A DESCRIPTIVE STUDY OF A SYNTHESIZED OPERATIONAL INSTRUCTIONAL DEVELOPMENT MODEL, REPORTING ITS EFFECTIVENESS, EFFICIENCY, AND THE COGNITIVE AND AFFECTIVE INFLUENCE OF THE DEVELOPMENTAL PROCESS ON A CLIENT

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

SPELIOS THEODORE STAMAS

1972

This is to certify that the

thesis entitled

A DESCRIPTIVE STUDY OF A SYNTHESIZED OPERATIONAL INSTRUCTIONAL DEVELOPMENT MODEL, REPORTING ITS INSTRUCTIONAL EFFECTIVENESS, EFFICIENCY, AND THE COGNITIVE AND AFFECTIVE INFLUENCE OF THE DEVELOPMENTAL PROCESS ON A CLIENT

presented by

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has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Education

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Date August 31, 1972

O-7639

ABSTRACT

A DESCRIPTIVE STUDY OF A SYNTHESIZED OPERATIONAL INSTRUCTIONAL DEVELOPMENT MODEL, REPORTING ITS EFFECTIVENESS, EFFICIENCY, AND THE COGNITIVE AND AFFECTIVE INFLUENCE OF THE DEVELOPMENTAL PROCESS ON A CLIENT

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The problems which have beset American education and threaten to undermine it as a viable institution in society have been identified and extensively reported by the mass media and professional literature. Many of the causes for the problems in education have been associated with: (1) the inefficient manner in which American education has used existing financial and human resources, and (2) the ineffectiveness of instruction as evidenced by the high drop-out rates at all levels in the educational process. Consequently, educators must be responsive to increasing public demands for better education. One alternative which appears to have potential for improving the quality of training programs is the instructional development process. For some years, the same basic systematic process has produced significant results in the American space program, many of the national defense systems, business and industrial programs and, to a more limited extent, education. Thus, there are réasons for believing that this systematic problem solving approach may be one of the more useful options available to educators.

This study revealed that there have been attempts to adapt the systems approach to problems in education through the development and use of instructional models. These attempts are extensively documented in the model-building literature. However, the models for planning the systematic improvement of instruction appear to be too general to be of maximum operational value to instructional developers.

Therefore, this study proposed to improve the process of instructional development by generating an operational synthesized model from a review of related research. The study also examined the effectiveness and efficiency of the model's process within the context of one training program.

The setting for this study was the Breathalyzer Operator Training Program (BOTP), a monthly training program for Michigan law enforcement officials. The population included eight different groups, totaling 222, of police officers who attended BOTP schools from October, 1971, through May, 1972. Three distinct research objectives were examined in this study. The first related to synthesizing an operational instructional development model from the related literature and reporting the experiences of using the model with a client. The Provus Pittsburg Discrepancy Evaluation Model (Nelson, 1970) was used to formatively evaluate consistencies and discrepancies between the model and the actual process of instructional development with the BOTP.

The second objective focused on statistically measuring the effectiveness of the instructional development process in improving student learning over a series of eight monthly training programs. Five dependent variables were identified from the written certification examination and the laboratory performance checklist criterion measures. The two variables related to the written certification examination were subjected to an analysis of variance to determine if significant improvements in student performance were discernible as a result of the instructional development. Paired comparisons using least significant differences between various combinations of BOTP schools (or months) were then computed to identify significant differences. The three laboratory variables were subjected to <u>t-test</u> statistical comparisons, between schools, of the percentage of satisfactory performance responses to determine if significant student improvement (over the October, 1971, BOTP school control group) was evident in the schools during instructional development from November, 1971 through May, 1972.

The final objective sought, first, to compare the attitude of the client toward the instructional development process with nationwide norms; secondly, to develop and administer instruments for measuring the clients cognitive growth related to the process; and lastly, to report the instructional efficiency of the process using three criteria. The client's raw score on an attitude instrument was compared to the grand mean score of nineteen national Instructional Development Institutes. Cognitive growth was measured by asking the client to numerically rate both his entry and exit cognitive proficiency on twenty-eight items representing the steps of the synthesized model. Entry and exit mean scores were then compared using the <u>t-test</u>.

Several discrepancies were reported between the synthesized model and the process used with the BOTP. Significant differences in student performance at levels ranging from .05 to .01 were discovered for the three laboratory variables designed to measure instructional effectiveness. However, no significant differences were reported on the variables related to the written certification examination. The experimenter found that the instructional development did not result in instructional efficiency on any of the three criteria used in the study.

The client's score of 214 on an attitude rating scale was slightly less than two S.D. above the grand mean score of 198.7 reported by nineteen Instructional Development Institutes.

The client's mean score on an instrument measuring his opinions regarding instructional development showed a t-test significance at the .01 level when comparing his entry (October, 1971) and exit (June, 1972) cognitive proficiency levels.

Responses to an open-ended questionnaire administered after the study was completed, revealed that: (1) the client continued to have a positive attitude toward instructional development; and (2) the client believed that one of the more significant results of the process was the change within himself--an increased sensitivity toward the value of making program changes in instruction and an increased sensitivity toward the quality of his own instruction.

The following conclusions are made from the study: (1) The synthesized model was effective in improving instruction, in that statistically significant differences favoring the programs under instructional development were obtained on three of the four dependent measures in the replications of the training programs for November, 1971, through May, 1972; (2) Instructional effectiveness, as defined in this study, will not necessarily result in instructional efficiency for programs which have not reached the stage of using self-instructional materials, in that a decrease in instructional efficiency was reported on all three of the criterion measures; (3) A positive attitude by the client toward the process can be maintained by providing statistical evidence of the effectiveness of instructional development, in that the client viewed the statistical evidence useful in justifying to his employer his continued involvement with instructional development; (4) The synthesized model was, for the most part, a good representation of the instructional development process since few model discrepancies were reported; (5) Attitude toward instructional development is likely to be more positive for those using the process in the field than for those individuals (or groups) exposed to the process in more formal instructional settings; (6) There is a positive relationship between the effective diffusion of the instructional development process to a client and the client's active involvement with the process, in that the study showed significant growth in the client's cognitive proficiency despite the fact that the synthesized model was not disclosed to him during the study; and (7) Effective instructional development can change people, in that the client stated on an open-ended questionnaire that one of the most significant results of the process was the change within himself.

The synthesized model provides an operational framework within which instructional developers can consult with instructors regarding the systematic improvement of training instruction. Whether the model can be generalized to other types of instructional systems is a question yet to be answered.

However, the instruments used to measure the client's cognitive proficiency and his attitude level relative to the process need further refinement, including tests of reliability and validity.

The experimenter concluded that several refinements to the synthesized model should be considered by those who may wish to use the model or replicate this study.

For example, refinements to the synthesized model need to: (1) include resequencing several steps of the process; (2) contain heuristics, or rules of thumb; (3) include prerequisite guidelines which specify to the client what commitment(s) he will have to make if the instructional development is to achieve maximum success; (4) explicate how to perform the functions of the model; and (5) specify criteria for measuring how adequately each step of the model was performed during instructional development.

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By

Spelios Theodore Stamas

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

College of Education

1972

DEDICATION

To My Father

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to the many persons who have contributed to the design, development, and execution of this thesis.

Particular thanks are expressed to Dr. Kent L. Gustafson, chairman of the guidance committee, for his counsel and special interest in my program and for spurring me on to an intensive study of a practical problem in instructional development. Appreciation is also expressed to Drs. Norman T. Bell and Elwood Miller for their counsel, and to Dr. Allan J. Abedor for his interest, thoughtfulness, and encouragement as an 11th hour substitute on the guidance committee.

Special thanks go to Dr. Paul W. F. Witt for his interest in my program, Mr. Jerry Stemler without whose cooperation this thesis would not have been possible, and Dr. Lawrence Lezotte for his key suggestions in the design of the study.

Gratitude is expressed to Dr. Daniel Jacobson for his valued friendship and kindness in keeping an "open-door" at times when a sympathetic ear was most appreciated.

Deepest appreciation goes to my wife Connie, my son Ted, and my daughters Gayle and Beth for their patience and understanding throughout the development of this study. To them, I offer my gratitude for the love and encouragement they have provided.

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CHAPTER I

THE PROBLEM

Purpose of the Study

The purpose of this study is to provide a model which can improve the instructional development process and thus the effectiveness and efficiency of instruction. The study proposes to improve the process of instructional development by generating an operational synthesized model from a review of related research. It also proposes to examine the effectiveness and efficiency of the model's process within the context of one training program.

Procedures

To achieve this purpose, the study proposes to: (1) synthesize an operational instructional development model from model commonalities apparent in the related research, from professional contacts with instructional developers, and from selected literature dealing with the individual components of the instructional development process; (2) apply the synthesized model to the Breathalyzer Operators Training Program (BOTP); (3) state consistencies and discrepancies, if any, between what the model suggests, and what actually occurred; (4) suggest the steps of the synthesized model which, on the basis of the discrepancies, would appear to need revision; (5) present statistical and research data designed to measure the degree to which the instructional development with the BOTP resulted in: (a) improved student learning over a series of training sessions or schools and (b) improved instructional efficiency in terms of instructional time, instructional costs, or instructional man-hours; and (6) present evidence which will support or deny positive affective behavior toward the instructional development process as well as cognitive growth in understanding and use of the process by the Director of Training for the BOTP (client).

The Need for the Study

It is generally recognized that American education is beset with serious problems, some of which threaten to undermine it as a viable institution in society. These problems have been identified and extensively reported and re-reported by the mass medias and the professional literature to the American public. For this reason, no purpose would be served by any literature review related to the: (1) financial crisis in public and private education; (2) problems of equalizing educational opportunities for all segments of American society; or (3) need for greater instructional relevance and student instructional alternatives in the curricula of our schools.

What is important, however, is that many of the causes for the problems in education have been associated with: (a) the inefficient manner in which American education has used existing financial and human resources in the system, and (b) the ineffectiveness of instruction as evidenced by high drop-out rates at all levels in the educational process.

Consequently, educators must be responsive to the public demands and explore or examine new alternatives for improving the effectiveness and efficiency of instructional design, development and implementation. One alternative which appears to have potential for improving the quality of education is the instructional development (ID) process. It is generally agreed by those who call themselves instructional developers, that ID is a systematic process which at a minimum uses learning theory and communication research in the design, development, and implementation of programs which are more effective and efficient in their teaching/learning activities.

For some years, this systematic process has produced significant and obvious results in: (1) the American space program as reflected by the success of the Apollo and other space efforts; (2) many of the national defense systems which require systematic training of military personnel as well as a systematic design, development and implementation of early warning attack and weapon systems; (3) business and industrial programs whose success correlates highly with efficient and effective training of sales personnel; and (4) American public and private education (on a more limited basis) for systematic retraining of teachers, e.g., NSMI (1970); DeCecco (1968); Alexander and Yelon (1969); Gerlach and Ely (1971); Kemp (1971); and Douglas (1971).

Thus, there are reasons for believing that an instructional development process which uses a problem-solving approach similar to those used by government and industry, may be one of the more useful options available to training managers and educators in their quest for quality instructional programs. Interest by these educators in the potentials of ID is evidenced by the increasing use of models which have been developed and reported in the professional and research literature during the past decade (Appendix A).

