out here that the process of check and recheck (iteration) is continual and is performed throughout the entire analysis phase.

The overall process involved in a mission analysis is shown in Figure 6.



Source: Kaufman (31, p. 63).

Figure 6. A Sample Mission Profile for Accomplishing the Mission of "Perform a Mission Analysis"

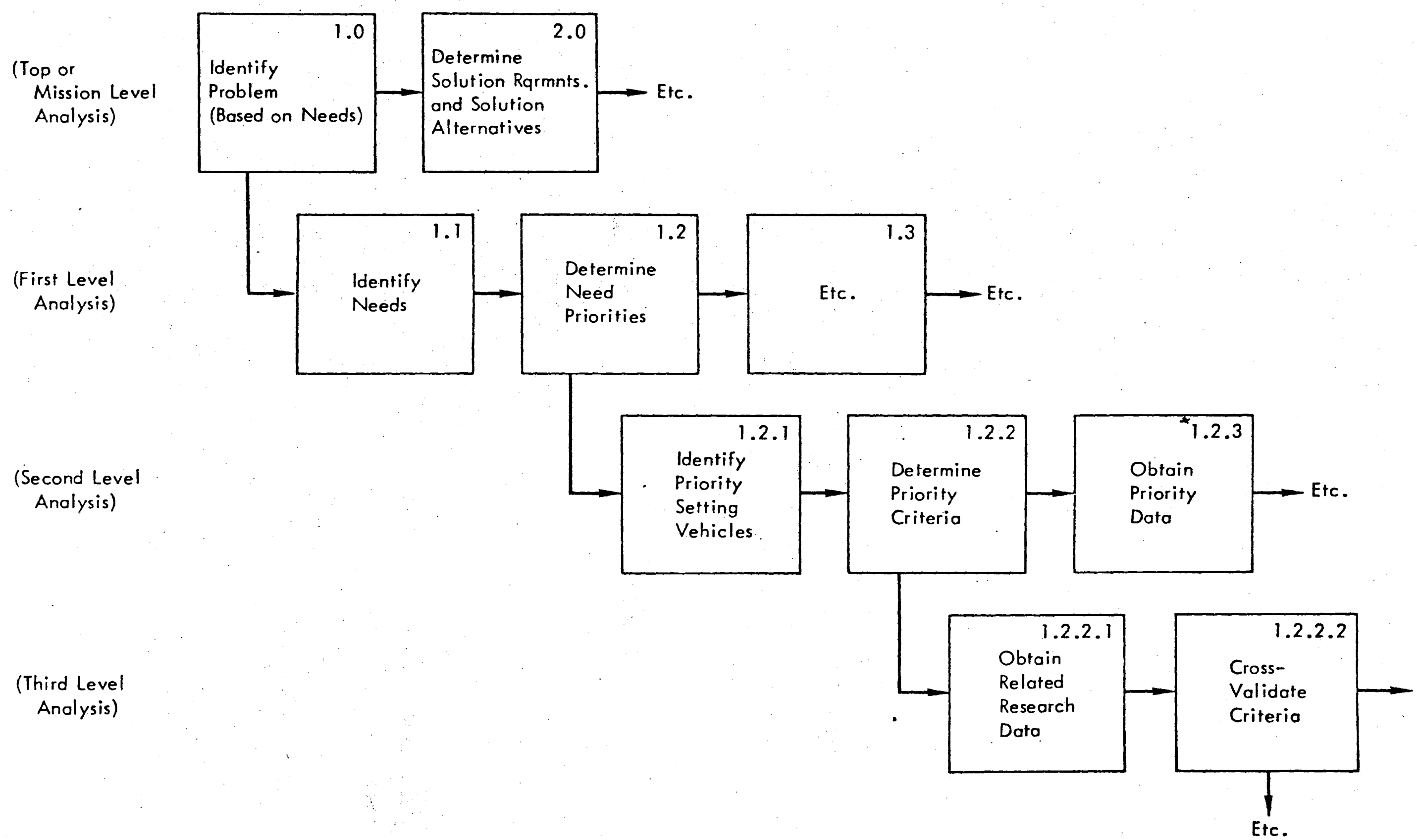
Function Analysis

In performing function analysis, the system analyst is further extending the mission objective, the performance requirements, and the mission profile. At the same time he is deriving and identifying additional "whats" that have to be dealt with in order to assure the successful achievement of the mission objective and performance requirements. In addition to identifying "what" has to be done, the analyst also identifies in "what order" they must be done.

Function analysis proceeds from the top-level (mission profile) functions, one at a time in an orderly manner. The product of any function analysis is the identification of any array of functions and subfunctions (down to the lowest level of relevance), including the determination of the interrelations required to achieve a mission.

At this point, it would do well to establish some procedural rules to be followed when using system techniques. Referring to Figure 7, the "top-level" of function analysis is the mission profile. Function analysis formally proceeds from the analysis of the functions identified in the mission profile. Each function is analyzed to identify the functions of which it is constituted. These functions that are derived from the mission profile are called "subfunctions." The function analysis process continues until all the functions are analyzed and identified for all the top-level (mission profile) functions. This tells "what" must be done to achieve each top-level function. In this determination, there may be parallel or alternate paths to be taken. Figure 8 illustrates this point.

By placing the functions below the mission and the subfunctions below the functions, the planner is operating in a vertical plane. By placing the functions and subfunctions in a serial manner with a line connecting them, he is operating in a horizontal plane. Further development of the design proceeds according to these planes. As he drops down vertically, he is analyzing the lower level or smaller jobs to be accomplished. A decimal numbering system is used to determine the level of the ensuing actions. The description of the function is always done by action words such as: provide necessary equipment, assess needs, determine population, etc.



Source: Kaufman (31, p. 19).

Figure 7. A Hypothetical Example of Vertical and Horizontal Expansion in Function Analysis

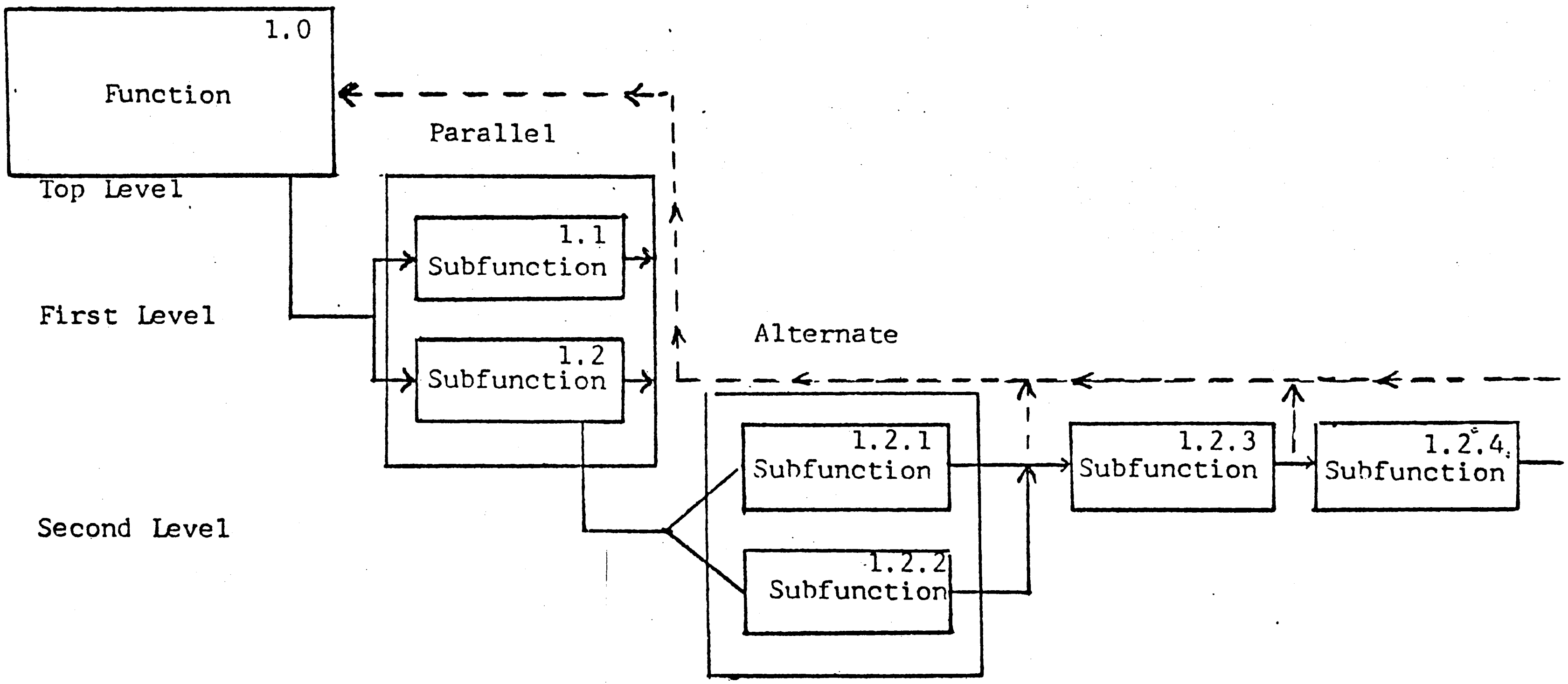


Figure 8. Parallel and Alternate Paths

Each time a function is identified, the performance requirement for it must be identified--i.e.--what, in precise measurable terms, must be done to get this function accomplished. Constraints for meeting the performance requirements for that function must also be identified and reconciled.

Task Analysis

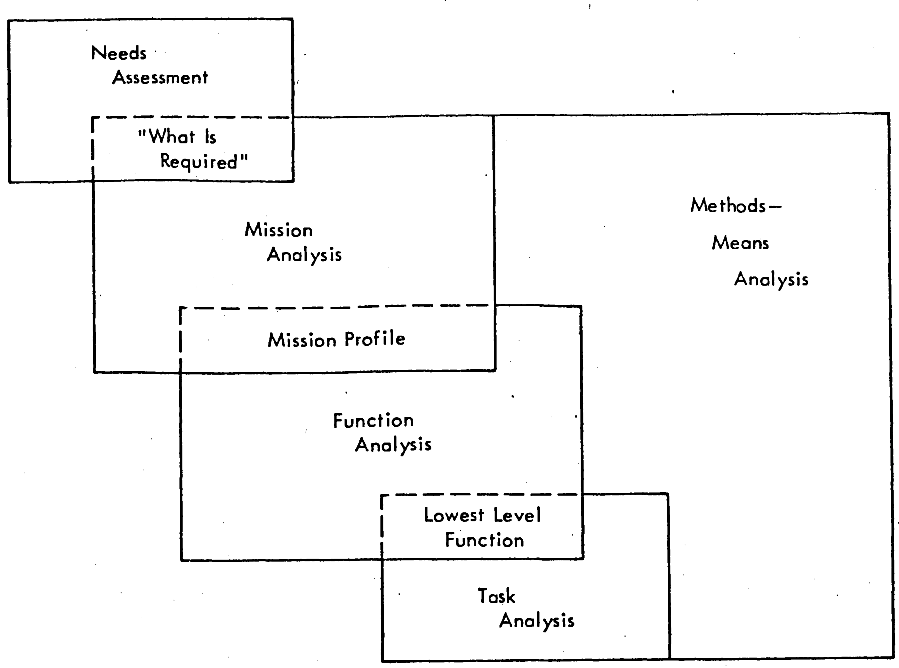
Tasks may be defined as units of performance which, when collected, constitute a function. Emphasis here is still upon what tasks must be performed in order to accomplish a subfunction. Task analysis is the "lowest level" of a system analysis; it derives from mission analysis and the related function analysis. This task analysis provides the final level of detail required to identify all the "whats" in system analysis. The relation of task analysis, mission analysis, and functional analysis is shown in Figure 9.

Task analysis may be conceived of as occurring in two basic steps:

1. Identifying the basic tasks (or steps) involved in accomplishing an overall function (task listing).
2. Determining the characteristics of the tasks, their requirements, and their context, and putting these in a time-ordered sequence (task description).

Together, these two parts constitute a task analysis that tells what units of performance are to be accomplished and the performance requirements associated with each task.

The difference between mission analysis, function analysis, and task analysis is a difference in degree rather than kind. Task analysis is basically accomplished in the same manner as is the mission analysis and the function analysis--it is an identification and the breaking down of elements required to accomplish something. In task analysis, however, more detailed performance information is obtained and reported; for this will provide the basic structure and information for the actual design, implementation, test, and evaluation of the educational plan when put into operation.



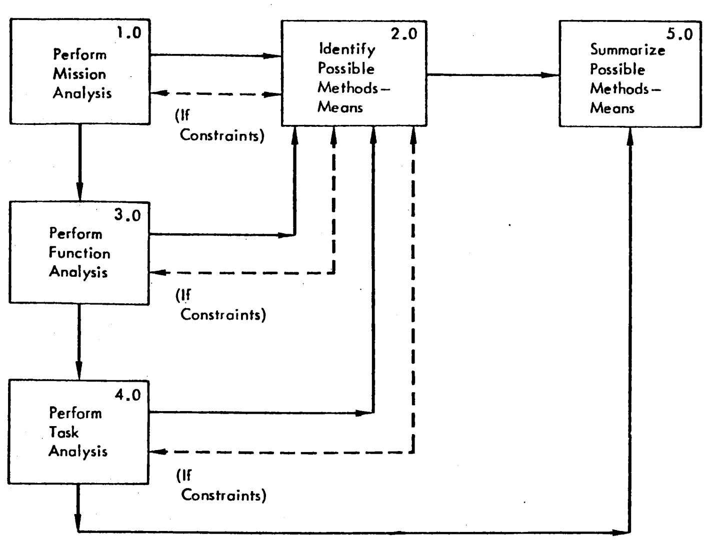
Source: Kaufman (31, p. 120).