Moreover, instructional models have been used by educators in the past several years to cope with instructional problems. Barson (1965) used his model with four major American universities as a model for systematic development of college-level courses. Hamreus (1968) developed a model which was condensed by the National Special Media Institutes (1970) for use during Instructional Development Institutes designed for teachers, administrators, policy makers, and specialists. Alexander and Yelon (1969) devised their model as a common experiential referent while working with faculty on instructional design. Douglas (1971) formulated his model as an operational plan for instructional development with staff at Burlington County College in Pemberton, New Jersey. Although there is all this interest in instructional models, all these model-builders and users indicate a need for more study and model refinement.

As this study will reveal, there have been many attempts to adapt systematic processes to instructional problems by developing models. These attempts are well documented in the model-building literature reported since the 1960's. However, these models for planning the systematic improvement of instruction, or the systematic identification of problems within an educational system, appear to be too general to be of maximum operational value to instructional developers. If the potential of models is assumed, it is important to improve the process of instructional development by advancing the knowledge in model-building theory.

Obviously, this study cannot reasonably solve all the instructional problems which have beset training programs in America over the years. Regardless, the results of this study can contribute to the development of better strategies for designing, developing and implementing instructional programs. Therefore, the study is limited to reporting the experiences of the experimenter in using a synthesized instructional development model with a training program, the BOTP for the State of Michigan.

One question which needs to be discussed at this point is: Why use instructional systems which involve instructional models? It is therefore useful to explicate the specific uses and importance of models.

<u>Uses and Importance of Models</u>

In attempting to place the history of model-building in perspective, Karl Deutsch (1948-49) states that "men have tended to order their thoughts in terms of pictorial models since the beginning of organized thought" (p. 387). He elaborates:

> The model itself was drawn from something in their immediate experience, available from their technology, and acceptable to their society. Once adopted, it served, more or less efficiently, to order and correlate the experiences which men had, and the habits they learned, and perhaps to suggest a selection of new guesses and behavior patterns for new or unfamiliar situations (p. 387).

Deutsch maintains that pictorial models are most useful as a way of ordering experiences so that more intelligent decisions can be made on probable solutions to problems.

After briefly tracing the historical precedent for models in society, Deutsch concludes that "later models were drawn by men from work of their hands, that is from processes and things which they themselves could bring into existence, put together or to take to pieces, and which they therefore could analyze and elaborate more adequately in their parts and interrelationships" (p. 387).

Alexander and Yelon (1969) see the value of a model as a communications tool for providing a Common Experiential Referent (CER) in instructional systems design. They theorize that:

> When people work together designing systems, they invariably encounter communications difficulties. This is usually because, coming from different backgrounds and having different ways of approaching a task, they tend to view problems differently. Often each employs a different vocabulary, or technical language, derived from his particular area of training or competence, which also impedes communication of ideas (pp. 44-46).

In summary, the CER flowchart model is the stimulus and referent from which the instructional developers can move toward a consensus on the best strategies and procedures to follow in the design, development, and evaluation of programs. This common experiential approach presupposes that changes in the referent model may result from the information input provided by individual members of the design team. Generally speaking, the theoretical assumption underlying this approach is that model consensus by the instructional developers will result in greater commitment to the process as subsequent developmental activities evolve.

Silverman (1967) recommends the use of models rather than theories of teaching at this stage in the development of educational technology because, as he contends, "models offer greater flexibility in dealing with what he refers to as field or dynamic forces operating within the environment" (p. 5). He explains further that the "key property of a field is the dynamic one; every part depends upon every other part and parts cannot be studied in isolation from the whole" (p. 5). Silverman emphasizes this thesis by observing that:

> The best way to proceed in developing a theory of teaching is to begin with what is known about learning in the laboratory and in the classroom by adopting a model derived from a theory of learning and/or from systematic approaches to the study of learning in the laboratory. . . . The relationship between the laboratory and the classroom may be improved by the use of models. By model I mean mode of representation. In this sense a model may be a replica. . . . A model tolerates exceptions, but a theory does not easily do so. . . . Models can be useful and yet they demand less commitment to them than do theories. They can be discarded and replaced if shown not to be useful (pp. 4-5).

In discussing the values and limitations of using a diagrammatic model as a means of picturing the communications process, Barnlund (no date) noted that:

> When social scientists try to isolate and order all the elements of a complex event--that is, when they approach such systems analytically--the results are almost unmanageable (p. 86).

Barnlund continues by saying that "one advantage of a model then, is the ease with which it handles a multitude of variables and relates their effects upon each other in highly complicated ways--thus preserving the integrity of the events under study" (p. 86). Further, Barnlund believes the designer of a model is forced to identify variables and relate them with a precision that is difficult for the writer to achieve because of the stylistic demands of effective writing (p. 86). Finally, he maintains that "a diagram or formula can portray at a single glance, and with great transparency, the assumptions and properties of a new theoretical position, thus stimulating the study of alternative approaches" (pp. 86-87).

Gerlach and Ely (1971) view models as a guideline or road map which should be used as a checklist in planning for teaching (p. 12). They explain that a checklist "shows the major components of the total teaching/learning system, even though it does not portray the fine details of each component" (p. 12). To Gerlach and Ely, one value of a model is its ability "to visualize, in simplified fashion, something not easily observed" (p. 12). They conclude that "when a model is used without constraints it can serve as a powerful aid to a teacher in helping him organize his instructional planning more carefully, thereby minimizing the possibility of overlooking essential components" (p. 12).

Merrill (no date) describes model-building as a research approach. It is his contention that "a careful analysis is made of the various components of the instructional system, and classification schemes are hypothesized" (p. 6). Using this research approach, often referred to as the systems approach, protects against what Randall (no date) calls "partial solutions to educational problems" (p. 1). Randall insists also that instructional design which is systematic and employs such techniques as model-building can be a useful tool for maintaining proper perspectives requisite to productive innovation and change" (p. 1).

Kaufman (1968) reaffirmed the contention of Merrill, Randall, and Gerlach and Ely when he noted that the systems approach as represented in instructional development models "would be an effective and efficient tool to assure that the complex interactions will be properly considered" and that since the educational world is complex, it would seem that a formal problem solving model may serve it well (p. 419).

Kaufman's concern for using a formal problem solving model for ordering complex problems to assure proper interaction between all the variables or components related to that problem is the basic premise of systematic planning.

Models have also been used to advantage in developing specifications for instructional simulations. For example, Twelker (1969) claims that "A simulation will only be as good as the model on which it is based. . . ." (pp. 5-7). In carrying this further, Abt (1970) maintains that the physical scientist or engineer who experiments in a simulated reality with reduced-scale model of devices or processes uses theory about how things are related to each other to define the model relationships, and then experiments with the model to test various solutions in alternative possible environments (p. 11).

Thus, in summary, models have the potential of: (1) ordering experiences so that more intelligent decisions can be made on probable solutions to problems; (2) serving as a common experiential referent from which individual members of a design team can move toward process consensus and commitment; (3) portraying the teaching process in a flexible manner since they demand less commitment and tolerate exceptions; (4) representing a multitude of variables while preserving the integrity of the events under study; (5) portraying, at a single glance, the assumptions and properties of a new theoretical position; (6) stimulating the study of alternate approaches; (7) protecting against partial solutions to educational problems; (8) serving as a checklist in planning for teaching; and (9) simulating reality in reduced-scale to test various solutions in alternatives possible environments.

Precedence for the Study

A precedent for the present study was established by Barson (1965) when he developed a model for analyzing instruction and implementing newer media of communications for improving instruction (p. 1). Two years later, he tested the model as part of a USOE study which enlisted the cooperation of four universities (p. 1). Although Barson tested the effectiveness of the model in analyzing instruction and implementing newer media of communications, the experimenter could find no evidence in this literature review to indicate that the model was revised after the study. Further, the same pattern related to model refinements is evident in the related literature. Few instructional developers have attempted to apply a model to developmental problems for the purpose of reporting consistencies and discrepancies in the model. Of significance also is the fact that few, if any, instructional developers have reported strategies for measuring the effectiveness of development resulting from the application of a model.

Potential Contributions of the Present Study

This study is designed to contribute to the literature in the field of Instructional Development by building on the work of Barson and others.

First, a literature review was conducted in order to synthesize an instructional development model from the model commonalities observable in the review. The main purpose was to generate a more operational instructional development model than is located in the literature.

Secondly, the study was designed to report procedures for measuring or assessing the extent to which the instructional development process improved student learning and instructional efficiency. Recent demands for accountability in the learning/teaching process make it imperative that instructional developers, as well as all educators, systematically design and develop procedures for evaluating the effectiveness of their efforts during program development. The need to be accountable was clearly voiced by President Richard M. Nixon in his 1970 Education Message when he observed that as a result of the obvious shortcomings in the quality of American education:

> . . . we derive another new concept: accountability. School administrators and school teachers alike are responsible for their performance, and it in their best interest as well as the interest of their pupils that they be held accountable (Lessinger, 1971, p. 14).

Stated concisely, educators need to focus on effective and efficient learning, not the retention of children in school. The ultimate goals should be (1) zero-rejects in learning, (2) greater relevance, (3) improved human dignity and self-image by dealing not only with individual differences but also individual similarities, and (4) a guarantee that every child shall learn (Lessinger, 1971, p. 14). Lessinger reaffirms that educators have made few attempts to measure the results of student learning or performance as a test of professional competency when he noted that we have now reached the point at which "results are what count, not promises and lamentations" (p. 13). As proof of our failure he reported that:

> Today, about one of every four American children drops out of school somewhere between fifth grade and high school graduation. In 1965, one of every four 18-year-old males failed the mental test for induction into the armed forces. And hundreds of thousands of parents, particularly of minority children, reacting to this information, have decided that their children are not stupid--that either some educators are incompetent, or inadequate (Lessinger, 1971, p. 13).

Deterline (1971) takes the same basic position on accountability. However, he inserts one additional element into any discussion of the topic when he explodes the myth that teaching means the presenting of information by a competent subject matter expert who, through testing, identifies student deficiencies and blames them on the student. Instead, Deterline insists that teachers "ought to be held accountable for the results of instruction, and rewarded or not rewarded depending on the results" (p. 16).

In relating the accountability problem more specifically to higher education, Gage (1971) writes:

> The current dissatisfaction with higher education as reflected by numerous articles in the newspapers, periodicals, etc. and by reluctant findings by state legislation, suggests that this would be a time when the public is asking that the (Blanket) mandate they have given educators either be returned, returned in part, or at least reexamined. In a sense, the public is asking us in higher education to at least provide them with some evidence that we are taking care of the blanket. That is, this may be a chance to demonstrate to both ourselves and the public that we are as strong as they are . . . the public is going to insist that some evidence be provided that the American college is behaving responsibly (pp. 1-2).

If Gage is correct, the implications of accountability are clear. Instructional developers must examine ways to better prove their accountability through the reporting of evaluation data, including statistical and research evidence, in measuring the effectiveness and efficiency of the process.

Thirdly, the study is designed to use the Provus Pittsburg Discrepancy Model as a formative evaluation instrument for: (1) setting the instructional development criteria or standards; (2) establishing consistencies and discrepancies, if any, between program operations and standards; (3) using the discrepancy information to isolate program and instructional development strengths and weaknesses.

Fourthly, the study is designed to build on the work of Barson and other instructional developers by developing instruments and strategies for measuring a subject's attitude and cognitive comprehension level related to the instructional development process.

Generalizability of the Study

The study is generalizable to other Breathalyzer Operators Training Programs (BOTP) as well as to instructional programs which possess the same attributes or characteristics of the BOTP. These attributes are: (1) a five-day, forty-hour structured training program; (2) jointly sponsored training or instructional program; (3) relatively homogeneous (police officers) learner population; (4) lecture-discussion and laboratory instructional methodologies; (5) multi-membered instructional staff; (6) in-house training facilities; (7) learners motivated by the incentive of job promotion; (8) learners motivated by the effects of non-learning; (9) disciplined or controlled learning environments, and (10) general learner population of high-school graduates.