Figure 9. System Interrelationships

Methods-Means Analysis

Mission analysis, function analysis and task analysis are process tools which identify and document those functions and tasks which must be performed in order to ensure the predictable accomplishment of a mission objective. These processes attend to the identification of the "whats," which provide the data base for making decisions as to how the performance requirements will be achieved. The process by which the data bank is produced is called "method-means analysis."

A "method" is the strategy for achieving some performance requirements and, a "means" is a vehicle by which a strategy is achieved. Accordingly, methods-means analysis is the identification of the maximum possible number of methods and the advantages and disadvantages of each for achieving the specified performance requirement(s) identified in a system analysis. Figure 10 is a process diagram of the relations between any analytical step in a system analysis and the conduct of a methods-means analysis.



Source: Kaufman (31, p. 127).

Figure 10. The Process for Performing a Methods-Means Analysis

In system analysis, method-means analysis is carried on concurrently with mission, function, and task analysis. A diagrammatic representation of the relation between a mission, function, and task analysis and method-means analysis appears in Figure 9, which indicates that the methods-means analysis is "parallel" to the determination of the mission, the functions, and the tasks on an on-going basis.

System Synthesis

At this point, all the feasible "whats" for problem solution (curriculum development in this case), have been identified. System analysis provides all the necessary data to proceed to system synthesis. The statement of the mission, the identification of constraints, and the function task and methods-means analysis provide the information that is necessary to solve the problems of accomplishing the mission. Referring to Figure 5, system synthesis is composed of three major activities: selecting solution strategies from alternatives, implementing solution strategy(ies), and evaluating performance effectiveness.

Select Solution Strategies from Alternatives

The data accumulated in system analysis are utilized in order to select the most effective and efficient ways and means for performing stated functions and tasks. Frequently, a choice criterion of "cost-benefit" is used, that is, the selection from among alternatives that which will at least achieve the minimal requirements at the lowest cost.

Selecting methods and means from alternatives requires that the various identified functions and tasks be allocated to: (1) people, (2) equipment, and/or (3) people and equipment in combination.

Selection must be made on the basis of the system as a whole, noting the interactional characteristics of the various requirements of the system. Frequently, tools of modeling and simulation are utilized to determine the most effective and efficient means for meeting the requirements. By simulation, different tools and strategies can be "tried out" in a fashion that will not compromise the current, on-going educational activity.

Implement Solution Strategy(ies)

In this second step in system synthesis the actual combination of physical factors and human factors are put into an operation process directed toward accomplishing the mission. It is in this step that the products of planning and selection are actually accomplished. The methods and means are obtained, designed, adapted, or adopted. A management and control subsystem is developed to assure that everything will be available and utilized as required and that proper data will be collected to determine the extent to which the system is functioning as required. The system is put into operation, including all the complexities of utilization and acquisition of people, equipment, learners, facilities, budgets, and the many other factors necessary for a properly functioning educational system.

Evaluate Performance Effectiveness

Data are collected concerning both the process and the products of the system during and after the system's performance. Against the requirements established in the needs assessment and detailed determination of requirements obtained from the system analysis, performance of the system is compared with the requirements. Discrepancies are noted between actual system performance and the performance requirements. This provides data on what is to be revised and thus gives diagnostic information that will permit valid system revision.

Based on the performance of the system as indicated by the performance data, any or all previous system steps may be modified and a system redesign job accomplished if necessary. This self-correctional feature of a system approach assures constant relevance and practicality. An educational system is never considered to be complete, for it must be constantly evaluated in terms of:

1. Its ability to meet the needs and requirements it set out to respond to.
2. The continued appropriateness of its original needs and requirements. Thus the system must have not only internal consistency and performance, but constant checking of needs and requirements to assure external validity as well.

A system approach, as described in this chapter, is a five-step process for planning an educational program. The five steps are: identifying problems from needs; determining solution requirements and solution alternatives; selecting solution strategy(ies) from among alternatives; implementing selected strategies; and evaluating performance effectiveness. A self-correcting process is built into the approach for revising as required, wherever required, and whenever required.

CHAPTER IV

A MODEL FOR A SYSTEMS APPROACH TO CURRICULUM DEVELOPMENT AND INSTRUCTION FOR OCCUPATIONAL EDUCATION IN ETHIOPIA

A model for curriculum development and instruction for occupational education in Ethiopia is proposed in this chapter and is based on the theoretical framework and system design techniques presented in the previous chapters.

The system processes for occupational curriculum design are similar to the analysis-synthesis steps in Figure 5, Chapter III (page 50), but related to learning outcomes or products. The system process is a method of inverse analysis starting from a gross statement of the desired end results and through a hierarchy of analyses performed on previous statements becoming successively more finite and particular.

What the student must know and do is specified through the analysis phase. How the student will achieve the knowledges and skills is determined by the methods-means-decisions. The next step requires synthesis of all specifications in selecting and developing strategies, methods, and materials; allocating instructional, administrative, and learning functions and tasks; determining sequences, scope, and time; revising as indicated; and designing the model whereby the instructional system will be implemented and evaluated.

A basic assumption in designing the model is that an occupational curriculum system is an open system and, thus, environmental forces are constantly affecting its operation.

This systematic model is three dimensional with the dimensions being humans, physical objects, and interactions. Human beings are involved as persons with feelings, emotions, and values and second as roles which they play in the system. It is assumed that all persons in the system operate with a knowledge, belief, and value base and that every action and interaction is influenced by the individual's value system.

Operation of the Model

Needs Assessment

Need assessment is the initial step in a systems analysis process for developing, implementing, evaluating, and improving projects, programs, schools, curriculums, and instruction, as well as the overall educational system.

Need assessment for educational system planning in curriculum development and instruction in Ethiopia is dictated by the centralized structure of the educational system of the country. The Planning and Research Office in the Ministry of Education with close collaboration with the Ministry of Planning and Development (Planning Commission Office) and the Ministry of National Community Development and Social Affairs, projects the need for trained manpower supply to the demand of the development of the national economy.

The Education Sector Review (18) Manpower Task Force final report presents the following on the present state of manpower planning in Ethiopia:

> Manpower planning in Ethiopia at present involves the Ministry of National Community Development and Social Affairs, the Planning Commission Office, and the planning divisions of the various government agencies which are producers of skilled manpower. The task of collecting and processing manpower data and of carrying out research in the manpower field has been entrusted to the Research and Statistics Section of the Department of Labor of the Ministry of National Community Development and Social Affairs. Responsibility for the coordination of manpower planning with development plans in other sectors of the economy rests with the manpower unit of the Planning Commission Office. To this end, the manpower unit compiles and evaluates manpower information received from the various ministries and agencies, with respect to both the public and private sectors. The unit is also responsible for developing long-term manpower plans, based on coordinating the information received above with that from educational and other training institutions. Detailed plans for adjusting supply to demand are the responsibility of the planning divisions of the supplier agencies. Prime among these is the Ministry of Education. The others include Haile Sellassie I University, the Ministry of Agriculture, the Ministry of National Community Development and Social Affairs, and the Ministry of Public Health (p. 4).

An example of the long-term manpower projection provided by the Ministry of Planning and Development (Planning Commission Office) is an excerpt from the Third Five Year Development Plan (28):

> In Class C*, mechanics, electricians, machinists, welders, and all types of building trades craftsmen will be required, as well as subordinate clerical and secretarial help. An estimated 24,100 are required for these three sectors alone, while the projected output for the entire economy is close to 20,000. Clearly there will be need, especially in manufacturing, where about 12,000 Class C workers are needed to draw upon semi-skilled workers increasing their skills by on-the-job training (p. 97).

---

*Class C represents skilled workers who have completed one to four years education beyond the eighth grade.

At the conclusion of the Manpower Task Force report of the Education Sector Review (18), a recommendation which is of significance for this study is provided:

> Manpower information and results of studies should be communicated promptly to the Planning Office of the Ministry of Education and Fine Arts and to the Department of Social Services in the Planning Commission Office, which units should work in cooperation to indicate appropriate responses by the Ministry of Education, Haile Sellassie I University, and other suppliers of skilled human resources. This will permit the education system to make the periodical adjustments necessary to bring the demand for and supply of manpower near equilibrium (p. 2).

Therefore, based on the above discussion, needs assessment for curriculum development and instruction for occupational education in Ethiopia is determined by the Office of Planning and Research in the Ministry of Education, as well as the Ministries of Agriculture, Public Health, National Community Development and Social Affairs, and Haile Sellassie I University. These offices would provide all the necessary documentation and data for determining educational needs in curriculum planning.

Development of the Mission

Proceeding from the needs assessment, the mission analysis states the overall goals and measurable performance requirements (criteria) for the achievement of the occupational curriculum system. These required outcomes (mission) specifications are closely related to the previously identified needs. The mission objective and its associated performance requirements state the appropriate specifications for the curriculum system being planned.

The mission statement is, therefore, a written document providing direction for the curriculum development process. It is by its very nature a statement of goals. The mission statement is made within a larger context which includes national and regional goals. Accordingly, the mission statement is characterized by its tentativeness and is subject to change due to environmental forces upon the system. Furthermore, a fundamental necessity is that the mission become and remain operational. Every action and interaction within the system is a direct consequence of the mission being in operation.

The determination of constraints will identify those factors within which the system will operate. In the case of developing an occupational curriculum system, these constraints would include resources such as funds, personnel, equipment, etc.

The Mission Profile

It is proposed that the functions for an occupational curriculum development and instructional system for educational institutions and training in Ethiopia be: the statement of needs, the determination of program requirements and alternatives, the selection of program development strategies, the implementation of those strategies, and the evaluation of the performance and effectiveness of the program.

The mission profile for this system is presented in Figure 11. Whatever the mission statement provides for the particular situation of an occupational training, these top-level functions are descriptive of what is to be done and in what sequence in order that the mission may be accomplished.

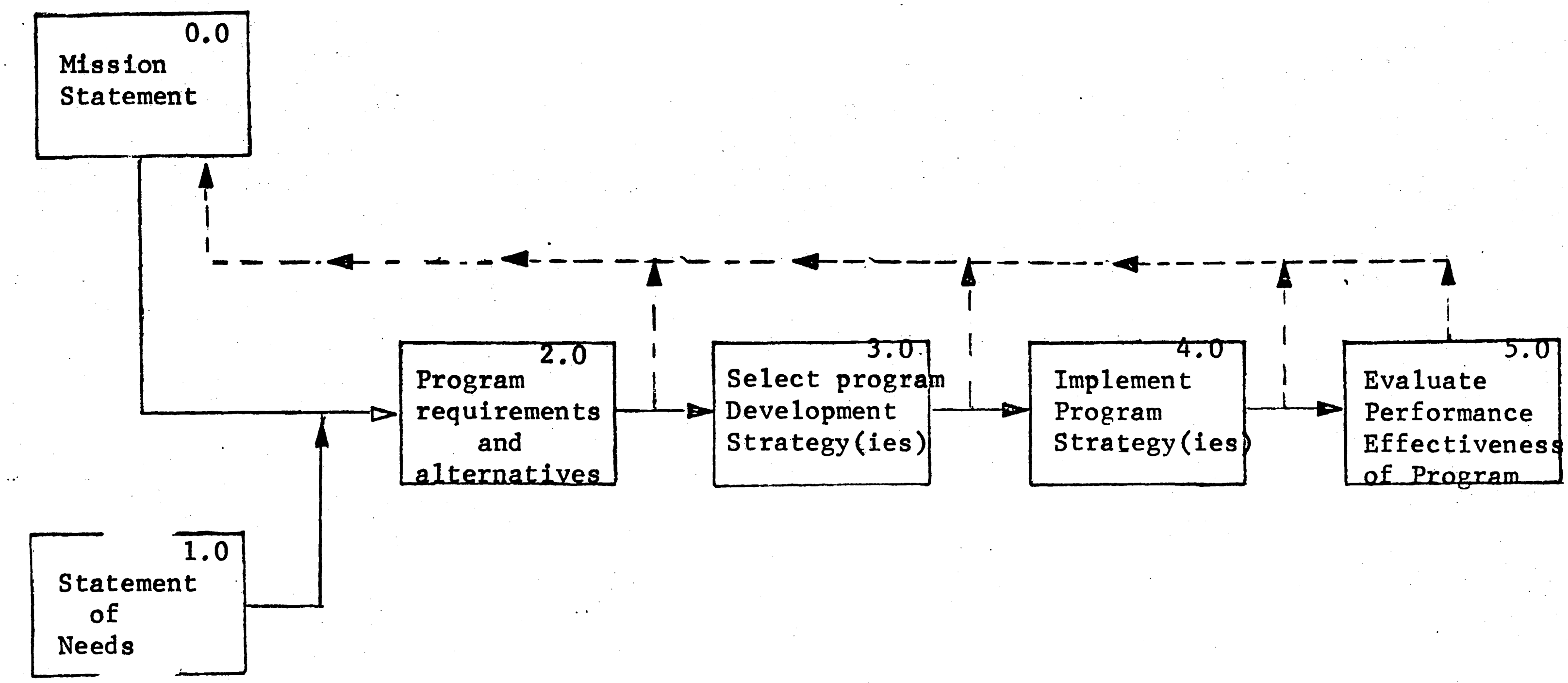


Figure 11. Mission Profile

Function Analysis

The first function to accomplish the mission is the statement of needs. In developing curriculum in the educational system of Ethiopia, needs are not determined by the curriculum specialist or whoever is concerned in planning curriculum. Therefore, in function 1.0, Figure 11, a loose action term is proposed, whereby from the need-assessment and the mission development, the need is only stated as a reference function. Accordingly, in the design the box is left open to suggest that it is shown as a reference entity.

The second top-level function is the determination of the program requirements and alternatives (function 2.0). Figure 12 illustrates the break-out of this function.

Subfunction 2.1 is concerned with developing an advisory and/or consultative committee. The first group of this advisory committee, the General Advisory Committee (subfunctions 2.1.1 to 2.1.3), is an industry-wide consulting committee where members, through levels of their positions, have a broad understanding of the employment needs and trends of the industry they represent. According to Burt (8):

> Simply stated, a general advisory committee is responsible for making recommendations affecting the planning of the total occupational program of the local school system. It may be established by the director of vocational education or the school superintendent on a continuing basis, meeting frequently or infrequently during the year; or it may be organized on an "ad hoc" basis and discharged upon completion of its assigned task. Its membership usually consists of leading businessmen, industrialists, government officials, educators, and labor representatives in the area (p. 331).

The Education Sector Review (18) Task Force on vocational education recommends that the advisory committee be comprised of representatives of:

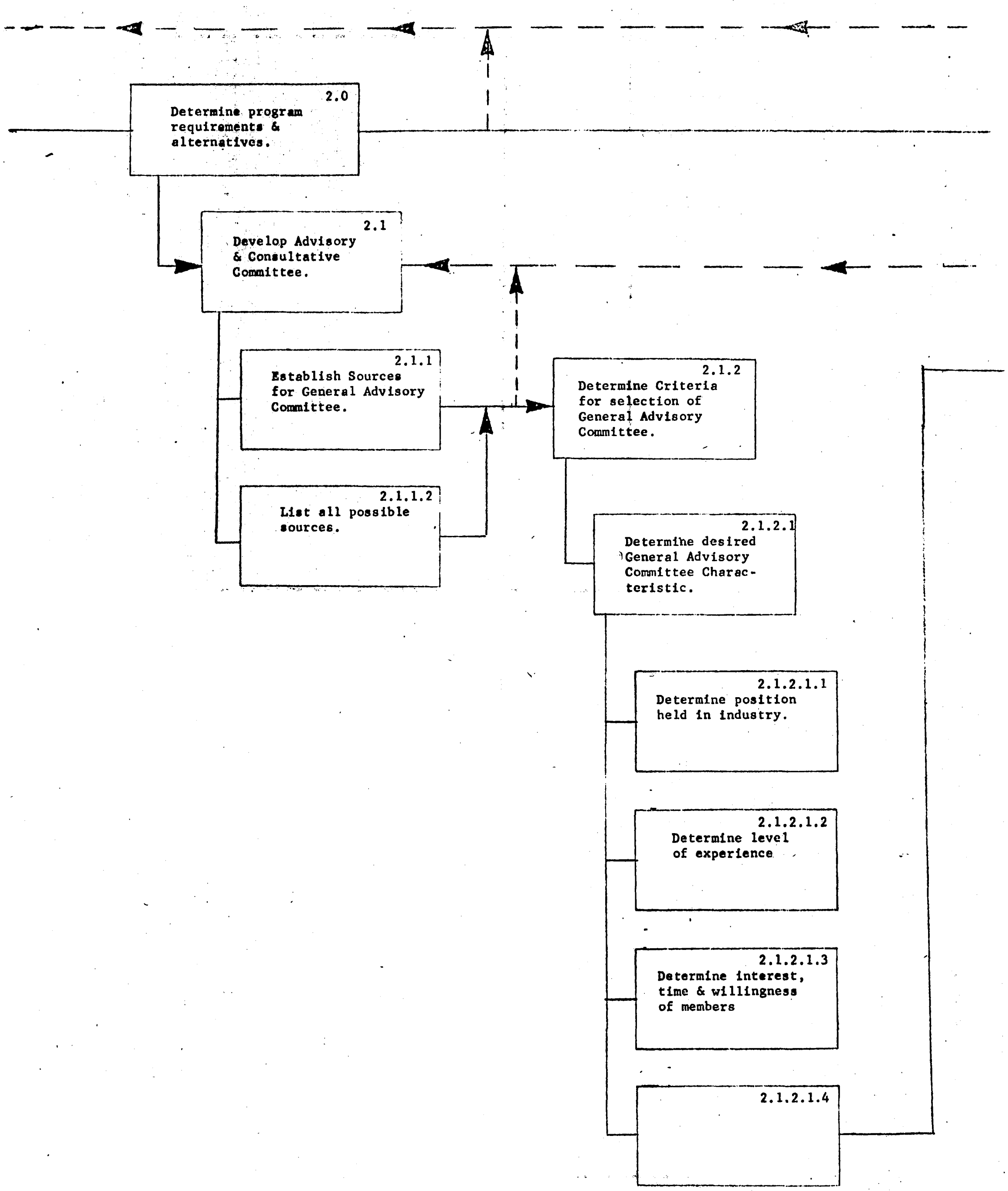


Figure 12. Developing Advisory and/or Consultative Committee

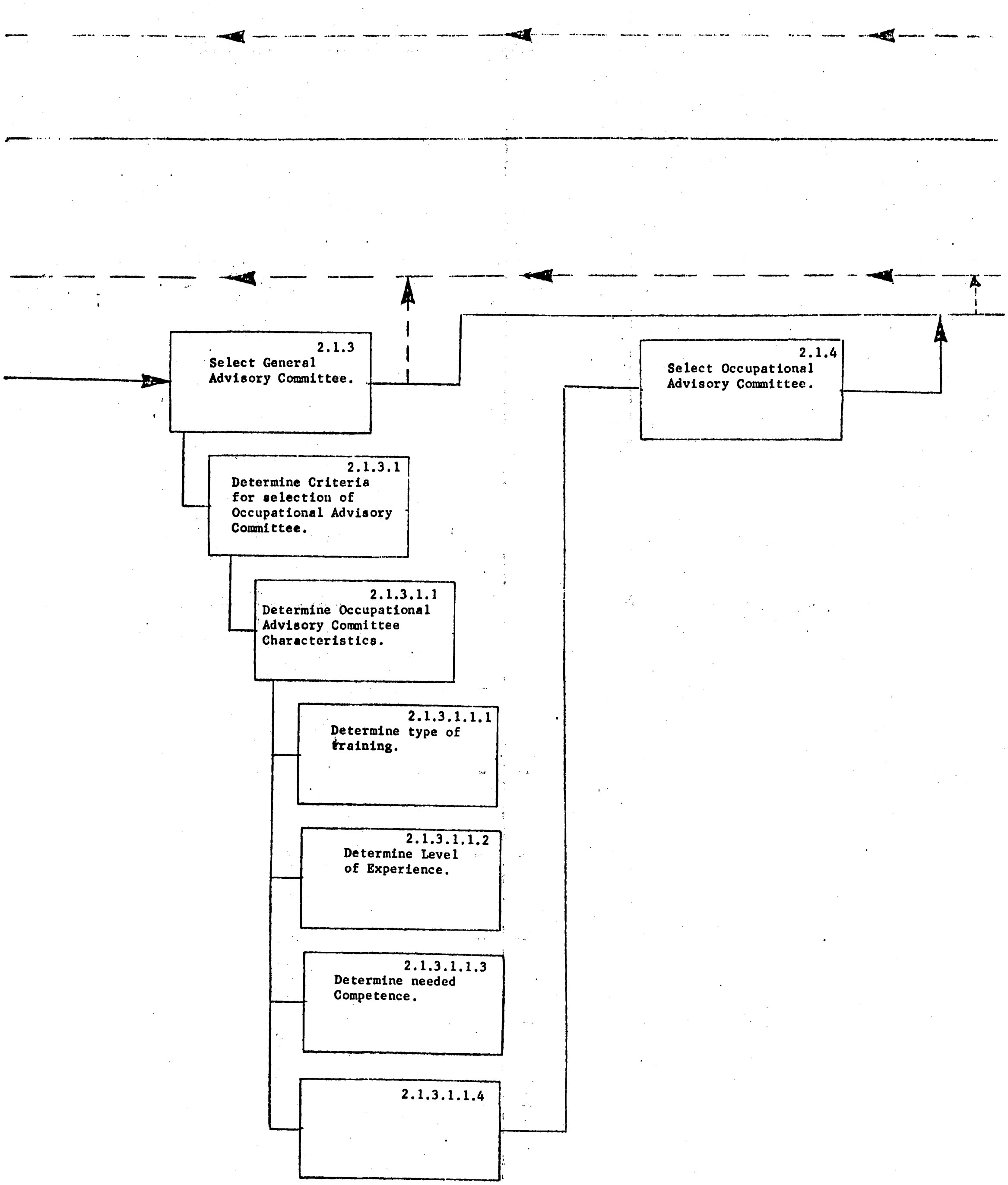


Figure 12. (Continued)

(a) Authorities responsible for the planning of vocational and technical education and training;

(b) Various organizations such as the Employers Association, Confederation of Labor Union, Teachers Association;

(c) Public employment agencies;

(d) Other competent organizations such as Ethiopian Medical Association, Ethiopian Engineers Association, Commercial School and Technical School, Alumni Association, etc.

An important function of the General Advisory Committee is to identify appropriate knowledgeable individuals who can provide occupational advisory service to the program.

It should be noted at this point that there is always a box left open at the bottom of each functional level in each illustration. This indicates that the system is open and, depending upon the circumstances of a particular occupational program, further subfunctions could be added.

The Occupational Advisory Committee, expressed in subfunctions 2.1.3.1 to 2.1.4:

> . . . limits itself to a specific occupational job or apprenticeable trade which require specialized manipulative skills or knowledge. Its purpose is to advise in the development and operation of the total instructional program within that specific occupation (8, p. 332).

This committee might also be called a "curriculum" or "skill" committee. The committee members are competent individuals involved in activities related to the occupation or supervising those actively engaged in the tasks of the occupation.

The work done by this committee is extremely critical to the development of a curriculum. The whole occupation has to be analyzed in complete detail. All the work activities must be listed in sequence and defined. The function of each activity must be explained to the curriculum specialist and agreement must be developed with respect to the amount and kind of knowledge and skill necessary to completely perform each activity in an occupation. Identification of the skills and the proficiency levels must be correct to design the educational experiences which give the student sufficient foundation to successfully function on the job. Also, a complete understanding of the job activities, the skills, and the proficiency levels to perform the activities helps to safeguard against under-training or over-training.

The determination of goals and objectives for the program, as expressed by subfunction 2.2 (Figure 13), is a critical process. The role and advice of the General Advisory Committee is important in this subfunction analysis. The necessity to refer to the mission statement at this system stage is crucial. In the development of the program there must be no variance from the previously stated goals. The system design at this stage forces behavior and action into alignment with those expressed goals.

The system design establishes the need for the accomplishment of a task analysis and a method-means analysis in the subfunctions under 2.2. These analyses are the determinants of what tasks are necessary in order to perform the function as well as how they may be performed. There is not a selection of one of the "hows" but merely a listing of them.

The program objectives state the expected ability of the student to perform in relation to the occupation when he has successfully

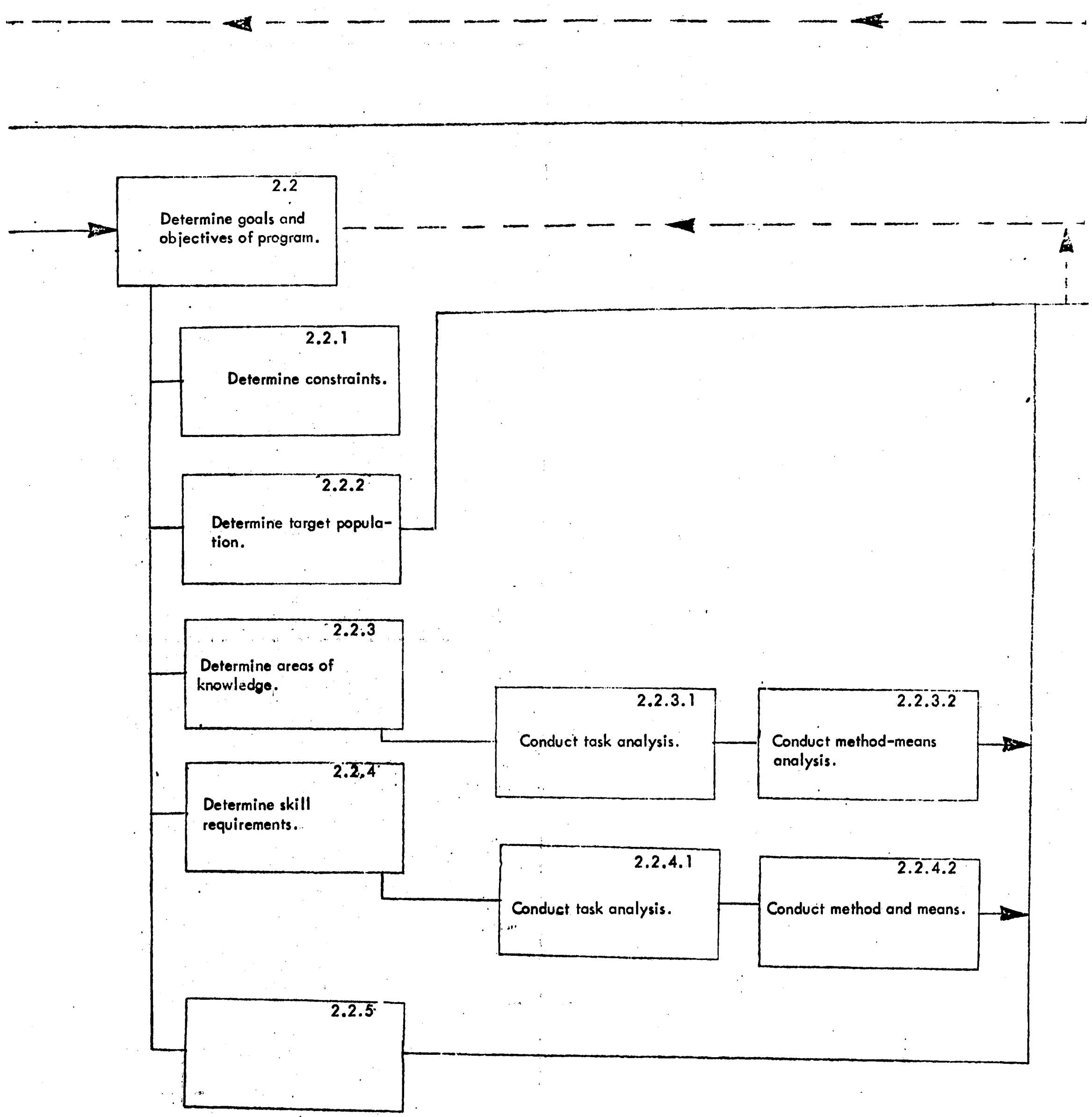


Figure 13. Program Determination

completed training. In determining objectives, an analysis of the program must first be dealt with. According to Mager and Beach (39):

> The key question to ask is this: "What kind of things should the student be able to do at the end of the course that will most facilitate his becoming a skilled craftsman in the least amount of time?" In other words, what should the student be able to do at the end of the course so that all that stands between the student and skilled performance is practice (p. 29)?