Concurrently, the statistical and research strategies used to measure the effectiveness of the instructional development and the formative evaluation design used during the program development hold implications for instructional developers in general.

Hypothesis

The following null hypothesis is to be statistically tested in the study:

H_1 There is no difference in student performance on: (1) the written certification examinations, and/or (2) the laboratory checklist sheets, between the baseline (October, 1971, BOTP) mean scores and the mean scores of the BOTP schools from November, 1971, through May, 1972.

Additional Research Questions

Five additional research questions are to be examined within the context of the experimenter's field experience with the BOTP. Descriptive and observational data will be used to answer the following research questions:

1. What differences, if any, between the synthesized model and the actual instructional development process used with the BOTP will be revealed by the Provus Pittsburg Discrepancy Model?
2. To what extent did the instructional development with the BOTP result in changed instructional efficiency as measured in terms of: (a) an increase or decrease in actual time of the BOTP

through the addition or delection of instructional objectives and/or teaching/learning activities; (b) an increase or decrease in program costs, and (c) an increase or decrease in instructor man-hours?

3. What changes, if any, occur in the client's attitude toward instructional development as revealed in a structured, open-ended questionnaire administered to the client approximately one month after the termination of the experimenter's field experience with the BOTP?
4. What differences, if any, will there be between the raw score of the client and the grand mean score of participants in nineteen Instructional Development Institutes (IDIs) on the Attitude Toward Instructional Development rating scale instrument?
5. What mean score differences, if any, will there be between the client's entry (October, 1971) and exit (June, 1972) cognitive proficiency level of the ID process as measured by the Client's Opinion's Regarding Instructional Development instrument?

Assumptions

1. It was assumed that the BOTP needed improvement as evidenced by the initiative taken by the Director of Training for the BOTP (the client) in seeking help from instructional developers in improving the training program.

2. The assumption was also made that using a systematic process (instructional development) during the designing, development and evaluation of instruction would be better than not using a systematic process.

The potentials of using a systematic approach to problem solving can be assumed by the successes which have resulted in: (a) the American space program; (b) many of the national defense systems; and (c) business and industrial programs.

3. The assumption was made that the primary sources of information relative to the instructional development process are ID models reported in the literature. The assumption is supported by the fact that there have been many instructional development models reported during the past decade.

4. The assumption was made that an instructional development model contains a minimum of four components: (a) specification of behavioral objectives; (b) information flow between and among the steps (feedback); (c) flowchart or combination flowchart/narrative description of process; and (d) a recycling process which permits a continuous re-examination of whatever is developed to determine its instructional effectiveness, efficiency, or relevance.

5. The assumption was made that the instructional models reported in the literature were of limited value at the operational level of the instructional development process. Therefore, it was assumed by the experimenter that a more operational ID model needed to be synthesized from the review.

6. The assumption was made that the synthesized model would have at least as much potential for improving instructional effectiveness and/or instructional efficiency as any of the ID models reported in the literature. This assumption is based on the fact that the synthesized model is

a composite of process steps common to ID models, most of which are reported to be highly functional by their respective authors.

7. It was assumed by the experimenter that one important element in instructional development is changing people's self-concept. Therefore, the study assumed that the effectiveness of instructional development must, in part, be measured in terms of increased positive attitude by the client as a result of the instructional development project.

Definition of Terms

Instructional Development--a systematic process which uses learning theory and communication research in the design of effective and efficient teaching/learning activities. The process contains a minimum of four components: (a) specification of behavioral objectives; (b) information flow between and among the steps (feedback), (c) flowchart or combination flowchart narrative description of process, and (d) a recycling process which permits a continuous reexamination of whatever is developed to determine its instructional effectiveness, efficiency, and/or relevance.

Instructional Developer--used in the singular, it refers to the experimenter; used in the plural, it refers to those individuals who comprise the team of developers, e.g., the client and the experimenter. Under more ideal circumstances a team of instructional developers might include a client, an instructional media specialist, a learning psychologist and an evaluation specialist.

BOTP--Breathalyzer Operator Training Program for the State of Michigan; monthly (except July and August) training schools for Michigan police officers.

Experimenter (E)--the author of the study.

Subject(s)--police officers who had attended any one of eight BOTP schools for training as Breathalyzer Operators.

Synthesized Instructional Development Model--the model designed by the experimenter from the commonalities reported in the related literature; the model used by the experimenter, or instructional developer, and the instructional developers with the BOTP.

Operational Instructional Development Model--a flowchart, or analog, depicting the process steps in instructional development which accompany a written description of the process.

The Breathalyzer Instrument--a scientifically designed instrument used in the State of Michigan by certified police officers to measure the blood alcohol content of automobile drivers arrested for driving under the influence of alcohol.

Model Discrepancy--refers to: (1) deviations between the steps included in the synthesized model and the actual procedural steps used by the experimenter with the BOTP; (2) steps of the synthesized model which were not adequately accommodated during the ID with the BOTP; or (3) steps in the model which the experimenter believed were not in correct sequence.

Organization of the Thesis

Chapter I outlines the purpose and need for the study within the context of instructional development, presents a definition of relevant terms, lists statistical hypotheses and research questions and delineates several assumptions related to the study.

In Chapter II, the development of the synthesized operational model is explained. The synthesized model itself is also included in the chapter along with a brief narrative of model entry points.

In Chapter III, the design of the study is presented. The nature of the sample is specified, as well as the analysis of the devices to be used for measuring the research and statistical hypotheses.

In Chapter IV, the findings from the data are analyzed, and the conclusions for the hypothesis stated in Chapter I are discussed.

Finally, in Chapter V, the implications of the study are discussed, recommendations for further study provided, and heuristics, or "rules of thumb" emerging from the study presented.

CHAPTER II

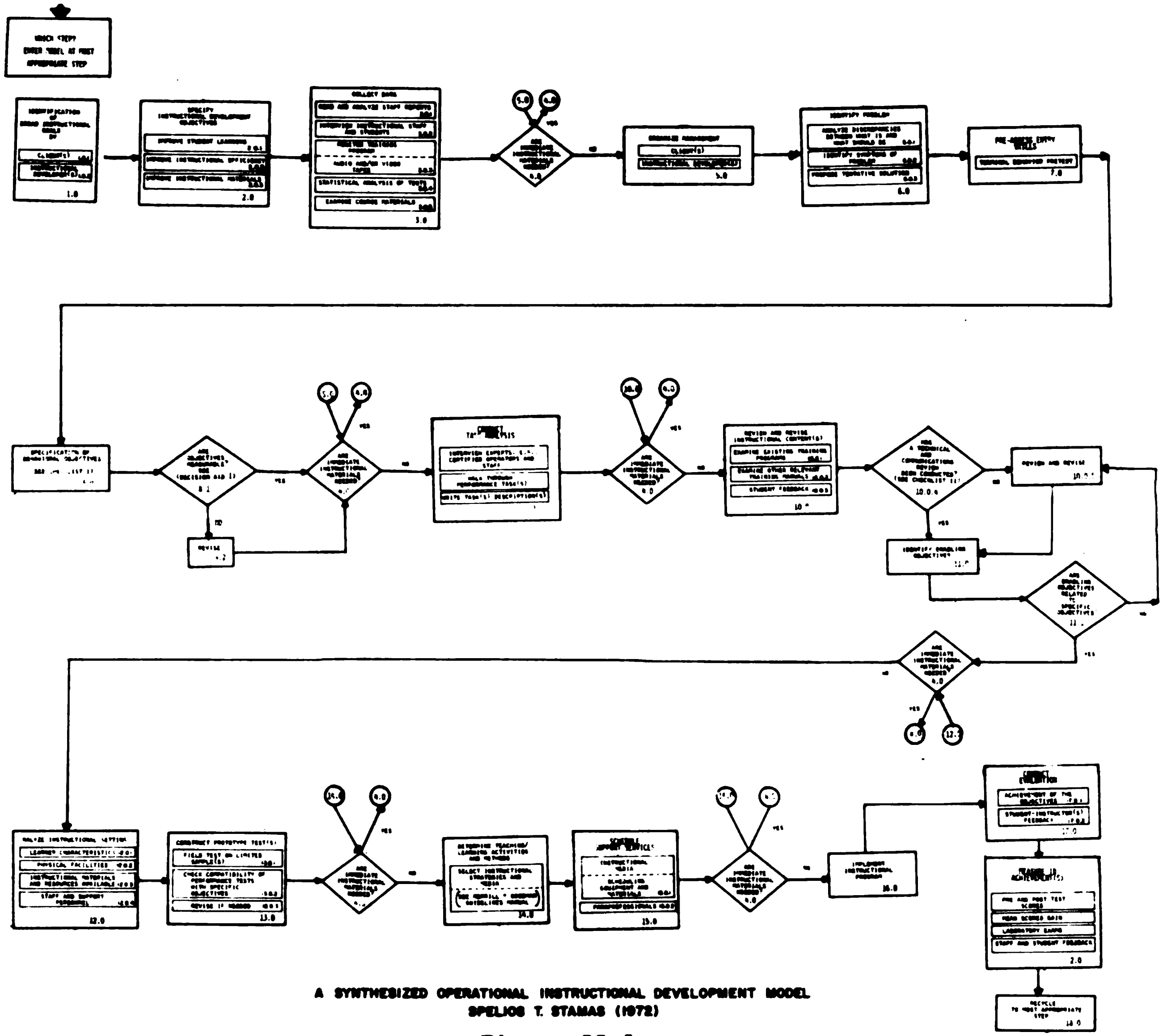
RELATED RESEARCH

Development of Synthesized Operational Model

Review of Related Research

The major input for developing the synthesized operational ID model (Figure II-1) was an extensive review of nineteen instructional development models developed by instructional technologists, curriculum developers, and training managers. To qualify as an ID model for purposes of this study, a model had to contain, as a minimum, the following four components: (a) specification of behavioral objectives; (b) information flow between and among the steps (feedback); (c) flowchart or combination flowchart narrative description of the process; and (d) a recycling process which permits reexamination of whatever is developed to determine its effectiveness, efficiency, or relevance.

The review also includes a discussion of four non-qualifying but related instructional models. Although these models do not qualify as ID models under the criteria specified in this study, the experimenter reported those models because they contained selected elements of the ID process and/or were deemed to be reputable models. Of the four models the Abedor Model on prototype development evaluation had particular significance because it is the only model that represents the prototype development and evaluation process at the operational level.

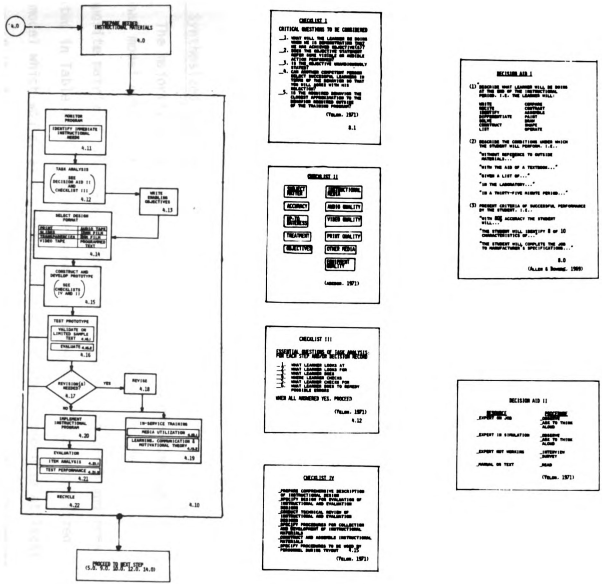


A SYNTHESIZED OPERATIONAL INSTRUCTIONAL DEVELOPMENT MODEL
SPELIOS T. STAMAS (1972)

Figure II-1

Continued

Figure II-1--Continued



The review consists of a description of each model, including brief critical analyses of the strengths and weaknesses of the individual models. This review is included in Appendix A. A summary of the models reviewed, point by point, is also presented in Table II-1 as a composite matric of model commonalities and differences.