Therefore, in the subfunction of determining goals and objectives of the program (2.2), an intermediate goal between the mission statement and the objectives that are to be realized by student performance is established. As an intermediate goal, it is required to be in alignment with the mission statement.

The determination of target population and the concomitant educational requirements, in relation to the occupational program being planned as expressed in subfunction 2.2.2, is another process where the advice and assistance of committees is helpful.

In determining areas of knowledge and skill requirements (subfunctions 2.2.3 and 2.2.4 respectively) the role of the advisory committees, especially the Occupational Advisory Committee, is important. These groups can offer a wealth of knowledge based on work experience and familiarity with the technology needed to develop effective occupational instruction. Burt (8) writes:

> Curricula must be developed among job requirements, skill requirements, technical and practical knowledge requirements, and must also maintain a general education balance which is flexible and adjustable to changing conditions (p. 153).

This same concept of knowledge and skill requirements determination in developing an occupational curriculum is more explicitly identified by Larson (37) as consisting of: (1) speciality subjects and (2) related subjects.

The speciality subjects provide the concentration of subject matter knowledge and skills essential to perform as an employee on the job. This is the heart of any occupational program. Without the essential competencies acquired through the speciality subjects, the student would have nothing to "sell" respective employers.

The speciality subjects are usually concentrated in the shop and/or in the laboratory. If the program is machine shop, auto mechanics, welding, carpentry, electricity, etc., the speciality subjects are shop courses. If the program is mechanical technology, electronics, electromechanical, instrumentation, etc., the speciality courses are those shop and laboratory courses that prepare the student to perform psychomotor plus cognitive functions on the job.

All related subjects may be grouped into two classifications: general and technical. Basic or fundamental education and liberal arts education are considered general education subjects. General education provides the tool subjects for expediting mastery of the speciality subjects. This includes courses like English composition, general mathematics, social sciences, etc. In Ethiopia these general education subjects are referred to as core-subjects required in the training programs in all fields.

Technical courses include those courses that directly provide supporting knowledge or information essential to the performance of the speciality. These courses may be science, drawing, mathematics, etc. Each course provides background information to strengthen the competencies of the learner.

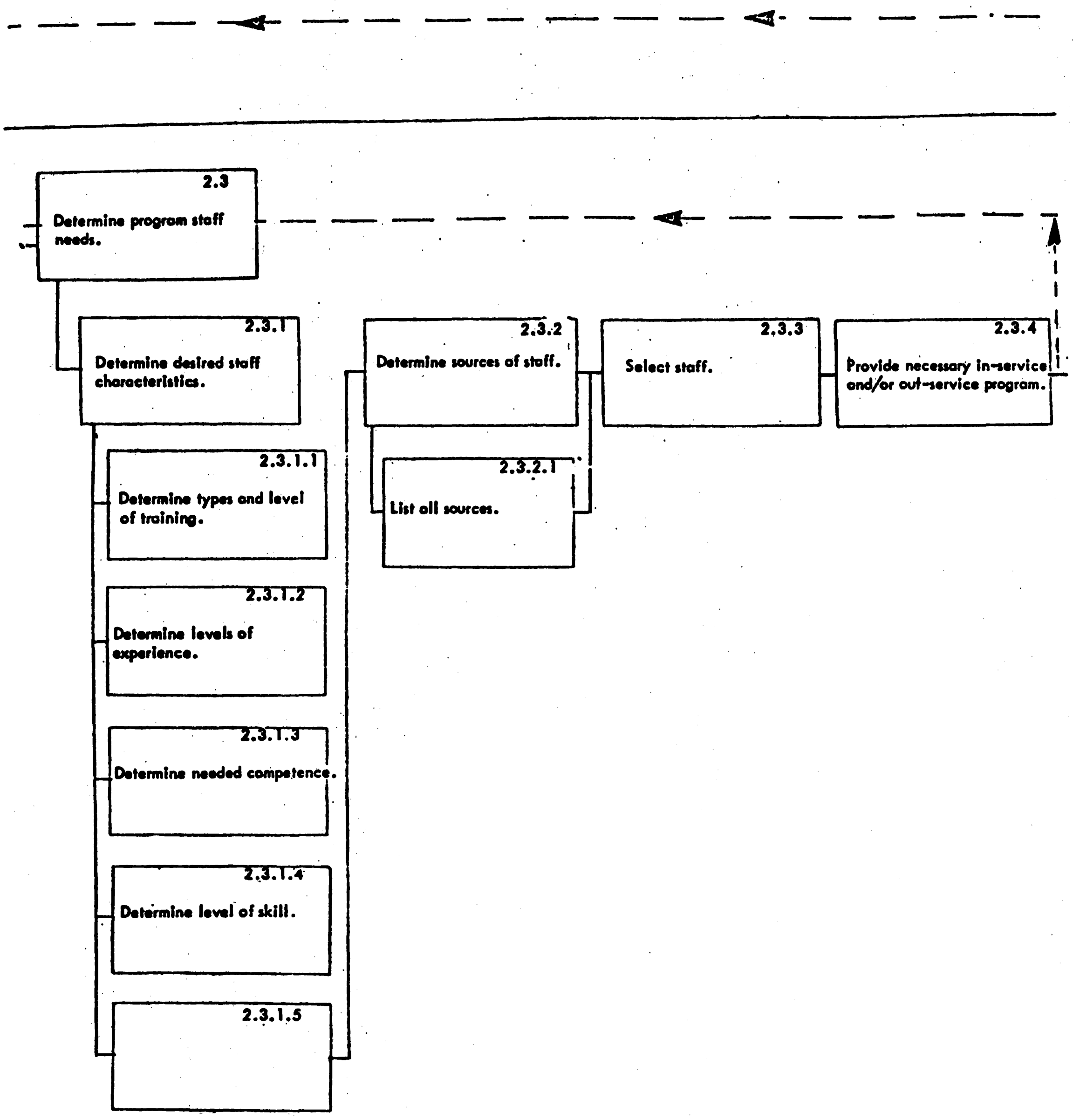


Figure 14. Program Staff Determination

The determination of these subject areas concerned in the developing of knowledges and skills requirement of the program is accomplished by the agreement and cooperation of the advisory committees and the curriculum specialists with due consideration of the core-requirements established by the educational system of the country.

In Figure 14, subfunction 2.3 deals with the human element in the system. Human characteristics are the prime determinants of all the interpersonal relationships occurring during the implementation phase of the system. An analysis is made to identify individuals who are needed to implement the program. The advisory committees assist and advise in determining qualifications and recruitment of staff.

In determining the student selection program, subfunction 2.4, Figure 15, the General Advisory Committee and the Occupational Advisory Committee will cooperate in student selection and recruitment. The determination of the student population, as expressed in subfunction 2.2.2 (page 77), has laid the ground work for student recruitment. Establishing the counseling program (subfunction 2.4.2) to include follow through and followup is crucial to the occupational program being planned, as well as for feed-back (iteration) for curriculum improvement.

The General Advisory Committee, the Occupational Advisory Committee, and Curriculum Specialists determine the facilities required (subfunction 2.5) for the program, as illustrated in Figure 16. They help identify the type of equipment, shop and laboratory facilities, the materials needed, and equipment maintenance and replacement program, as well as health and safety standard operation.

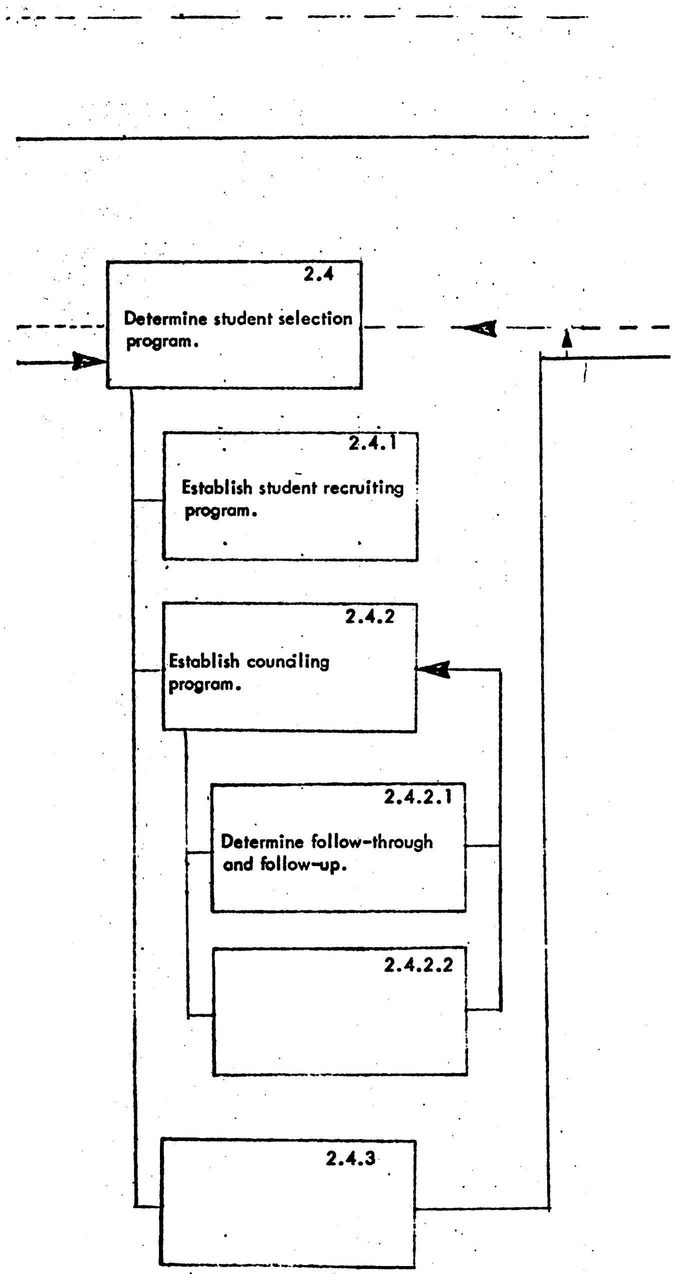


Figure 15. Student Selection Program

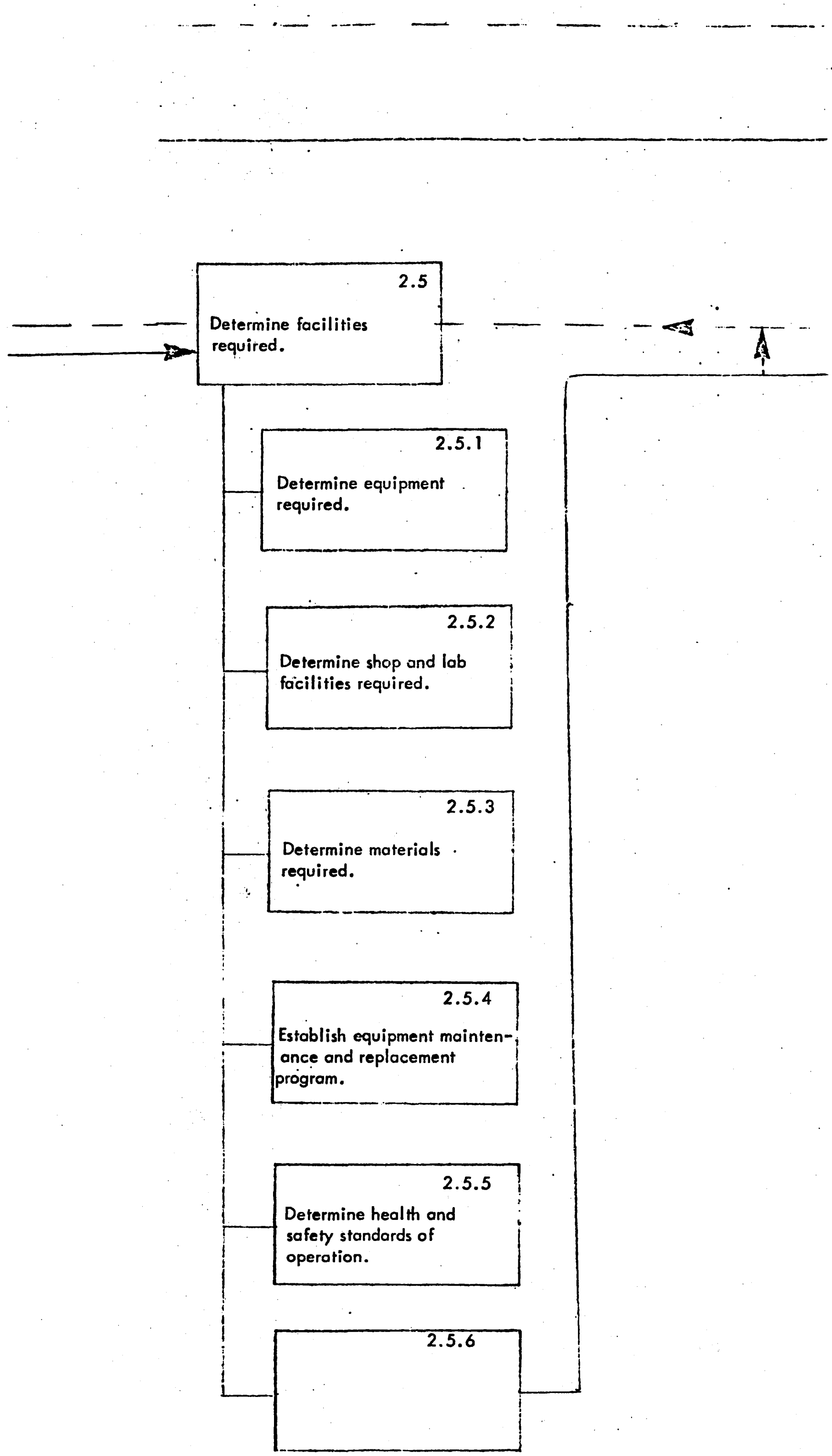


Figure 16. Determination of Required Facilities

Top-level function 3.0 is concerned with the selection of the program development strategy. Figure 17 illustrates the breakout of this function.

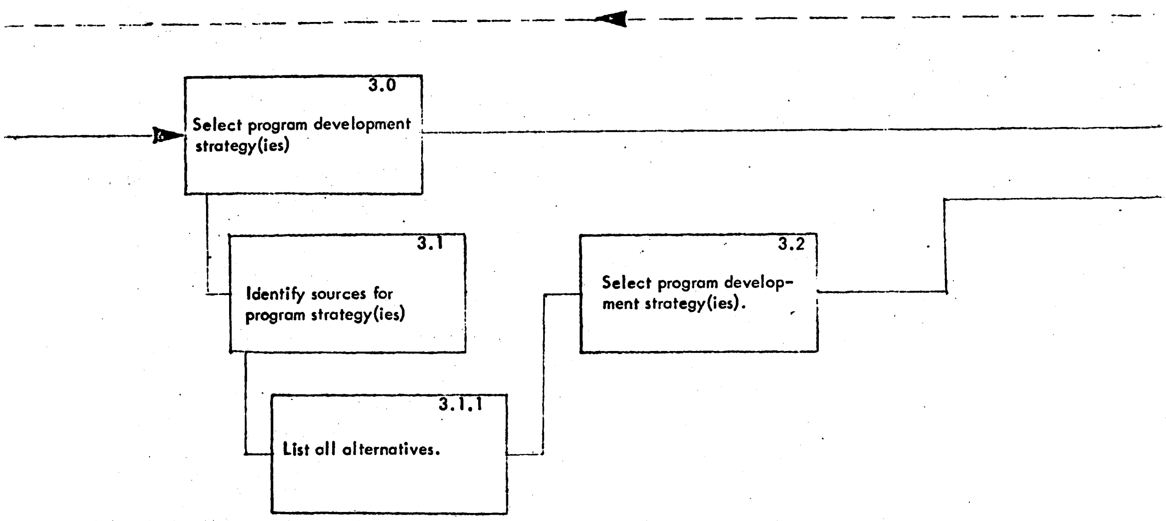


Figure 17. Selection of Program Development Strategy

There are many strategies or methods of building an occupational curriculum. Some of these are more valid than others in providing the educational experience needed by the students upon the completion of the program. These methods are often used in combination, depending upon the conditions under which the curriculum specialist has to work and the time and resources available to him to complete the process. Briefly, some of the common methods, as described by Larson (37), are:

1. Occupational or job analysis. This is essential for a new occupation or one for which a validated analysis is not available. It is also necessary in order to reflect the recent changes within the job or occupation.

2. "Scissors and paste pot" method. This consists of selecting and using parts of the curriculum of other existing institutions. Those parts which seem desirable are adopted while the remainder is rejected. While this can be done in much less time than the occupational analysis, the validity of the product is uncertain.

3. "Lifting" the curriculum from some other institution. This is a highly questionable procedure. The institution may have different objectives, standards, entrance requirements, and placement opportunities. It is even possible that the curriculum was not a good one for that institution. Usually this is the least desirable method to use in building a curriculum for a new institution.

4. Combination of above (p. 116).

Information obtained from the Occupational Advisory Committee in determining the areas of knowledge and skills requirement would suffice for providing the necessary data in some curricula development. In such cases, function 3.0 may not be necessary and can be by-passed.

Top-level function 4.0 is actually putting the program development strategy into operation. Figure 18 contains the design for this phase of the system's operation, which is essentially a synthesis operation. Functions and tasks are allocated to personnel within the system and the advisory and consultative committees. The total number of "hows" are scrutinized and a specific method for program development is determined. Further analysis as to the means of operation is conducted. The iteration process is important here since a particular "how" may not accomplish the task and evaluative feedback would provide for alternative "hows" to be implemented. The provision of physical facilities and materials follows the methods-means analysis. The

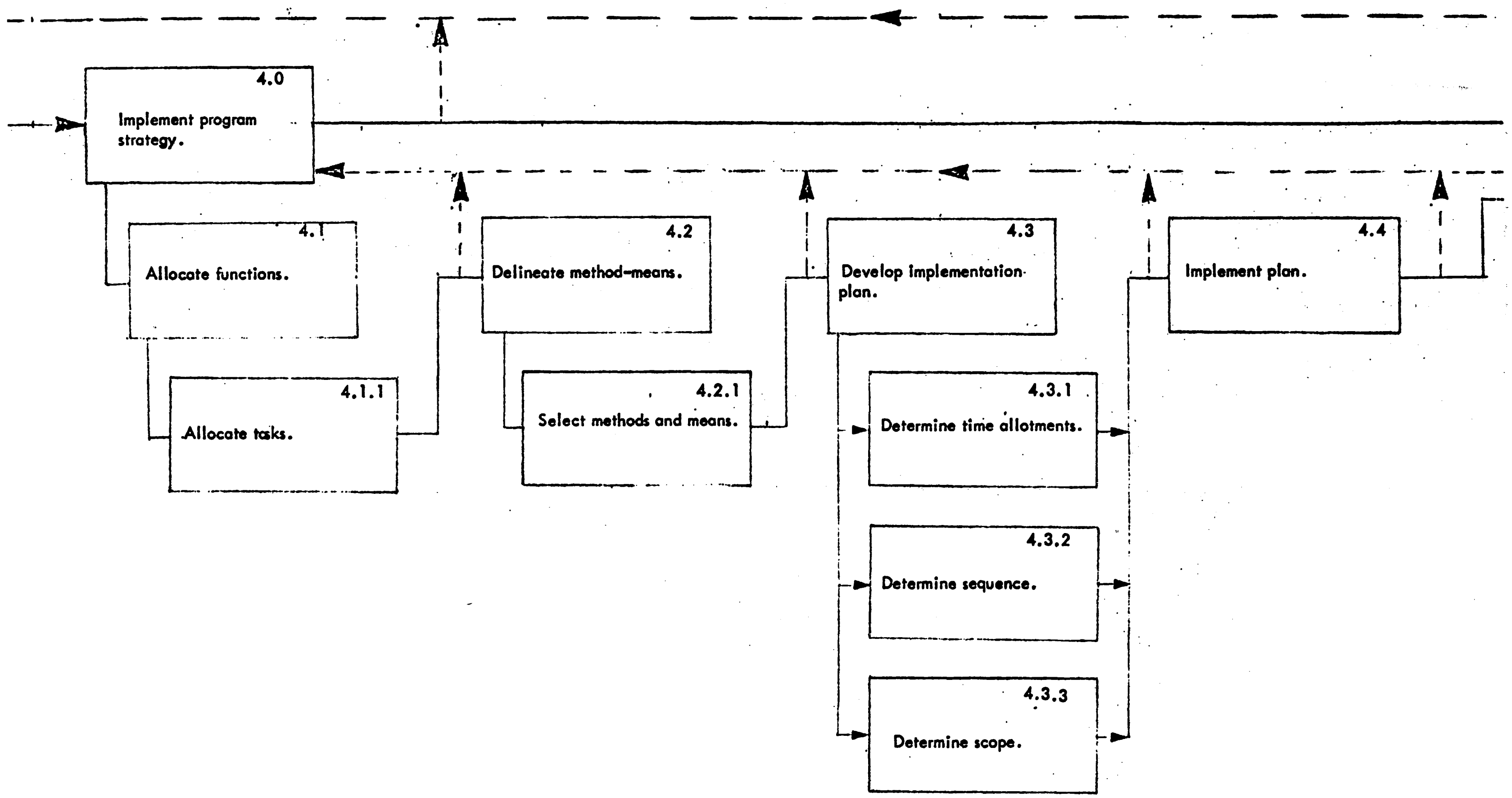


Figure 18. Implementation

selection of facilities and materials comes after all the analytical procedures. This means that facilities and materials are not precursors to that which is deemed desirable for students involved in the program.

Under subfunction 4.3 a plan is designed for the total implementation process paying particular attention to time allotment, scope, and sequencing.

The last top-level function to be performed is evaluation. As has been previously stated, the system, by means of the iteration process, has undergone constant evaluation throughout the analysis and synthesis phase. This function, however, provides a culminating effort focusing primarily upon learner performance. These performances are evaluated in regard to intermediate goals and eventually to the mission statements. This evaluation is also an evaluation of the entire system's performance.

The determination of the performance requirements was done during the mission analysis. It would seem desirable to measure as accurately as possible all of those performances which are quantifiable. At the same time, full recognition must be given to those performances which are nonquantifiable. Sensitivities, attitudes, and feelings which are expressed in performance by the learner lend themselves, in many cases, to qualitative evaluation procedures.

Figure 19 depicts the break-out of the evaluation function. Through subfunction 5.1 provision is made for process (formative) evaluation, which includes paper and pencil tests, oral questions, object tests, performance tests, observation of students at work, and inspection of completed job or project. Process evaluation is concerned with the success of the student at the time of progression through the educational program. Paper and pencil tests (subfunction 5.1.1) are

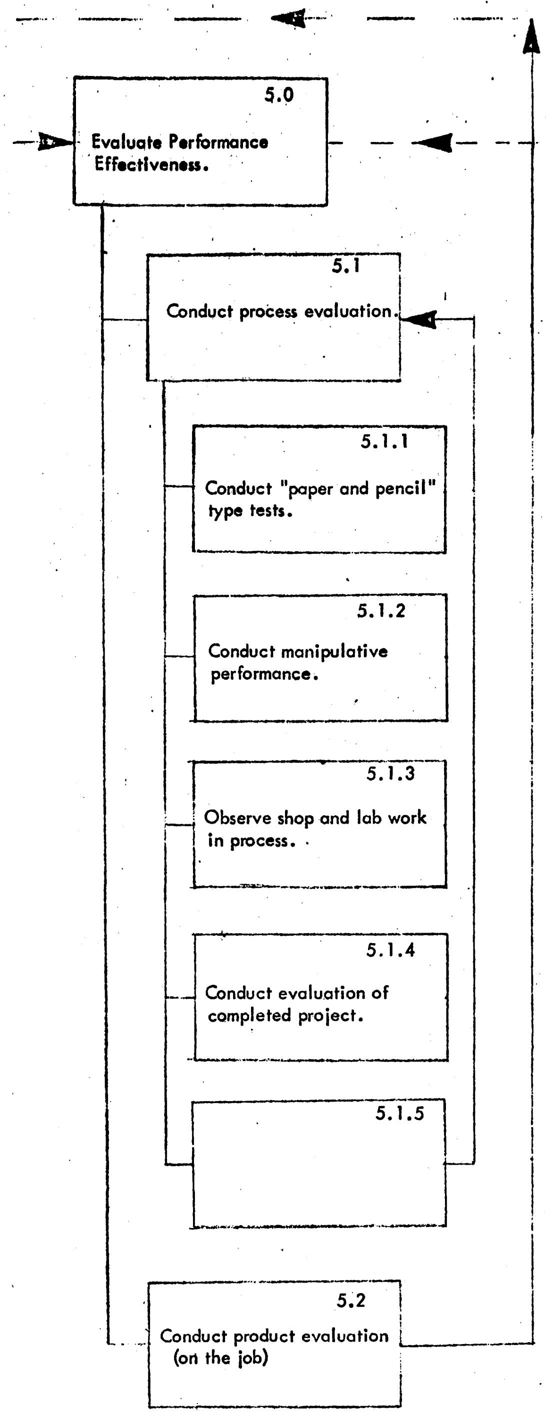


Figure 19. Evaluation

described as objective or essay tests. Manipulative performance tests 5.1.2 are tests designed to measure the student's ability to perform the selected operations of a specific job under controlled conditions. Implicit in these tests is the possession of the ability to apply essential knowledges in addition to required manipulative skills. Observation of shop and laboratory work in progress 5.1.3 is a useful tool in evaluation. Through observation, impressions are developed which often constitute the basis for an informal assessment. Observation of the student's attitude, appearance, use of tools, equipment, and materials, manner of working, association with other individuals, and conscious efforts to perform effectively are important factors in the final assessment given most employees by many employers. The final evaluative test 5.1.4 of ability to perform is reflected in the success or failure of the completed project. Correlation of achievement of standards with the instructional program is possible through evaluation of the project itself. Inherent in such evaluation is consideration of the techniques employed, equipment and tools used, as well as skills and knowledges of the students. Product (summative) evaluation (subfunction 5.2) reflects the success of the student after the completion of the formal period of education or training and indicates the success of the student on the job.