The composite matrix was structured in the following manner. First, the experimenter listed all of the different ID steps evident in any of the models reviewed. Secondly, the second dimension of the matrix was designed and included the individual models comprising the review of related research. The last step involved placing X's in the cells. An "X" indicates that ID step is found in the respective model. Once completed the matrix presents a graphic representation of the number of times each ID step occurs in the models surveyed. This frequency count was one source used to determine which steps to include in the synthesized operational model shown in Figure II-1.

The Synthesized Operational Model

The majority of the steps represented in the synthesized operational model evolved from model commonalities evident on the composite matrix of ID models reviewed in the related research and presented in Table II-1. The experimenter elected to build a synthesized ID model which would, as a minimum, include the steps common to at least three of the instructional development models presented in the literature review (Appendix A). However, in the case of the Technical and Communications Review step (Step 10.0.4), the Abedor Model alone was selected because it represented, in the opinion of the experimenter, the most

Table II-1.--Composite Matrix of Model Commonalities.

Synthesized Model Component	Barson	Hamreus	Kaufman	Childs	Banathy	Stowe	IDI	Briggs	Gustafson	Gerlach-Ely	Douglas	Kemp	Gagne	Taba	DeCecco	GMI	Alexander & Yelon	Popham	Tracey	Gordon	BUIC II	ATC	Abedor
Broad Instructional Goals	X		X	X		X						X	X							X			
Collect Data	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Organize Management	X		X	X			X		X				X						X	X	X	X	
Identify Problem		X	X				X		X														
Pre-Assessment of Entry Skills	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Specification of Behavioral Objectives--Perf. Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Enabling Objectives		X	X	X			X													X	X	X	
Task Analysis	X	X	X		X	X		X					X	X			X		X	X	X	X	
Analyze Setting	X	X	X			X	X	X	X	X			X							X	X	X	X
Review & Revise Instructional Cont.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Technical & Communications Review		X		X			X		X														X
Select Design Format	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Construct & Test Prototype	X	X	X	X		X	X	X	X			X							X	X	X	X	X
Design Teaching/Learning Activities	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Support Services		X	X																				X
Implement, Evaluate, Revise, Recycle, Feedback Loop	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

comprehensive treatment of this phase of ID. The experimenter was unaware of any other non-qualifying (or qualifying) ID model which treats the technical and communications review of the developmental process as thoroughly as does the Abedor Model. Checklist II depicts the steps of the technical and communications review which Abedor states must be considered during ID.

The sequencing of the ID steps was determined by: (1) the ID sequencing pattern evident in the majority of the models reviewed, and (2) the experimenter's best intuitive judgment related to the most logical order of process steps for development with the BOTP. Checklists and decision aids were included as a means of creating a more operational model than is generally found in the related research. The checklists and decision-aids delineate more precise operations or functions to be followed during some of the more complex phases of instructional development.

Entry Step: Discussion

Entry into the model's process is denoted by the step designated Which Step? The purpose of this step is to accommodate a theoretical assumption shared by the experimenter, Gustafson (1971) and other instructional developers that ID is a non-linear process which could conceivably begin at any step along the model. For example, a client and/or an instructional developer might enter the process for the first time while evaluating the current instructional program (Step 17.0). This evaluation stage will generally lead the client and/or instructional developers into a sequence of somewhat linear steps beginning with Step 1.0 of the synthesized model. The process essentially remains linear until the developer(s) recycles from decision points represented by the diamond symbols on the model or on the basis of feedback obtained during evaluation (Steps 17.0 and 18.0).

As a result of evaluating student tests or performances, a client could recognize that there is a problem in his course as evidenced by lower than expected or desired student performances. Thus, the client might enter the ID process by requesting assistance from an instructional developer in Identifying the Problem (Step 6.0). After acknowledging the existence of a problem and discussing its related symptoms, the instructional developer would, as soon as feasible, recycle to Step 1.0 in order to begin the process as prescribed by the linear aspects of the synthesized model.

It is also highly probable that a client might initially ask for help in Conducting a Task Analysis (Step 9.0) of some performance requirements in his course or instructional program. By the same token, he might request assistance in Specifying Behavioral (Step 8.0) and/or Enabling Objectives (Step 11.0). Or the client might desire the expertise of a learning measurement psychologist in Constructing Evaluation Instruments (Steps 7.0 and 17.0). Regardless of what the reason for the initial contact between the client and the instructional developer(s) the ID process will require eventually a recycling to Step 1.0 of the synthesized model. From that point the process follows, for the most part, the specified linear sequence of steps indicated in the model.

Discussion of Model's Development

Although many ID models begin with a specification of behavioral objectives, the experimenter felt that the Identification of Broad Instructional Goals (Step 1.0) is a prerequisite step to specifying behavioral objectives because they provide the framework around which to develop more specific objectives. In many of the ID models, the identification of the broad and specific objectives is customarily the function of a team of instructional developers, i.e., instructional technologist, learning psychologist, evaluation specialist, and subject matter specialist. However, for purposes of ID with the BOTP, the experimenter recognized that these other specialists would not be available to participate as a team on an on-going basis during the development. Therefore, only the client and the instructional developer (instructional technologist) were listed as the subcomponents of Identifying Broad Instructional Goals (Step 10.0) and Organizing the Management (Step 5.0).

The experimenter's personal bias regarding the ID process is reflected in Specifying ID Objectives (Step 2.0). In reviewing the related research, the experimenter noted that none of the models attempted to build in a step calling for an evaluation of the effectiveness and/or efficiency of instructional programs designed and developed during the instructional development. It is the experimenter's belief that the instructional developer(s) must be accountable to a client for: (1) a statement of the type(s) of course improvements which are intended during the development (Step 2.0), and (2) a plan for effectively evaluating the results of the instructional development (Step 2.0). Thus, this step specifies the goals and direction of the ID. The different types of course improvements and the evaluation data are listed as sub-steps in the synthesized model. At the conclusion of each cycle of ID, the instructional developer must provide statistical and/or research data to support or reject the effectiveness and/or efficiency of the instructional development up to that point in time.

Because of the somewhat unique monthly repetitive feature of the BOTP, the experimenter also decided that the next appropriate step in the synthesized model should be Data Collection (Step 3.0). This step is intended to give the experimenter (a non-content specialist) and the client, information on previous BOTP training schools. The data collected at this step of the process is of particular value to the non-content specialist since he will find this data useful in establishing a more effective dialogue with the subject specialist (client) when Specifying Behavioral Objectives (Step 8.0).

The synthesized operational model also attempts to reflect the experimenter's personal belief that instructional development includes two distinct facets: (1) the long-range developmental requirements of a course or an instructional program, and (2) the short-range or immediate needs of a course during development (Step 4.0). The developers must be able to "loop" in and out of the main sequence of steps in the synthesized ID model. This "looping" permits the developer to consider immediate instructional materials production needs, i.e., transparencies, 35mm slides, videotapes, of the existing program while course development progresses simultaneously.

In an attempt to effectively operationalize some of the more complex steps of the synthesized operational model, Checklists III and IV as well as Decision Aid II were included because of their utilitarian value in depicting the process functions more completely and concisely. The Abedor Model represents the only model which treats this stage of the process. The model provided the basis for specifying (on the synthesized model) the short-term developmental process used when developing instructional materials. This prototype development evaluation process is depicted by Steps 4.14 through 4.22 on the synthesized model.

The data collected in Step 3.0 would subsequently be used to Identify the Instructional Problem (Step 6.0) by isolating problem symptoms, preparing tentative solutions, and analyzing discrepancies between what presently exists and what is desired as a result of the instructional development. Once the problem is identified the developer would thereupon Preassess Student Entry Levels (Step 7.0) prior to the start of a BOTP school. Although preassessment of entry levels normally (in most ID models) occurs after the specification of behavioral objectives and development of relevant learning activities, the experimenter felt that this entry information might be equally useful as input for modifying objectives and/or learning activities in order to better accommodate the individual needs of the trainees who would be attending the various BOTP schools. The pre-test would thus serve to identify potential learning problems and needs in sufficient time to be able to appropriately modify the instruction given to a particular group of law enforcement officers.

Decision Aid I depicts the precise student performance goals required in Specifying Behavioral Objectives (Step 8.0). The format for writing objectives shown in the model is one recommended by Allen, Bowers et al. (Allen, Bowers et al., 1969, p. 27). The critical questions which must be asked to determine if the objectives are indeed measureable (Step 8.1) are presented in Checklist I.

Most of the models reviewed included a Task Analysis (Step 9.0). However, none of the ID models reviewed specified the steps involved in a task analysis as thoroughly (at the operational level) as Yelon's checklist of subcomponents for this step. For this reason, the experimenter believed that including this checklist would enhance the operational value of the synthesized ID model.

The input sources for Revising Instructional Content (Step 10.0) were identified by the experimenter while monitoring a BOTP school prior to officially initiating the formal phases of the instructional development.

Irrespective of the fact that less than half of the ID models reviewed included Enabling Objectives (Step 11.0), the experimenter felt, from a logical point of view, that any model which emphasizes the importance of writing specific objectives at the outset of ID must also give due consideration to identifying the enabling objectives which prepare the learner to ultimately perform as required.

The remaining steps (Steps 12.0 through Step 17.0) in the synthesized model are all present in the majority of the models reviewed in the related research. The requirements of each step are those specified in the IDI Model of the National Special Media Institutes.

Summary

Chapter II discussed how the experimenter developed the synthesized operational ID model shown in Figure II-1.

Chapter III will present the design methodology and the research strategies, population definition, hypothesis, and research questions for the study, data analysis procedures and the limitations of the study.

Chapter IV will present findings and conclusions on the stated hypothesis and the several additional research questions.

Chapter V will discuss the implications of the study, recommend areas of further study, and present heuristics, or "rules of thumb" emerging from the study.

CHAPTER III

DESIGN OF THE STUDY

Methods and Procedures

The research methods and procedures used to investigate the effectiveness and efficiency of the synthesized model as well as the cognitive and affective influence of the process on the client are described in this chapter.

Three distinct research objectives were examined in this study. The first related to synthesizing an operational instructional development model from the related literature and reporting the experiences of using the model with a client.

The second objective centered on statistically measuring the effectiveness of the instructional development process in improving student learning in the Breathalyzer Operators Training Program (BOTP) over a series of replicable monthly training programs while, at the same time, maintaining and/or improving instructional efficiency.

The final objective sought, first, to compare the attitude of the client toward the instructional development process with nationwide norms and, secondly, to assess the client's cognitive growth related to instructional development.

Research Strategy

The overall research strategy called for gathering and analyzing objective, descriptive, and experimental (statistical) data emanating from the eight Breathalyzer schools from October, 1971, through May, 1972. The strategy also included the client's descriptive and post-data obtained by the experimenter in June, 1972.

Definition of the Population

The population used for the study consisted of an instructional development client and Michigan police officers who attended any one of eight monthly replications of the BOTP during the period from October, 1971, through May, 1972.

The week-long Breathalyzer programs, or schools, were conducted at Kellogg Center on the campus of Michigan State University and included a total of 222 Michigan police officers (S_s). The attendance figures for each of the schools is shown in Table III-1.

Table III-1.--Attendance Figures for Each BOTP Replication.

	Oct. 1	Nov. 2	Dec. 3	Jan. 4	Feb. 5	Mar. 6	Apr. 7	May 8	T
Subjects S_s	26	14	30	29	29	33	29	32	222

→ Time →

In November, half of the S_s who took the final written certification examination were disqualified as subjects because an alternate form of the regular certification examination was administered to them for purposes not related to this study. Therefore, only police officers who were required to pass the regular Michigan Operator Certification Examination were used as subjects.

The same basic criteria were used to select the police officers for each of the BOTP schools. For example, the S_s were a mixture of Michigan police officers from local police departments, Michigan State Police units, and Michigan Sheriff's departments throughout the state. Secondly, all of the officers were recommended by their department superiors to attend the school. And thirdly, department superiors generally followed the practice of recommending experienced officers who had good potential for making law enforcement a career.

The client in the study was the Director of Training for the BOTP schools. Along with being the Director of Training, he was also one of six training staff members who served as instructors. The BOTP training course schedule is shown in Figure III-1.

Collection of Data

Descriptive data designed to examine the appropriateness of the synthesized model and the client's post instructional development attitude were collected using the basic techniques known as high inference observations (Kerlinger, 1964, p. 510). Using this method, an observer abstracts relevant information from his on-going observations and later

A.M.	Monday	Tuesday	Wednesday	Thursday	Friday
8:30 – 9:20	Introduction and Course Objectives	Widmark Formula	Examination	Legal Aspects	Final Examination
9:20 – 10:20	Metric System	Henry's Law	Pharmacology and Toxicology		
10:30 – 11:20		Chemistry of Alcohol			Court Testimony
11:30 – 12:20	Introduction to Breathalyzer			Field Evidence & Case Preparation	
P.M.	L	U	N	C	H
1:30 – 2:20	Group I: Role of the Drinking Driver; Group II: Laboratory: Testing Known Solutions	Group I: Laboratory: Testing Known Solutions; Group II: Role of the Drinking Driver	Group I: Subjects for Controlled Drinking Exercise; Group II: Testing Simulator Solutions and Testing Drinking Subjects	Group I: Testing Simulator Solutions and Testing Drinking Subjects; Group II: Subjects for Controlled Drinking Exercise	Court Testimony
2:30 – 3:20					Chemical Tests: Blood - Urine
3:30 – 4:20	Group I: History of Alcohol & Chemical Testing	Group II: History of Alcohol & Chemical Testing			Course & Examination Review
4:30 – 5:30					Graduation
6:30 – 8:30			Lab Exam. Group II	Lab Exam. Group I	

Figure III-1.--Breathalyzer Operator Training Course Schedule.

makes inferences about variables. Questionnaires and attitude rating scale instruments were two additional sources of descriptive data (Abedor, 1971, p. 85).

The experimenter (E) had the dual responsibility of interacting with the client (C) as part of a field experience, while also observing and recording the nature of these interactions and subsequent decisions. Narrative data were collected at each meeting between the experimenter and the client.

The Provus Pittsburgh Discrepancy Formative Evaluation Model (Nelson, 1970) was used to evaluate the instructional development by identifying and reporting consistencies and discrepancies between the model and the actual instructional development strategies used with the client during program development.

Experimental data related to measuring the degree to which instructional development resulted in improved student learning were collected and extracted from two sources: the written certification examinations and the laboratory checklist examination. For obvious ethical reasons, copies of these instruments could not be included in the Appendix section of this study.

To determine the attitude of the client toward the instructional development process, the National Special Media Institute's Attitude Toward Instructional Development rating scale was used as a norm against which to compare the client's attitude. This attitude rating scale has been validated by the Instructional Development Institutes (IDI) for teachers, administrators, policy-makers, and specialists. An open-ended questionnaire was designed by the researcher for use with a client as a means of obtaining additional information on the client's attitude toward the instructional development with the BOTP.

The experimenter searched for a validated instrument to measure the cognitive growth of the client. This search failed to discover any available instrument. Therefore, the experimenter designed a written instrument for use in collecting and reporting information and results on the variables related to the client's cognitive growth. A copy of this instrument is included as Appendix E. Time constraints placed severe limitations on a careful validation of the instrument. The Client's Opinions Toward Instructional Development rating scale instrument reports the client's personal assessment of his proficiency with the process at the outset of the development and again after the termination of the experimenter's field experience.

Design Methodology

Baseline Data

The October, 1971, BOTP school provided baseline data against which to measure improvement in student learning in seven replications of the BOTP. The October school was selected as the baseline data source because it represented the first training school observed by the experimenter. Secondly, the results of the October school were assumed to be typical of earlier schools, from which data was not readily available. Thirdly, there were no schools held in July, August, or September of 1971. Consequently, the October, 1971, BOTP school was the most recent data source available prior to undertaking instructional development.

Model Validation

The Provus Pittsburgh Discrepancy Model assumes that the evaluation process is one of: (1) setting criteria or standards; (2) establishing discrepancies, if any, between operations and standards; and (3) using this discrepancy information to isolate the strengths and weaknesses of the program (Nelson, 1970, p. 20). For this study, the instructional development process criteria or standards are represented by the steps of the synthesized model. Discrepancies were the deviations from the process depicted in the model. The discrepancy information was used to make recommendations related to using a flowchart model while engaging in instructional development and suggesting which steps of the synthesized model might need revision. The reporting of the discrepancies and subsequent recommendations was mainly subjective and based on the observations of the experimenter during a field experience with the BOTP. The Provus Model, according to Nelson, "seems to hold great promise for educational evaluation" (Nelson, 1970, p. 18). Although no data was found to confirm its validity and its reliability, it was presumed by the experimenter that, because of the general acceptance and reputation accorded the model by evaluation specialists, the Provus model would be appropriate and flexible enough to evaluate the synthesized operational model and the BOTP.

The Provus Pittsburgh Discrepancy Model

The basic purpose of program evaluation, as defined by Malcolm Provus in the Pittsburg Discrepancy Model, "is to determine whether to improve, maintain or terminate a program" (Nelson, 1970, p. 20). These three classes of decisions constitute major foci of the Discrepancy Model.

The actual evaluation process itself is one of first setting program criteria or standards; second, establishing discrepancies, if any, between program operations and standards; and finally using this discrepancy information to isolate program strengths and weaknesses. After such strengths and weaknesses have been isolated, various types of problem-solving techniques may be applied. These problem-solving techniques are utilized in an effort to identify appropriate strategies for overcoming the weaknesses, if the decision to improve or maintain the program has been made (Nelson, 1970, p. 20).

The evaluation process consists of moving through stages in content categories in such a way as to facilitate a comparison of program performance with standards while at the same time identifying standards to be used for future comparisons (Nelson, 1970, p. 21).

According to Provus, this process of comparisons over stages is best understood through examination of a flowchart of that process (see Figure III-2).

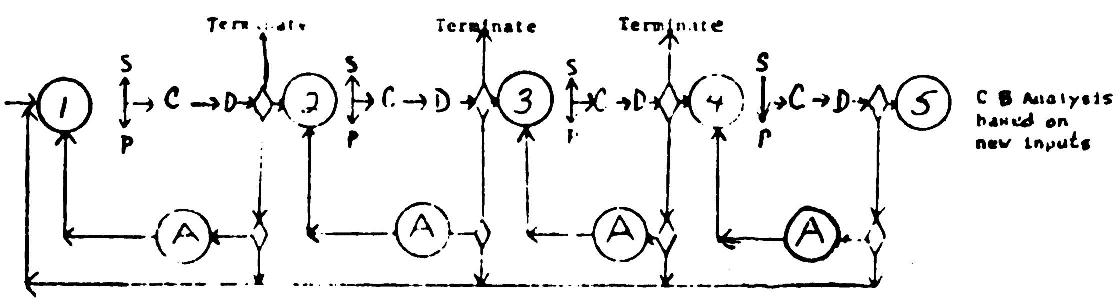


Figure III-2.--Provus Discrepancy Model Process Flowchart.

In the chart, S represents a standard; P, program performance; C, comparisons; D, discrepancy information, (A), a program change in performance or standards (Nelson, 1970, pp. 21-22).

Specific program content which may be examined as input might include staff qualifications, staff preprogram training, student selection criteria, student entry behavior, media, facilities, and administrative conditions. Specific types of transactions which might be examined might include student interaction with other students, staff, media facilities; staff interreactions with staff, students, media facilities and the administration; and student-staff interaction or transactions directly related to objectives. Specific output which would be examined would include attainment of the enabling objectives (EO), the terminal objectives (TO), the ultimate objectives (UO), and the inter-relationships which exist between the different types of objectives (Nelson, 1970, p. 23).

Why Was the Provus Model Selected?

This model was selected because the BOTP contained elements of the three generic characteristics of the temporal criteria described in the discrepancy model (Figure III-3). First, the BOTP is permanent in that the training program was already installed as one for which the sponsors had continuous responsibility. Secondly, it has continuity because it is an on-going, continuous project. Finally, it is cyclical due to its recurring, staged development, with provisions for adaptation and/or revisions between cycles (BOTP schools). However, the cyclical characteristic was the overriding element in the BOTP since the BOTP instructional development would most likely require revisions which would be

Criteria for Selection / Model	Temporal			Stability		Output			Resources						
									Expertise Required			Financing			
	Permanent	Continuous	Cyclic	Highly Defined	Highly Flexible	Evolution of Program	Dissemination	Accountability	Staff	Available Agencies	Consult	Hard	Soft	Internal	External
Stake Countenance	1		2	1			1	1			x		x	x	x
CIPP Stufflebeam	2	1		2	1	1	2			x			x		x
Discrepancy Provus	3	2	1	2	1	1	2	3	X			x	x	x	x

Figure III-3.--Model Selection Criteria.

implemented between replications of the BOTP training schools. The model selection chart in Figure III-3 rates the Provus Model as first choice for the evaluation of cyclical programs.

The model selection criteria also rates the Provus Model as second choice on the stability criterion. However, the distinction between whether the BOTP is highly defined or highly flexible is not a sharp one. The BOTP, at the outset, had broad general goals, but these goals were not articulated into precise behavioral objectives until the instructional development process commenced. Although it had a feedback characteristic, the feedback was more of a summative type, little of which was used for subsequent program revision.

The third criterion was concerned with the type of output desired from the evaluation. The main purpose of the evaluation output of the BOTP was to contribute evaluation output information which could be used in the evolution of the program. The focus was not on dissemination of results to interested publics, nor was the purpose to present an evaluation document for purposes of training accountability to the sponsoring agencies. Therefore, the Provus Model is first choice on this stability criterion as well.

The final selection criteria dealt with resources available. These resources are of two types: (1) expertise required for evaluation, and (2) type of financing available. Of the three evaluation models only the Provus Model accommodates evaluation by the staff without the use of expertise from local and national agencies or outside consultants. Here again the Provus Model rates as first choice on this criterion. Finally, the Provus Model was selected because financing can come from a combination of local and federal sources. The BOTP meets this criterion since it is supported by funds from local, state, and federal sources.