With the completion of the evaluation function, an assessment is made of the degree to which the mission has been accomplished. The focus has been upon the learner. The system being a dynamic entity can accomodate change. Student performances, as measured against the mission statement, will necessitate system revisions. The student's performance at or above the designated level in a certain area would definitely influence the program needs and consequently induce program changes.

Figure 20 provides a view of the entire model for systems approach to curriculum development and instruction for occupational education in Ethiopia.

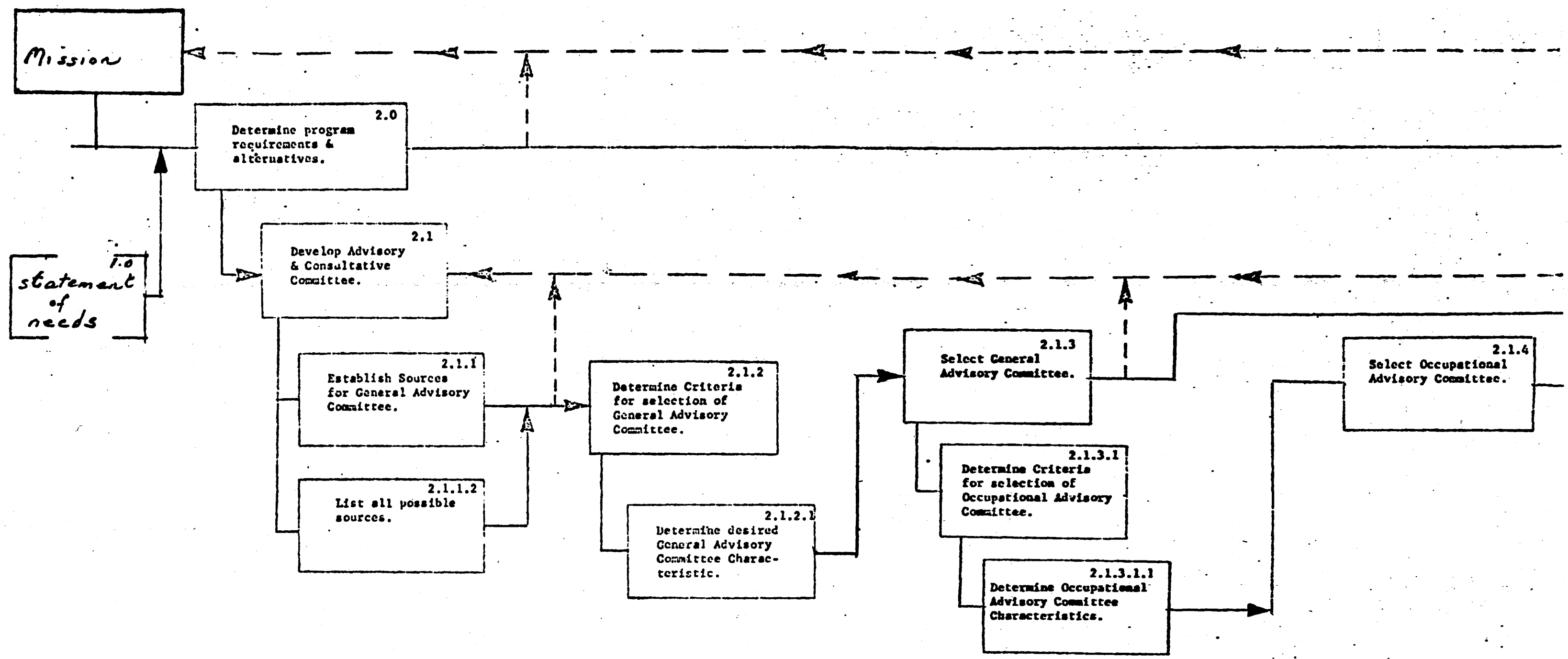


Figure 20. A Model for Curriculum and Instruction Development in Occupational Education

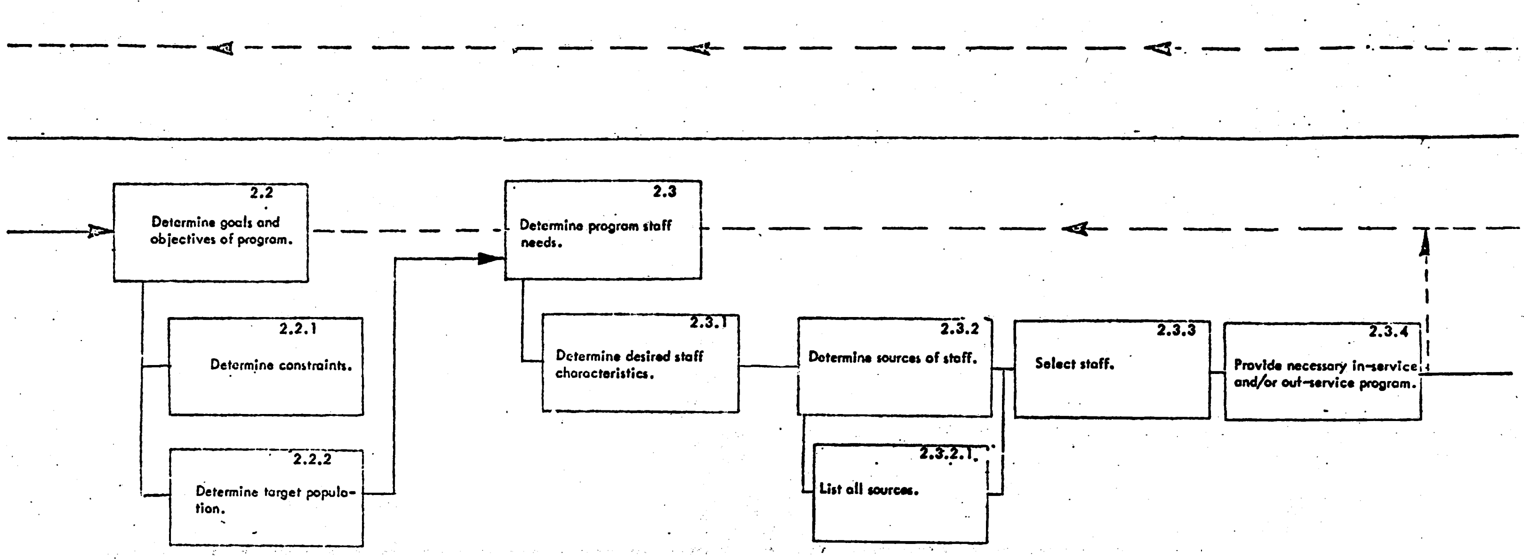


Figure 20. (Continued)

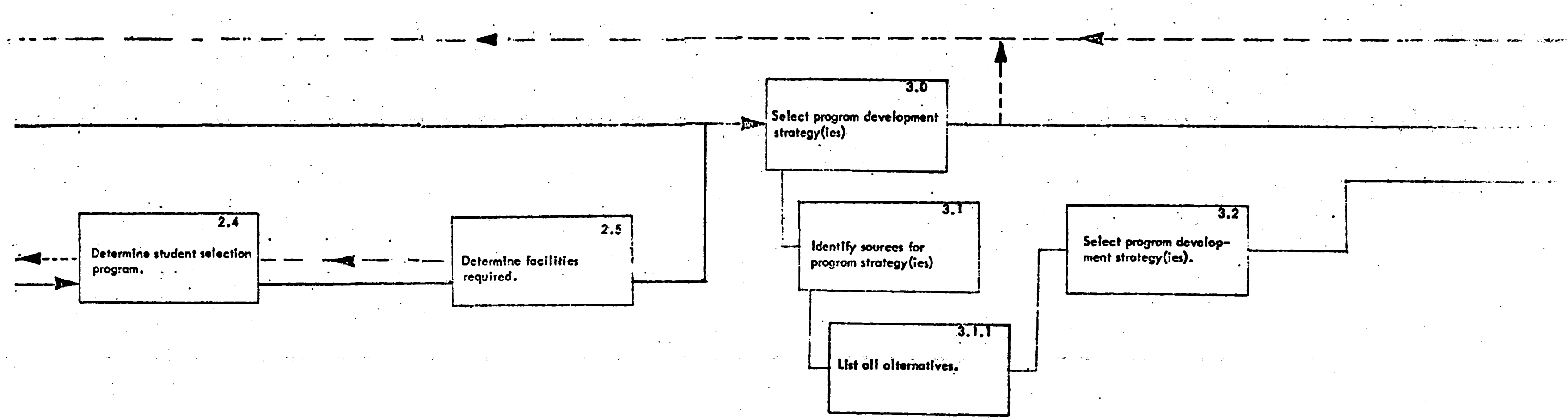


Figure 20. (Continued)

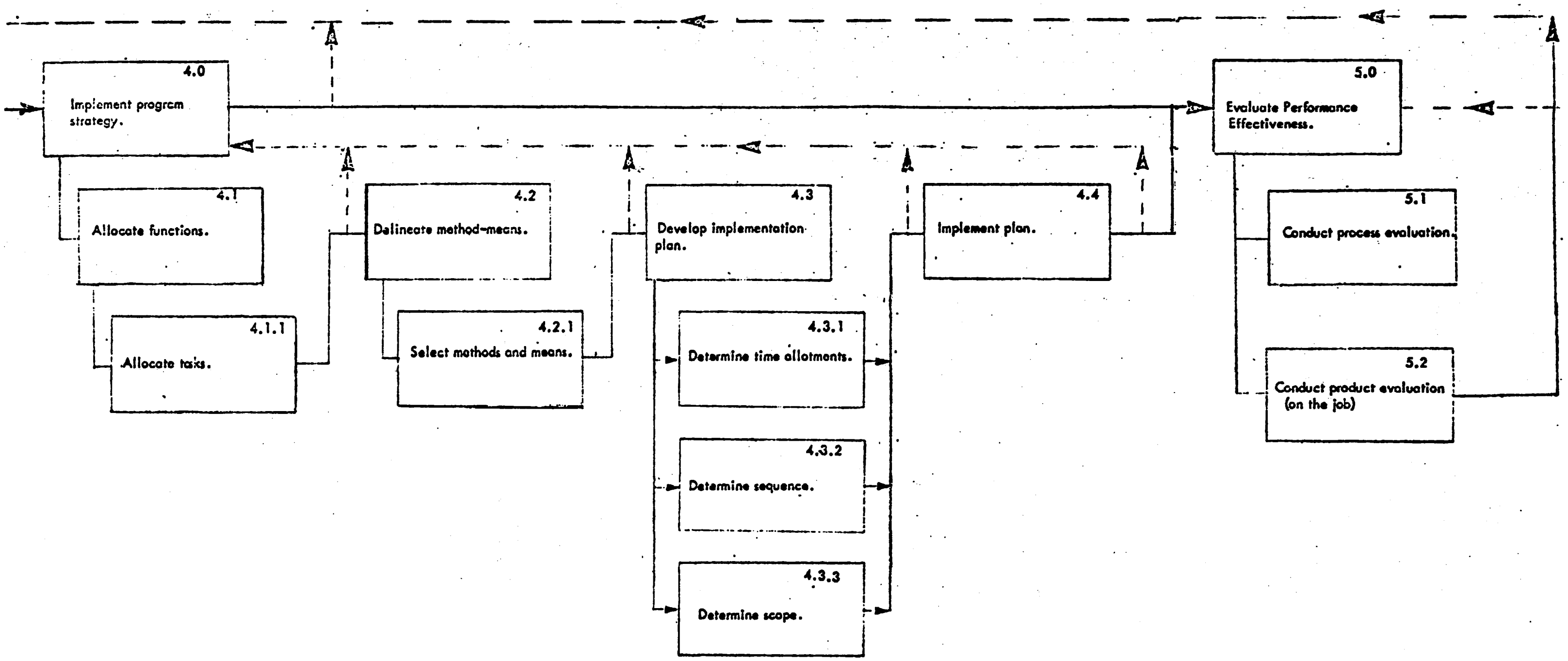


Figure 20. (Continued)

CHAPTER V

APPLICATION OF THE MODEL: A HYPOTHETICAL CASE STUDY

Application of the model for clarification of the system's operation would come about if a portion of a mission statement were taken through the system. This would be an entirely hypothetical situation and under no circumstances should it be viewed as prescriptive in nature.

If the need assessment, based on the Five Year Development Plan of Ethiopia, and the documentation from the Office of Planning of the concerned Ministry, is one that requires a training program for an agricultural-mechanics middle level technician (Class B*), then the mission of the occupational curriculum development system, in this hypothetical case, would be:

> By June 30, 1976, design a curriculum for an agricultural-mechanics occupational training program at the post-secondary school level for a target population with XYZ characteristics, which will achieve Q performance on L criterion measure by 90% of the students.

Performance requirements of the system would probably provide the following specifications (criteria):

---

*Class B represents those who have had schooling of one to three years beyond secondary education.

1. There must be learner achievement with the program to the criteria level of 90/90* when the resulting curriculum package is used by the specified target population.
2. The curriculum must meet the occupational education curriculum requirements standard of the Ministry of Education.
3. The curriculum must be in such a format as to make it adaptable for use in all agricultural training institutions of all regions of the country.
4. The program is to be implemented with a total cost of not more than X amount of dollars.

The constraints may include limitations in monetary resources, teaching staff, equipment, etc.

The mission profile would be the same as Figure 11 (page 71). The mission statement would be "develop an agricultural mechanics curriculum." This would lead to an analysis of exactly what "agricultural mechanics" means. There would need to be a clear definition. The definition could be: "agricultural mechanics deals with sales and services of agricultural power units, mostly tractors, integrated machinery, and related equipment."

From this mission statement the functional analysis process follows. The first top-level function in the mission profile is the statement of need (function 1.0). This is a reference function and would probably include phrases such as the following derived from the need-assessment and the mission statement:

---

*90/90 criteria means that 90% of learners meeting stated entry prerequisites will achieve 90% or better on the criterion-referenced test measuring achievement for prestated performance objectives.

<u>program</u>: training of agricultural mechanic middle level technicians.

<u>curriculum</u>: knowledges and skills in sales and services of farm machinery and equipment.

<u>student</u>: ability to demonstrate performance of skills and knowledges in sales and services of farm machinery and equipment to the Y degree.

In this "walk-through" hypothetical situation, only the major subfunctions of the system are considered with a full realization that all other functions and subfunctions are interrelated.

Subfunction 2.1 (Figure 12, Page 73) is concerned with developing an advisory and consultative committee. Based on the discussion of this subfunction in the previous chapter, this advisory and consultative committee would be developed from the following sources:

General Advisory Committee:

1. Authorities responsible for the planning of vocational and technical education and training.
2. Agricultural Association of Ethiopia.
3. Agricultural machinery and equipment sales representative.
4. Farm managers (potential employers).

Occupational Advisory Committee:

1. Farm maintenance and service employees.
2. Agricultural machinery and equipment sales and services employees.
3. Agricultural extension workers.

Subfunction 2.2 (Figure 12, Page 73) is concerned with the determination of goals and objectives. In systems theory both the mission statement and the intermediate goals are process-type goals. Therefore, the goals in this hypothetical case are performance goals, defined by the advisory committees, and curriculum specialists, with due consideration to the core-requirements set by the Ministry of Education. The following are examples of the goal and objectives determination:

Goal: Provide students with knowledges and skills required in the performance of sales and services of farm machinery and equipment.

Objective: At the end of the program the student should be able to demonstrate the performance of the knowledge and skills required in the sales and services of agricultural power units, tractors, machinery, and equipment. Students performance is to be measured by 90/90 criteria on the final comprehensive examination.

In this writing only two subfunctions under 2.2 are broken out further and these are: determine areas of knowledge (subfunction 2.2.1.3) and determine skill requirements (subfunction 2.2.1.4).

In determining the areas of knowledge, the use of the knowledge area is to perform as a vehicle to attain the aforementioned program goal. In the selection of these areas, the advisory committees and the curriculum specialists are concerned with due consideration to the occupational requirements of the Ministry of Education. An analysis of the area of knowledge, based on the discussion in the previous chapter, is broken out in Figure 21.

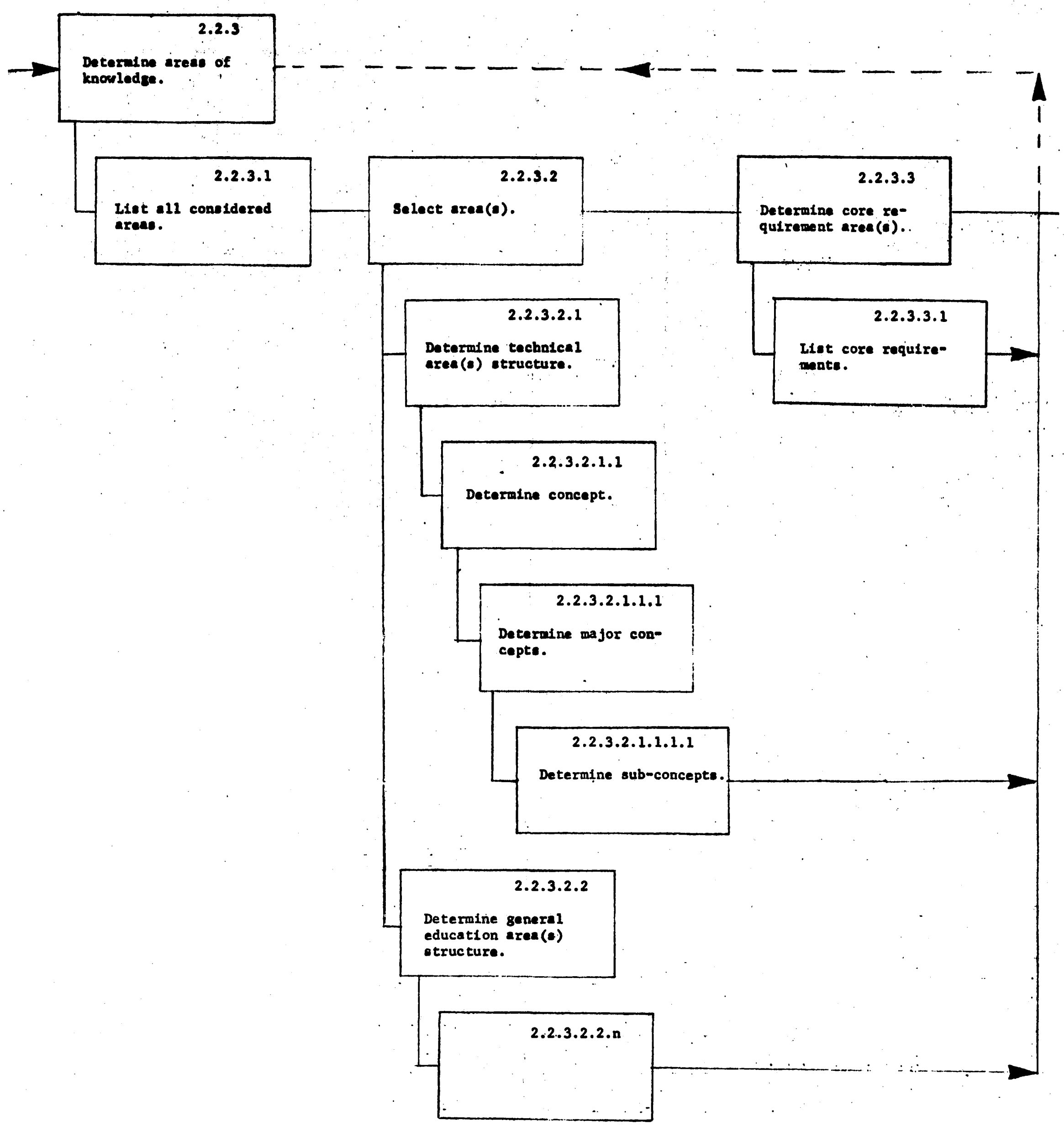


Figure 21. Knowledge Determination

Determination of skill requirement also follows the same procedure as that of the knowledge area determination. In this case, since the basic purpose is to provide the trainee with the necessary skill proficiency (cognitive and/or manipulative) for job entry in agricultural mechanics, the requisite skills are identified and listed as shop skills and/or laboratory skills. (Illustrated in Figure 22.)

From the determination of goals and objectives and the required knowledge and skills, the next step is to analyze what is needed in terms of staff to implement the program (Figure 14, Page 80). Decisions are made for staff selection and for any necessary in-service programs to develop the characteristics to the greatest degree possible that are necessary for program implementation.

The student selection program, subfunction 2.4 (Figure 15, Page 82), for this hypothetical example would include setting entrance requirements and interviewing students that have completed high school. The advisory committee members may help in both writing up the entrance requirements as well as in interviewing. The establishment of the counseling program for follow-through and follow-up is also an important function for this group.

Facilities required (Figure 16, Page 83)--materials, shop and/or laboratory facilities--are determined based on the skills identified in Figure 22. Equipment maintenance and replacement program should also be established at this stage of program development.

The selection of program development strategy for accomplishing the intermediate goals and mission statement for an agricultural mechanics training program helps to identify the methods and means for implementing the program. So far the "whats" in the system analysis

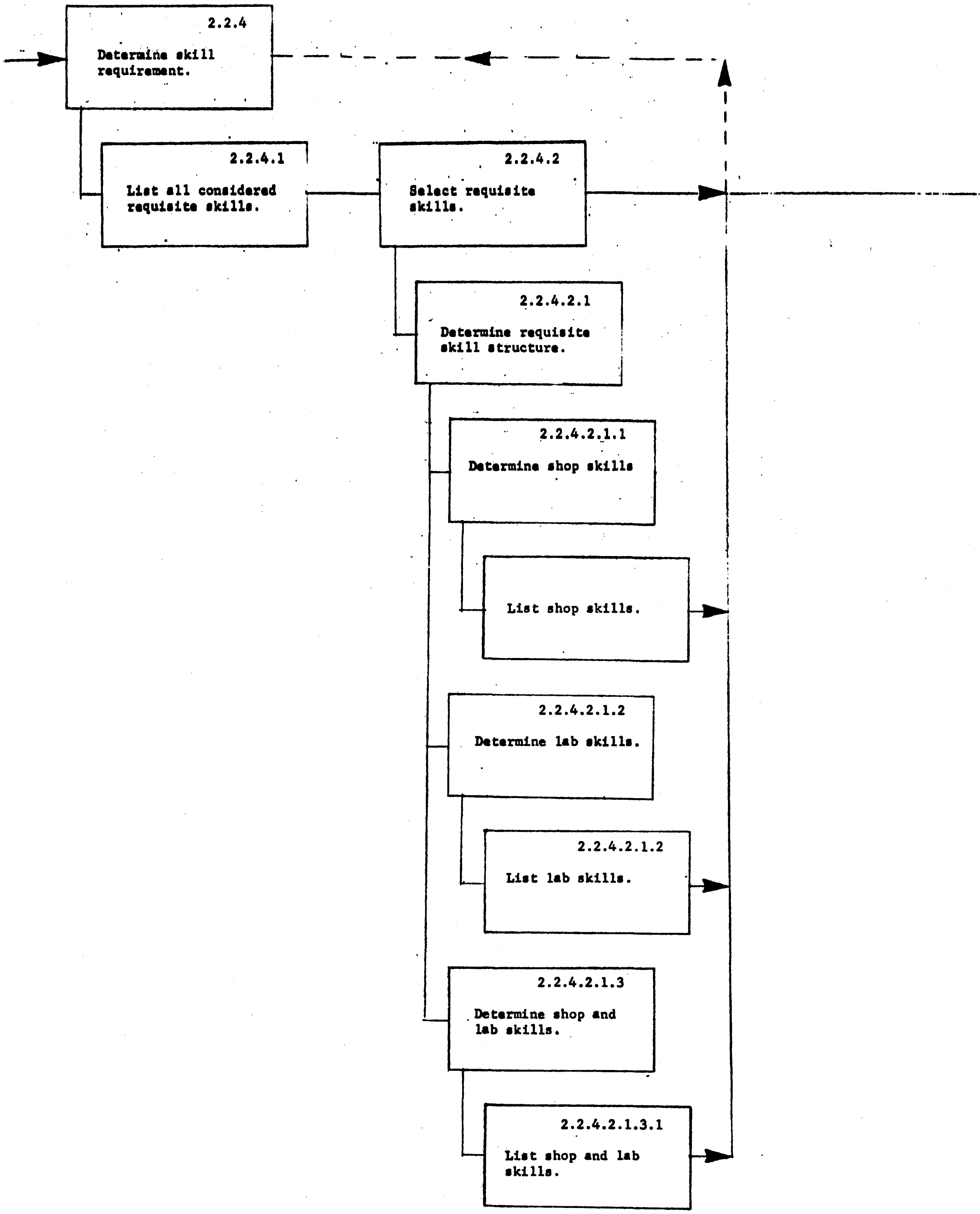


Figure 22. Requisite Skill Determination

phase have been identified. The selection of the strategy is important to establish the accomplishment of the "hows" in system synthesis. For the hypothetical case in this study, an occupational analysis strategy is recommended as the system is to develop a new curriculum.

Occupational analysis would help in further identification, breakdown, and separation of competencies utilized in the performance of the function, task, and operation involved in the agricultural mechanics program. Most readily identified are the skills employed. Essential knowledges are less discernible. Employable habits and desirable attitudes are even more elusive.

The next procedural step would be to implement the program to accomplish the selected intermediate goals and mission statement (Function 4.0). Figure 18, Page 86, illustrates the procedure to be taken. Functions or jobs to be performed, identified in the system analysis phase and by occupational analysis process, are allocated to personnel along in the accompanying tasks. Allocations could be made according to the willingness, interest, and available time of the advisory committee, the curriculum specialists, and other staff. The delineation of methods is left entirely up to these groups of people.

The development of the implementation plan (subfunction 4.3) is merely the designation of what will be implemented, when it will be implemented, where it will be implemented, and how much will be implemented. Scope, time allotment, and sequence of the functions, tasks, and operations are blocked and put into relevant instructional context.

Finally in the evaluation process (function 5.0, Figure 19, Page 88), the performance effectiveness of the program is determined. Student performance on pencil and paper tests, on manipulative performance, shop and/or lab observation evaluation, and degree of quality and quantity accomplishment of the assigned project are to be assessed as process evaluation. Since student performance is the main output of the system into the environment, those persons in the environment, particularly employers, would be involved in product evaluation. Students performance on the job is the basis for this product evaluation. Employers feedback into the system would be important input for program improvement.

The hypothetical situation of developing an agricultural mechanics training program at the post-secondary level has been taken through the major operations of the system. Even though this hypothetical example was not taken through many lower level functions, it is assumed that a coherent picture of the path has been produced.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

It is the thesis of this study that the judicious use of systems approach in the educational programs of Ethiopia will create an efficient method of planning. Therefore, the purpose of this study is to provide an insight as to how curriculum planners can make use of the systems approach in developing curriculum, and thereby propose a model for systematic curriculum development and instruction in occupational education for training institutions in Ethiopia.