Instructional Effectiveness

Written Certification Examination

Principal and Non-Principal Variables.--To measure improvement in student learning, two variables were identified on the written certification examination: principal and non-principal test items. Principal test items refers to those questions on the examination related to the specific teaching responsibility of the client. The client identified sixty-one such items on the Certification Examination for which he felt a direct responsibility in his teaching assignments. The remaining sixty-five test items on the examination comprised the non-principal test items, for a total of 126 test items on the Breathalyzer Operator Certification Examination. Appendix B contains a list which identifies the principal and non-principal test items for the written certification examination.

Test Rescoring by Experimenter.--The experimenter worked only with the client and not with the other five regular instructors for the training schools. Thus, it was necessary to rescore the written examinations for the eight BOTP schools to isolate the principal test questions from the non-principal. The rescoring was done by the experimenter using punched IBM scoring masks. Scoring accuracy was verified by the experimenter through a second count of correct responses on each of the examinations. To minimize the possibility of grading fatigue, the experimenter followed the policy of rescoring not more than two sets of examinations per day.

Test Reliability.--The Kuder-Richardson Alternate Formula 21 for average scores was used to estimate the reliability of the principal and non-principal test items on the examination. Using the formula:

$$r_{tt} = \frac{n o_t^2 - \overline{R}\,\overline{W}}{(n-1)\, o_t^2} \quad \text{with} \quad \begin{array}{l} n = \text{number of items} \\ o_t^2 = \text{variance of } (P_1),\ (NP_2) \\ \overline{R} = \text{mean score right} \\ \overline{W} = \text{mean score wrong} \end{array}$$

it was determined that the reliability for principal (P_1) items was estimated to be .68 while the reliability factor for the non-principal (NP_1) items was estimated to be approximately .76. It is significant to note that this form of the Kuder-Richardson Formula 21 yields a low estimate of reliability (Guilford, 1965, p. 461). In his own words, Guilford cautioned that:

> It should be said that all the Kuder-Richardson formulas, indeed all the internal consistency formulas that depend on a single administration of a test probably underestimate the reliability of the test. . . . (p. 461).

He reported that, of all the forms of the Kuder-Richardson Formula 21, the form used in this study gives the lowest estimate of reliability. However, he gives no reasons to explain why low estimates are characteristic of the several variations of the Kuder-Richardson Formula 21 used in measuring test reliability.

Test Validity.--In contrast, however, serious questions can be raised as to the validity of the written certification examination used as the basis for measuring instructional effectiveness on the principal and the non-principal variables. This validity can be challenged by those, including the experimenter, who take the behavioral scientist position that the criterion test procedure must closely approximate the type of terminal behavior specified or suggested by the objectives of the program. In the case of the BOTP, two specific types of terminal performance competencies can be deduced from the goals of the BOTP: (1) effective student operation of the Breathalyzer instrument under the conditions of certification, and (2) satisfactory student proficiency in the techniques of testifying in court cases related to the Breathalyzer instrument. This first type of terminal objective suggests a criterion test designed to test the subject in a laboratory environment for purposes of determining his level of proficiency as a Breathalyzer operator. The second objective implies a type of performance criterion testing environment which permits an examination of the subject's proficiency in effective courtroom testimony relative to the Breathalyzer instrument, i.e., mock court trial. Under these circumstances, it seems that the written certification examination is not the most appropriate instrument within the context of the goals of the BOTP. Unfortunately, however, no other instrument exists for measuring cognitive growth in testifying under courtroom conditions.

Statistical Measurement Procedure.--The group mean scores for the monthly replications of the BOTP were reported for both the principal and the non-principal variables. A computer was used to transform the monthly raw test scores into monthly group mean scores on the two variables. For example, in Group No. 1, consisting of twenty-six subjects, the means for the two means were 55.08 for the principal and 53.23 for the non-principal; the standard deviations for the two measures were 4.01 and 6.50 respectively. The design called for the use of a two-way analysis of variance with repeated measures to interact with the data. The significance level was set at .05, although it was planned to examine significance at the .10 and .01 levels as well in the reporting.

If the F-ratio in the analysis of variance shows an indication of no significance and the experimenter suspects that there may be significant difference in some of the pairs, he will investigate further. For example, if the group interaction F-ratio reports no significant difference, the null hypothesis--H_0: $P_1 = P_2 = P_3 = . . . , = P_8$--would be accepted. This would mean that there is no reason to dispute the null hypothesis. But, if the experimenter suspects that there is at least one difference within the groups, he will make paired comparisons using least significant difference (Steel and Torrie, 1960, pp. 106-107).

Laboratory Checklist Examination

Laboratory Performance Variables.--The second source of data for measuring improvement in student learning came from the laboratory checklist sheets shown in Appendix C. The checklist in Appendix C consists of two discrete categories: simulator preparation and breathalyzer operation. From this laboratory sheet, three additional variables were identified.

The first category contains a checklist of fourteen performance behaviors whereas the second category is comprised of thirty-seven performance check points during the laboratory examination. Because Item #35 on the checklist sheet represents the single major laboratory performance problem as evidenced by highest error frequency each month, it was decided by the experimenter to include Checklist Item #35 as a third laboratory variable. This item asks the subject to demonstrate his skill in recognizing "good" and "bad" breath samples. According to the client it is the single most important laboratory test item since it can be automatically assumed that the S will not gain certification as a Breathalyzer Operator unless he is able to recognize a "good" breath sample when taken.

Framework for Reporting Laboratory Variables.--The three laboratory variables were each subdivided into dichotomous performance levels or standards as illustrated in Table III-2 on the following page. As indicated in this table, perfect performance scores by the Ss are represented by a score of 14 satisfactory responses for the Simulator Preparation variable and 37 satisfactory responses for the Breathalyzer Operation variable. All scores on the laboratory performance examinations below these two figures would constitute unsatisfactory performance by the Ss.

The performance checklist (Appendix C) provides for three possible performance ratings by the examiner: satisfactory, needs improvement, unsatisfactory. However, for this study, the experimenter combined these ratings into two discrete categories: satisfactory and non-satisfactory (Table III-2). Non-satisfactory responses include any rating

Table III-2.--Framework for Reporting Laboratory Variables

	Simulator Preparation							
	BOTP Replication							
	1 Oct.	2 Nov.	3 Dec.	4 Jan.	5 Feb.	6 Mar.	7 Apr.	8 May
14 Satisfactory Behavior Responses	15	19	29	24	23	19	21	22
Less than 14 Satisfactory Behavior Responses	12	11	1	8	5	15	7	6
	Breathalyzer Operation							
	BOTP Replication							
	1	2	3	4	5	6	7	8
37 Satisfactory Behavior Responses	2	6	14	13	7	9	14	12
Less than 37 Satisfactory	25	24	16	19	21	23	14	15
	Checklist Item #35							
	BOTP Replication							
	1	2	3	4	5	6	7	8
Satisfactory Behavior Performance	17	15	24	22	11	25	22	25
Non-satisfactory Behavior Performance	10	15	6	10	17	9	6	3

given by the examiner other than satisfactory. Doing this had the effect of setting the measurement standards slightly higher than the performance levels required during the laboratory examination. For example, if the subject was evaluated as needing improvement on any items on the checklist during the laboratory examination, he was given additional opportunities, often with prompts, to make the correct response until he performed to the satisfaction of the examiner on those items. Rarely did a subject who was initially evaluated as needing improvement on performance items fail to make the necessary corrections required for a subsequent satisfactory performance rating. Thus, if anything, the design strategy for the laboratory variables imposed stringent criteria for measuring improvement in student performance, or instructional effectiveness.

Statistical Treatment for Laboratory Variables--The laboratory variables were subjected to a t-test which provides a statistical comparison of the proportion or percentage of satisfactory performance responses for any pair of months. The method employed is first to calculate the percentage or proportion of satisfactory responses on a variable for each month or school. Secondly, designate these proportions as P_1, P_2, P_3 . . . , P_8. Next, assume the P_1 (October BOTP) is the standard of comparison. From that point, compare P_1 with P_j with j = 2, 3, 4 . . . , 8. The t-test is then applied using the following formula:

$$t_c = \frac{P_j - P_1}{\sqrt{\frac{P_j Q_j}{n_j}}}$$

where $j = 2, 3, 4, \ldots, 8$

$Q = (1 - P_j)$

$\sqrt{\frac{P_j Q_j}{n_j}}$ = the SEM

The last step is to compare t_C with t_T, the tabulated _t_ in the table, d.f. = n-1, at significant levels ranging from .01 to .10.

Additional Research Collection Procedures

Instructional Efficiency

The efficiency of instructional development will be reported in terms of whether or not it resulted in: (1) a reduction or increase in actual time of the BOTP through the addition or deletion of instructional objectives and/or teaching/learning activities; (2) a reduction or increase in program costs, and (3) a reduction or increase in instructional staff man-hours.

Client's Attitude Toward Process

To assess the client's attitude toward instructional development, the _Attitude Toward Instructional Development_ rating instrument in Appendix D was used. This instrument was developed by the National Special Media Institute for use in evaluating the effectiveness of Instructional Development Institutes (IDI) designed for teachers, administrators, policy-makers, and specialists. The experimenter administered the test to the client in late June, 1972 following C's association with E for eight months. It is planned to compare the client's score on the instrument with the grand mean score of nineteen nationwide IDI's. The grand mean score for the Institutes would be compared to the client's score on the same instrument. Finally, the mean deviation, standard deviation, and variance would be computed as a preliminary step for determining the standard deviation of the client's score from the grand mean of the Institute groups.

Client's Opinions Regarding Instructional Development

The Client's Opinions Regarding Instructional Development (Appendix E) is an instrument designed by the experimenter to measure the client's cognitive growth by comparing his mean entry score with his mean exit score on twenty-eight items related to the synthesized model whose steps represent the process. These mean scores were subjected to a t-test to determine if significant cognitive growth was evident in the exit mean score when compared with the entry mean score. The computed t (t_C) would be compared to the t_T for significance at the .05 level. The degrees of freedom (d.f.) for t_T is the number of items in Entry plus those in Exit minus two. In the case of this instrument the d.f. is 54. The data would then be presented as shown in Table III-3.

Table III-3.--Framework for Reporting t-test Analysis of Entry and Exit Behavior of the Client

	$\bar{X}$	$S_{\bar{X}}^2$	t_C	t_T	d.f.	Comments
Entry						
Exit						

Instrument Administration.--The Client's Opinions Regarding Instructional Development instrument consists of a rating scale system for twenty-eight specific items related to the components of the synthesized model. The instrument was administered to the client in late June, 1972, at which time the client was asked to make subjective judgments in regard to his entry and exit cognitive comprehension levels. There was a single administration of the instrument following termination of the experimenter's field experience.

Client's Post Attitude Questionnaire

The structured, open-ended questionnaire in Appendix F was prepared by the experimenter for use in determining if the client planned to continue to use the process with future development and to estimate his present level of interest in the instructional development process. The questions and the responses would be presented in the study and the results analyzed by the experimenter using his experiences with the BOTP and his direct contacts with the client as frames of references for as objective an interpretation of the data as possible under the circumstances.

Statistical Hypothesis

Null Hypothesis 1: There is no difference in student performance on: (1) the written certification examination, and/or (2) the laboratory checklist sheets, between the baseline (October, 1971, BOTP) mean scores and the mean scores of the BOTP schools from November, 1971, through May, 1972, i.e.,

H_{01}: $P_1 = P_2 = P_3 = P_4, \ldots, P_8$ with P_1 = October, 1971 BOTP school
(Oct = Nov = Dec = Jan...May)
$P_1, P_2, P_3, \ldots P_8$ = November, 1971 through May, 1972, BOTP schools.

Alternate Hypothesis 1: Student mean score performance on: (1) the written certification examinations, and/or (2) the laboratory checklist sheets, will be higher for the BOTP schools during the replications from November, 1971, through May, 1972, than mean scores of the October, 1971, BOTP school, i.e.,

H_1: $P_1 < P_2, P_3, P_4, \ldots, P_8$
if $P_2, P_3, P_4, \ldots, P_8 > P_1$ there is a difference.

Statistical Treatment of the Hypothesis

H_1: Involves an analysis of variance and least significant differerences between paired means of the principal and non-principal variables of the written certification examination. The laboratory variables (simulator preparation, breathalyzer operation, and checklist Item #35) were submitted to t-test comparisons of the proportions of satisfactory responses for paired months.

Additional Research Questions

Five additional research questions are to be examined within the context of the experimenter's field experience with the BOTP. Descriptive and observations data will be used to provide answers to the following research questions:

1. What differences, if any, between the synthesized model and the actual ID process used with the BOTP will be revealed by the Provus Pittsburg Discrepancy Model?
2. To what extent did the ID with the BOTP result in changed instructional efficiency as measured in terms of: (a) an increase or decrease in actual time of the BOTP through the addition or deletion of instructional objectives and/or teaching/learning activities; (b) an increase or decrease in program costs, and (c) an increase or decrease in instructor man-hours.
3. What changes, if any, occur in the client's attitude toward ID as revealed by a structured, open-ended questionnaire administered to the client approximately one month after the termination of the experimenter's field experience with the BOTP.
4. What differences, if any, will there be between the raw score of the client and the grand mean score of participants in nineteen Instructional Development Institutes (IDIs) on the _Attitude Toward Instructional Development_ rating scale instrument?
5. What mean score differences, if any, will there be between the client's entry (October, 1971) and exit (June, 1972) cognitive proficiency level of the ID process as measured by the _Client's Opinions Regarding Instructional Development_ instrument?

The Limitations of the Study

The synthesized operational instructional development model was used with a single type of instructional system; namely, a law enforcement training program. The Breathalyzer Operator Training Program (BOTP) was the setting for a year-long ID field experience for the experimenter.

It is important to note that the experimenter engaged in instructional development with a client who, at that time, was not an academically ranked faculty staff member of the university. The client, while serving as Director of Training for the BOTP, was also pursuing a graduate program of studies.

Another limitation was that the study was confined to testing the synthesized model with only one client. Therefore, it will be essential to subject the model to further examination with other individuals (and/or instructional systems) in order to determine generalizability results.

The experimenter's bias while collecting and analyzing observational and descriptive data, may have, unbeknowingly to the experimenter, contributed to some measure of data contamination. However, the experimenter made every effort to be as objective as possible when collecting and analyzing the data.

The study was also limited by instrumentation used to collect data on the five research questions and the hypothesis. The experimenter used a formative evaluation instrument which was unfamiliar to him. In addition, the two instruments in Appendices E and F were designed by the experimenter but were not subjected to tests of reliability and validity.

Moreover, the study had to contend with variables beyond the immediate control of the experimenter, e.g., time constraints on the experimenter and the client, unavailability of representative samples for field testing prototype materials, and less than most appropriate criterion instruments for measuring instructional effectiveness.

Summary

Chapter III presented the design methodology and research strategies, population definition, hypotheses and research questions for the study, data analysis procedures and the limitations of the study.

Chapter IV presents the findings and the conclusions for the study.

CHAPTER IV

FINDINGS AND CONCLUSIONS

The purpose of this chapter is to report the findings and the conclusions of instructional development with the Breathalyzer Operator Training Program from October, 1971, through May, 1972.

The chapter is designed to present student performance experimental data to support or reject the stated hypothesis as well as descriptive and observational data from the client in discussing the five additional research questions in the study. This hypothesis and research questions will be presented in the same order in which they were presented in Chapters I and III.

Null Hypothesis 1

Null Hypothesis 1: There is no difference in student performance on: (1) the written certification examination, or (2) the laboratory checklist sheets, between the baseline (October, 1971, BOTP) mean scores and the mean scores of the BOTP schools from November, 1971, through May, 1972.

Written Certification Examination

Findings.--Table IV-1 summarizes the analysis of variance of the repeated measures for the principal (P_1) and the non-principal (NP_1) variables used in the study.

Table IV-1.--Analysis of Variance for the Repeated Measures of the Principal (P_1) and Non-principal (NP_1) Variables on the Written Certification Examinations.

Source	df	Sums of Squares	Mean Squares	F	Comments
Groups	7	393.58	56.23	1.28	NS
Subj-G	214	9389.30	43.88		
Total Subjects	222				
Repeated Measures-(P_1), (NP_1)	1	45.41	45.41	4.47	S (.05)
Rm*G (Interaction)	7	66.72	9.53	.94	NS

Table IV-1 indicates there is a significant difference somewhere within the repeated measures of the principal (P_1) and the non-principal (NP_1) test performances as evidenced by a comparison of the computed F-ratio (F_c) of 4.47 and the tabled F-ratio (F .05) of 3.84, d.f. = 1. However, no significant difference is reported in the interaction between the eight groups (schools) in the study. This finding is supported by a computed F-ratio of .94 whereas a tabled ratio of 14.07 is necessary to show significance at .05, d.f. 7,214. Finally, the analysis of variance shows no significant difference between the groups or months.

In attempting to discover where the significant differences occurred on the repeated measures of the principal and non-principal variables, mean score differences were further examined using a t-test analysis.

Table IV-2 shows that there were significant differences in student performance, in favor of the principal items, on the written certification examinations during the October and the May BOTP schools. During the October school, student performance on the principal (P_1) as opposed to the non-principal (NP_1) test items was significant at .05, d.f. = 25, as revealed by a computed t of 2.41 and a tabled t(.05) of 2.06. The same pattern of findings are reported for the May school. In May, a comparison of student performance on the repeated measures (P_1, NP_1) reported significance at .05 as disclosed by a comparison of a computed t of 2.01 and a tabled t of 2.00, d.f. = 31. The reasons for significant performance differences during these two months and not during other months of the study are unknown to the experimenter.

Further, significant differences in improved student performances on the principal as opposed to the non-principal test items on the eight written certification examinations are revealed in a comparison of mean scores as reported in Table IV-3.

Without submitting the mean scores to a t-test analysis, it can be safely assumed that there has been significantly better performance by the subjects on the principal (P_1) test items than on the non-principal (NP_1) throughout the BOTP schools. In every school there is improved student performance on the principal test items as is clearly evident in Table IV-3.

However, any generalizations relative to the impact that the instructional development may have had on the mean score comparisons of the principal and non-principal variables are inadvisable since the findings

Table IV-2.--Analysis of Principal (P_1) and Non-principal (NP_1) Variables

BOTP	Means		Difference	SED	t_c	d.f.	$t_{T(.05)}$	Remarks
	P_1	NP_1	$P_1 - NP_1$					
1	55.08	53.23	1.85	.77	2.41	25	2.06	Significant at .05
2	56.00	56.07	-(.07)	.76	-(.09)	13	2.16	Not significant
3	54.33	53.27	1.07	.54	1.98	29	2.05	Significant at .10
4	55.21	56.07	-(.86)	.58	-(1.48)	28	2.05	Not significant
5	54.28	54.03	.24	.62	0.39	28	2.05	Not significant
6	54.30	53.24	1.06	.62	1.70	32	2.00	Significant at .10
7	54.31	53.90	.41	.54	0.77	28	2.05	Not significant
8	53.16	52.10	1.06	.53	2.01	31	2.00	Significant at .05

Table IV-3.--Mean Scores on Repeated Measures for the Principal (P_1) and Non-principal (NP_1) Variables

Variables	Repeated Measures								
	1 Oct.	2 Nov.	3 Dec.	4 Jan.	5 Feb.	6 Mar.	7 Apr.	8 May	Ave.
P_1	91.77	91.80	89.07	90.50	88.98	89.02	89.03	91.77	89.66
NP_1	81.89	86.26	81.95	86.26	83.14	81.91	82.92	81.89	83.06

which manifested themselves during the BOTP schools from November, 1971, through May, 1972, were also visible during the October, 1971 BOTP school.

Data associated with the principal and non-principal variables were further analyzed to determine if there were any significant differences between paired means. These data are reported in Table IV-4.

Table IV-4.--Analysis of Variance for Paired Mean Scores

Group No. BOTP	1	2	3	4	5	6	7	8
No. of Subj.	26	14	30	29	29	33	29	32
Mean Score-P_1	55.08	56.00	54.33	55.21	54.28	54.30	54.31	53.16
Standard Dev. (P_1)	4.01	3.04	3.09	2.96	3.94	4.33	3.88	6.34
Mean Score- (NP_1)	53.23	56.07	53.27	56.21	54.03	53.24	53.90	52.09
Standard Dev. (NP_1)	6.50	5.51	3.90	5.70	6.65	6.85	4.66	7.35

The data in Table IV-4 was used to compute least significant differences (lsd) between paired means. The lsd is basically a student's t-test using a pooled variance as a timesaver over making individual t-tests. For the difference between the two means to be significant at the 5% level the observed differences reported for the repeated measures must exceed the lsd (Steel and Torrie, 1960, p. 106). The findings on the least significant differences between paired means on the repeated measures, e.g., November (2) with October (1), December (3) with October (1), etc., are reported in Table IV-5.

Table IV-5.--Least Significant Differences Between Paired Means on the Repeated Measures of the Principal (P_1) and Non-principal (NP_1) Variables

Treatment	October $\bar{X}$	lsd	df	Repeated Measures						
				2	3	4	5	6	7	8
P_1	55.08	1.69	7	.02	-(.74)	.13	-(.80)	-(.77)		-(1.92)
NP_1	53.23			2.84*	.04	2.84*	.80	.01	.67	-(1.14)

*Significant differences.

An analysis of Table IV-5 reveals a significant student performance improvement, over the October BOTP school, on the non-principal test items for the November and the January schools. No significant difference in student performance on the repeated measures for the principal items is discernible.

Conclusions.--There is a non-rejection of the null hypothesis on the two experimental variables related to the written certification examinations. This conclusion is verified by findings of no significant difference on all of the repeated measures on the principal and most of the non-principal variables. However, in regard to this, the experimenter suspected that the doubtful validity of using a written examination to measure psychomotor types of skill performances may have contributed to findings of no significant improvement in student learning on these two variables.

Laboratory Variables

Findings.--On the simulator preparation laboratory variable, significant improvements were found when comparisons were made between the baseline month (October) and seven subsequent replications of the BOTP schools. Table IV-6 contains a matrix of differences and corresponding t-test for the difference matrix on the simulator preparation laboratory variable.

The t-test analysis for the differences between paired combinations of BOTP schools indicates non-significant improvement in student performance on the simulator preparation variable during only the November and February schools. The data in Table IV-6 shows significant difference for the remaining paired combinations of BOTP schools with the baseline school (October). The reported significance for these combinations is between the .01 and the .05 levels. Of particular importance is the significant improvement at the .02 and .01 levels when March (6), April (7), and May (8) are each compared with the October (1) BOTP school.

One final interpretation of the data is that significant performance improvements at the .01 and .02 levels respectively were reported when comparing paired months toward the end of the instructional development cycle, i.e., April with March, May with March.

Table IV-6.--Matrix of Differences (D) and Corresponding <u>t-test</u> for the Difference Matrix on the Simulator Preparation Laboratory Variable.