An analysis of the theories, techniques, and principles fundamental to a systems approach for curriculum development was conducted to provide a theoretical framework for developing the model. The theoretical construct was based on systems theory, the application of systems approach in education, and the identification of the major components in the development of an occupational curriculum and instructional process. The design and operation of a systems approach in curriculum development and instruction was presented and discussed. Occupational education curriculum development process was viewed as a system having an environment which contains suprasystems as well as subsystems. The interaction within the system was theorized as having certain relationships to each of the parts of the system.

The components of an occupational education curriculum and instructional model proposed were: the mission statement; the statement of needs; and the determination of the program requirements and alternatives in systems analysis phase. The selection of program development strategy(ies); the implementation of the strategy(ies); and the evaluation and revision of the program constitute system synthesis. Simulation of the model was provided for clarification of the systems operation by describing a hypothetical case study through the model.

Recommendations

Based on the development of the theory and design of the model, the following are recommended for further study:

1. The model is designed for curriculum development and instruction in occupational education for Ethiopia. However, a study concerned with the adaptation of the model relative to occupational education curriculum development for schools in the United States or other educational systems should be conducted.
2. The fundamental principles, procedures, and theory of systems approach in curriculum development and instruction presented in this study can be applied for other educational planning or decision-making processes. Hence, studies concerned with other types of decision-making activities should be instituted for the application and to further refine the present model.
3. The selection of solution strategy(ies) from among alternatives, a top-level function in the model, can be administered by the use of procedures and tools such as: cost-benefit analysis, planning programming budgeting systems (PPBS); operations research and other system analytic techniques, including simulations, operational gaming, the Delphi Technique, the program

evaluation review technique (PERT), and the critical path method (CPM). Therefore, studies related to these procedures or tools should be considered in order to substantiate their work as a solution selection device from among alternatives.

4. A study involving the use of systems analysis approach should be made in order to substantiate the sophistication of the related literature supporting the model extended by this investigation.
5. A good model is one that speeds its own obsolescence. Therefore, further studies for refining or modifying the model designed in this investigation should be conducted.

BIBLIOGRAPHY

(1) Alberty, Elsie J. "Toward a Framework for Curriculum Development." Theory Into Practice, VI, No. 4 (October, 1967), 204-207.

(2) Banathy, Bela H. Instructional Systems. Belmont, California: Fearon Publishers, 1968.

(3) Beauchamp, George A., and Kathryn E. Beauchamp. Comparative Analysis of Curriculum Systems. Wilmette, Illinois: The Kagg Press, 1972.

(4) Bekri, Abdullahi. "An Analysis of Selected Curriculum Attributes with Recommendations for Curriculum Development in Vocational-Technical Education in Ethiopia." (Unpub. Ph.D. dissertation, University of Missouri, 1971.)

(5) Bern, H. A., Robert M. Diamond, John B. Haney, E. B. Montgonery, and Leonard C. Silvern. "Reply to Questions about Systems." AV Instruction, Vol. 10, No. 5 (May, 1965), 366-370.

(6) Blaschke, Charles L. "The DOD: Catalyst in Educational Technology." Phi Delta Kappan, Vol. 48, No. 5 (January, 1967), 208-214.

(7) Borow, Henry, Ed. Man in a World at Work. Boston: Houghton Mifflin Company, The Riverside Press, Cambridge, Massachusetts, 1964.

(8) Burt, Samuel M. Industry and Vocational-Technical Education. New York: McGraw-Hill Book Company, 1967.

(9) Bushnell, David S. "A Systems Approach to Curriculum Change in Secondary Education." Educational Technology, Vol. X, Part 2 (May, 1970), 46-48.

(10) __________. "An Educational System for the 70's." Phi Delta Kappan, LI (December, 1969), 199-203.

(11) __________. "A Systematic Strategy for School Renewal." Planned Change in Education: A Systems Approach. (Ed.) David S. Bushnell and Donald Rappaport. New York: Harcourt Brace Jovanovich, Inc., 1971, 3-17.

(12) Butler, F. Coit, Jr. "Job Corps Instructional Systems Development Manual." U. S. Office of Education. Denver: Rocky Mountain Educational Laboratory, Inc., 1967.

(13) Chapanis, A. "Man, Machines, and Models." American Psychology, Vol. 16 (1961), 113-121.

(14) Crawford, Meredity P. "A New Approach to Training Programs." Science Education News (December, 1968), 5-6.

(15) Davies, Ivor K. Competency Based Learning: Technology, Management, and Design. Great Britain: McGraw-Hill Book Company, (Uk) Limited, 1973.

(16) Draper, Edgar M. Principles and Techniques of Curriculum Making. New York: D. Appleton and Company, 1927.

(17) Edman, Raymod D. "A Systematic Theory for Curriculum Development and Instruction in An Elementary School." (Unpub. doctoral dissertation, Oklahoma State University, May, 1971.)

(18) Education: Challenge to the Nation. Report of the Education Sector Review. Addis Ababa, Ethiopia: Artistic Printers Ltd., August, 1972.

(19) Eraut, Michael R. "An Instructional Systems Approach to Course Development." AV Communication Review, Vol. 15 (1967), 92-101.

(20) Faunce, Roland C., and Nelson L. Bossing. Developing the Core Curriculum. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1958.

(21) Feyereisen, Kathryn V., A. John Fiorino, and Arlene T. Nowak. Supervision and Curriculum Renewal: A Systems Approach. New York: Meredity Corporation, 1970.

(22) Flanagan, John. "How Instructional Systems Will Manage Learning." Nation's Schools, Vol. 86, No. 4 (October, 1970), 68.

(23) Gagne, Robert M., Ed. Psychological Principles in System Development. New York: Holt, Rinehart and Winston, Inc., 1962.

(24) Habte, Aklilu. "Brain Drain in the Elementary Schools: Why Teachers Leave the Profession." Ethiopian Journal of Education, Vol. I (June, 1967), 27.

(25) Hartley, H. J. "Limitations of Systems Analysis." Phi Delta Kappan, Vol. L (May, 1969), 515-519.

(26) Imperial Ethiopian Government, Ministry of Education and Fine Arts. "Annual Report for the Year 1968-1969." Addis Ababa, 1969. (Mimeographed report)

(27) Imperial Ethiopian Government, Ministry of National Community Development. "An Assessment of Ethiopia's Manpower Requirements and Resources for Economic Development, 1961-1970 E. C." Addis Ababa, 1970. (Mimeographed report)

(28) Imperial Ethiopian Government. Third Five Year Development Plan, 1968-1973. Addis Ababa, Ethiopia: Berhanena Selam Printing Press, 1968.

(29) "Instructional System Development Manual." Washington: Office of Economic Opportunity, 1968.

(30) Jacobson, Gene S. "The Organization and Administration of the Public Schools in Ethiopia." Ethiopian Journal of Education, Vol. I (June, 1967), 14.

(31) Kaufman, Roger A. Educational System Planning. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972.

(32) _________. "A Systems Approach to Education: Derivation and Definition." AV Communication Review, Vol. XVI, No. 4 (Winter, 1968), 415-425.

(33) Knezevich, S. J. "Systems Analysis and Its Relationship to Educational Planning." ERIC ED-036-895.

(34) Kraft, Richard H. P., and Raymond F. Laltan. "Systems Engineering Techniques: Embarrassment or Opportunity for Today's Educators." Educational Technology, Vol. IX (September, 1969), 26-30.

(35) Krug, Edward A. Curriculum Planning. New York: Harper and Brothers Publishers, 1957.

(36) Larson, Milton E. "Review and Synthesis of Research: Analysis for Curriculum Development in Vocational Education." ERIC ED-035-746.

(37) _________. Teaching Related Subjects in Trade and Industrial and Technical Education. Columbus, Ohio: Charles E. Merrill Publishing Co., 1972.

(38) Lave, Roy E., Jr., and Donald W. Kyle. "The Application of Systems Analysis to Educational Planning." Comparative Education Review, Vol. XII, No. 1 (February, 1969), 39-56.

(39) Lee, A. Maugham. "Instructional Systems." AV Instruction, Vol. XV (January, 1970), 29-33.

(40) Lehmann, Henry. "The Systems Approach to Education." AV Instruction, Vol. XIII, No. 2 (February, 1968), 144-148.

(41) Mager, Robert F., and Kenneth M. Beach, Jr. Developing Vocational Instruction. Belmont, California: Fearon Publishers, 1967.

(42) Mager, Robert F. Preparing Instructional Objectives. Palo Alto, California: Fearon Publishers, 1962.

(43) McAshan, H. H. Writing Behavioral Objectives. New York: Harper and Row Publishers, 1970.

(44) McMahon, Gordon G. Curriculum Development in Trade and Industrial and Technical Education. Columbus, Ohio: Charles E. Merrill Publishing Co., 1972.

(45) Meals, Donald W. "Henristic Models for System Planning." Phi Delta Kappan, Vol. XLVIII, No. 5 (January, 1967), 199-203.

(46) Merrill, M. David. "Components of a Cybernetic Instructional System." Educational Technology, Vol. VIII, No. 7 (April, 1968), 5-10.

(47) Miller, Donald R. "A System Approach for Solving Educational Problems." ERIC ED-020-585.

(48) Miller, Donald R. A System Approach to Planned Change in Education: Volume to An Adaptive Framework for Public Education and Educational Management. Burlingame, Calif.: OPERATION PEP: A State-Wide Project to Prepare Educational Planners for California, August, 1970.

(49) Morgan, R. M. "ES '70: A Systematic Approach to Educational Change." Educational Technology, Vol. IX (September, 1969), 9-16.

(50) Morgan, Robert M., and David S. Bushnell. "Designing an Organic Curriculum." ERIC ED-017-737.

(51) Pfeiffer, John. New Look at Education: Systems Analysis in Our Schools and Colleges. New York: Odyssey Press, 1968.

(52) R. E. Corrigan Associates. A System Approach for Education. Anaheim, California: R. E. Corrigan Associates, 1969.

(53) Richmond, W. Kenneth. The Education Industry. London: Methven and Co., Ltd., 1969.

(54) __________. The School Curriculum. London: Methven and Co., Ltd., 1971.

(55) Saylor, J. Galen, and William M. Alexander. Curriculum Planning for Modern Schools. New York: Holt, Rinehart, and Winston, Inc., 1966.

(56) Silvern, Leonard C. Systems Engineering of Education I: The Evolution of Systems Thinking in Education. Los Angeles, California: Education and Training Consultants Co., 1971.

(57) __________. Systems Engineering of Education III: Systems Analysis and Synthesis Applied to Occupational Instruction in Secondary Schools. Los Angeles, California: Education and Training Consultants Co., 1967.

(58) __________. Systems Engineering of Education VI: Principles of Computer-Assisted Instruction Systems. Los Angeles, California: Education and Training Consultants Co., 1970.

(59) __________. "A Cybernetic System Model for Occupational Education." Educational Technology, Vol. VIII, No. 2 (January, 1968), 3-9.

(60) __________. "Systems Approach--What Is It?" Educational Technology, Vol. VIII, No. 16 (August, 1968), 5-6.

(61) Smith, B. Othanel, William O. Stanley, and J. Harlan Shores. Fundamentals of Curriculum Development. New York: Harcourt Brace and World, Inc., 1957.

(62) Sprangle, Richard E. "Systems Analysis in Education." ERIC ED-039-749.

(63) Tanner, C. Kenneth. Designs for Educational Planning: A Systematic Approach. Lexington, Massachusetts: D. C. Heath and Co., 1971.

(64) Tracey, William R., Edward B. Flynn, Jr., and C. L. Legree. "Systems Thinking for Vocational Education." Education I (November, 1968), 18-24.

(65) Tyler, Ralph W. Basic Principles of Curriculum and Instruction. Chicago, Illinois: The University of Chicago Press, 1967.

(66) Walsh, John Patrick, and William Selden. "Vocational Education in the Secondary Schools." Vocational Education. The Sixty-Fourth Yearbook of the National Society for the Study of Education. Chicago, Illinois: The University of Chicago Press, 1965, 88-134.

(67) Division of Vocational Education. A Guide for the Development in Vocational and Technical Education. Los Angeles: Division of Vocational Education, University of California, June, 1966.

VITA

Yoseph Befecadu

Candidate for the Degree of

Doctor of Education

Thesis: A SYSTEMS APPROACH TO CURRICULUM DEVELOPMENT AND INSTRUCTION FOR OCCUPATIONAL EDUCATION IN ETHIOPIA

Major Field: Agricultural Education

Biographical:

Personal Data: Born in Addis Ababa, Ethiopia, July 9, 1944, the son of Mr. Befecadu Wolde Michael and Mrs. Aster Workineh.

Education: Graduated from High School at Haile Sellassie I Day School in Addis Ababa, Ethiopia, May, 1962; received the Bachelor of Science degree from Haile Sellassie I University in Agriculture, June, 1967; received the Master of Science degree in Agricultural Education from Oklahoma State University, December, 1972; completed requirements for the Master of Science degree in Educational Administration at Oklahoma State University, May, 1975; completed requirements for the Doctor of Education degree at Oklahoma State University, May 10, 1975, Stillwater, Oklahoma.

Professional Experience: Zone Chief, Malaria Eradication Service, Addis Ababa, Ethiopia, 1967-1968; Agricultural Education instructor, Haile Sellassie I Teacher Training Institute, Addis Ababa, Ethiopia, 1968-1971; Graduate Administrative Assistant, International Student Advisement Office, Division of Student Affairs, Oklahoma State University, Stillwater, Oklahoma, 1973-1974; Graduate Administrative-Research Assistant, International Teacher Education Project, College of Education, Oklahoma State University, Stillwater, Oklahoma, 1974-1975.