Standard Error		BOTP	2 Nov.	3 Dec.	4 Jan.	5 Feb.	6 Mar.	7 Apr.	8 May
	1 Oct.	D	.08	.41	.19	.27	.00	.19	.23
		t-test	.89	2.53**	3.69***	.04	2.37**	2.37**	2.97***
.0877	2 Nov.	D		.33	.12	.19	-(.07)	.12	.15
		t-test		10.04***	1.52	2.61***	.87	1.42	1.97*
.0322	3 Dec.	D			-(.22)	-(.15)	-.41	-(.22)	-(.18)
		t-test			-(2.82)	-(2.02)	-(4.78)	-(2.65)	-(2.34)
.0768	4 Jan.	D				.07	.19	.00	.04
		t-test				.99	-(2.24)	.00	.46
.0721	5 Feb.	D					-(.26)	-(.07)	-(.04)
		t-test					-(3.07)	-(.87)	-(.46)
.0854	6 Mar.	D						.19	.23
		t-test						2.33**	2.93***
.0819	7 Apr.	D							.04
		t-test							.46
.0775	8 May	D							
		t-test							

*Significant at .05
**Significant at .02
***Significant at .01

Significance at the .01 level was also found on the Breathalyzer Operation variable when subsequent BOTP schools were each paired for comparative purposes with the October BOTP school (Table IV-7). The only exceptions to significance at the .01 level were evident for the November BOTP school (significance at .10) and the January school (significance at .05). Significance ranging from .01 when comparing December and March with November and .02 when January and May are each paired with the October school are also reported in the matrix in Table IV-7. As in the case of the simulator preparation variable, there were significant findings among several combinations involving BOTP schools during the last several months of the experimenter's field experience with the BOTP. For example, the student performance on the laboratory variable related to Breathalyzer operation showed (1) significance at the .01 level when April is compared to February and .02 when April is paired with March; and (2) significance at .05 when May and February schools are matched.

Corresponding <u>t-test</u> differences for the difference matrix on the Checklist Item #35 of the laboratory examination checklist sheet are recorded in Table IV-8. Although there was sporadic evidence of significant improvement at levels ranging from .01 to .05 in several of the paired months up to the April BOTP school, the most important findings related to paired comparisons of the April and May BOTP schools with earlier training schools. These comparisons are of particular significance to the study because an audio tape, designed and developed specifically to improve student performance on Checklist Item #35 on the laboratory

Table IV-7.--Matrix of Differences (D) and Corresponding t-test for the Difference Matrix on the Breathalyzer Operation Laboratory Variable

Standard Error	BOTP		2 Nov.	3 Dec.	4 Jan.	5 Feb.	6 Mar.	7 Apr.	8 May
	1	D	.13	.39	.33	.18	.21	.43	.37
	Oct.	t-test	1.73	4.31***	3.84***	2.15*	2.61***	4.52***	3.88***
.0728	2	D		.27	.21	.05	.08	.30	.24
	Nov.	t-test		2.93***	2.38**	.61	1.02	3.18***	2.56**
.0911	3	D			-(.06)	-(.22)	-(.19)	-(.03)	-(.02)
	Dec.	t-test			-(.70)	-(2.65)	-(2.34)	-(.35)	-(.23)
.0866	4	D				-(.16)	-(.13)	.09	.04
	Jan.	t-test				1.91	-(1.57)	.99	.40
.0819	5	D					.03	.25	.19
	Feb.	t-test					.39	2.65***	2.04*
.0794	6	D						.22	.16
	Mar.	t-test						2.32**	1.71
.0943	7	D							-(.06)
	Apr.	t-test							.58
.0954	8	D							
	May	t-test							

*Significant at .05
**Significant at .02
***Significant at .01

Table IV 8.--Matrix of Differences (D) and Corresponding t test for the Difference Matrix on the

Table IV-8.--Matrix of Differences (D) and Corresponding <u>t-test</u> for the Difference Matrix on the Checklist Item #35 Laboratory Variable

Standard Error	BOTP		2 Nov.	3 Dec.	4 Jan.	5 Feb.	6 Mar.	7 Apr.	8 May
	1 Oct.	D	-(.13)	.17	.06	-(.24)	.11	.16	.26
		t-test	1.42	2.34**	.71	-(2.57)	1.40	2.01*	4.52***
.0911	2 Nov.	D		.30	.19	-(.11)	.24	.29	.39
		t-test		4.12***	2.29*	-(1.16)	3.12***	3.69***	6.74***
.0728	3 Dec.	D			-(.11)	-(.41)	-(.06)	-(.01)	.09
		t-test			-(1.37)	-(4.42)	-(.85)	-(.18)	1.59
.0819	4 Jan.	D				-(.28)	.05	.10	.21
		t-test				-(3.08)	.63	1.13	3.52***
.0922	5 Feb.	D					.34	.39	.50
		t-test					4.53***	5.07***	8.57***
.0755	6 Mar.	D						.05	.16
		t-test						.65	2.70***
.0775	7 Apr.	D							.11
		t-test							1.84
.0583	8 May	D							
		t-test							

*Significant at .05
**Significant at .02
***Significant at .01

checklist sheet, was first introduced into the BOTP instructional program during the April BOTP school. (This same audio tape was used during the May school.)

An analysis of data in Table IV-8 reveals overall significant improvement in student performance at the .01 level on the Checklist Item #35 variable for all paired comparisons involving the May BOTP. The only exceptions were when the May performance levels were compared with those in December and April. Regardless, there was a reported student improvement at the .10 level when the May BOTP was compared to April as well as improvement in the performance improvement of the May BOTP over the December school.

Conclusions.--There is a rejection of the null hypothesis that there will be no improvement over the October BOTP on the laboratory variables.

Although the simulator preparation variable reported insignificant improvement in student performance during the November (2) and February (5) schools, this might be explained in part by two factors. The first factor is that the instructional development which might have had any influence on performance during the November (2) school was too minimal at that point in time to bring about a significant change. The second factor which may account for the irregularity in performance during the February (5) BOTP school might be explained by the fact that the client did not teach that school. Since no other instructional staff members were directly involved in the instructional development activities, it is reasonable to expect that quality control in the instruction on the simulator preparation variable was adversely affected. Therefore, the experimenter is of the opinion that performance during November and February might also have been significantly better than that in October if the regular instructor (C) was available to teach the laboratory sections on simulator preparation. Aside from this, the strong significance at .01 and .02 levels for all combinations of months with October offered impressive evidence for rejection of the null hypothesis. Moreover, the significant improvement apparent when: (1) the April school performance on this variable is compared with March (.05), and (2) the May BOTP school performance is compared with March (.01) gives further support to the conclusion on this null hypothesis as well as evidence that the instructional quality on this variable may have been somewhat stabilized during the last several BOTP replications.

In attempting to relate improvement on this variable to instructional development, Figure IV-1 is designed to graphically depict the specific changes introduced into the BOTP as a result of the instructional development.

It might be assumed that these instructional changes and materials would contribute to the improved performance reflected by the statistical data related to the laboratory variables used to test the null hypothesis. In the case of the simulator preparation variables, for example, the additional laboratory time introduced into the schedule for the BOTP in December and the 35mm laboratory slides designed and developed for use with the January and subsequent schools seemed to correlate with the schools which first reported significant student improvement on simulator preparation. Thus, it might be concluded that the additional laboratory

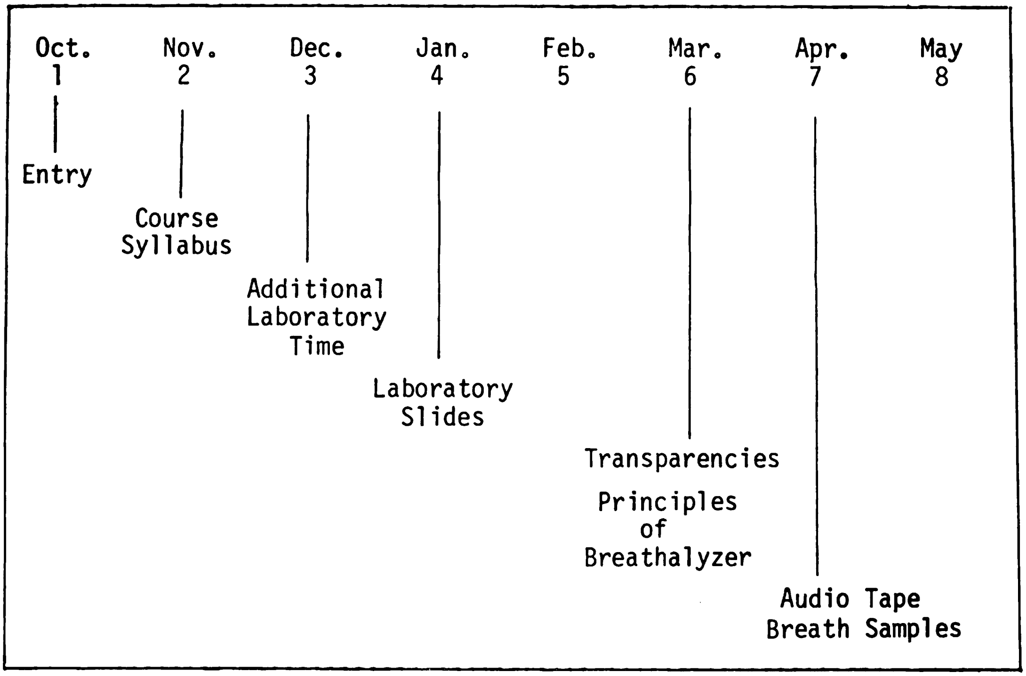


Figure IV-1.--Instructional Development Inputs Into BOTP Schools.

time introduced in December and the 33mm laboratory slides may have had significant bearing on student improvement in all but the February BOTP school. This conclusion relative to the potential value of the laboratory slides is confirmed by significant improvement at the .05 level or better for all BOTP schools under instructional development.

The finding also revealed significantly improved student performance during the April and especially the May BOTP schools over the December BOTP school. These findings are important to the study because they lend support to the fact that the audio tape of breath samples which was specifically designed and developed to alleviate the high frequency of unsatisfactory performance on Checklist Item #35 characteristic of earlier schools might have been the single most important factor to explain the improvement.

Thus, in summary, it may be concluded that the findings and the analysis of the findings support a rejection of the null hypothesis and the acceptance of the alternate hypothesis that the instructional development did contribute significantly to improving instructional effectiveness during the laboratory instruction.

Summary Hypothesis Matrix

Table IV-9 contains a summary matrix of conclusions on the null hypothesis of this study.

Table IV-9.--Summary Matrix of Conclusions on the Null Hypothesis of the Study

Hypothesis #1	
Instructional Effectiveness:	
Principal vs. Non-principal Variables......	Qualified Non-rejection
Simulator Preparation Variable.............	Rejection
Breathalyzer Operation Variable............	Rejection
Checklist Item #35 Variable................	Rejection

Model Discrepancies and Consistencies

Question 1: What differences, if any, between the synthesized model and the actual instructional development process used with the BOTP will be revealed by the Provus Pittsburg Discrepancy Model?

In presenting descriptive data related to this research question, the procedures of the Provus Discrepancy Model were followed as described in Chapter III. The steps of the synthesized operational model in Figure II-1 represent the standards, or criteria, for the instructional development and any deviations from the model constitute the discrepancies.

While analyzing the process used with the client, the experimenter reported whether there were any discrepancies from the model, and the specific activities which took place at each step during actual instructional development with the BOTP.

The model, as represented in Figure II-1 is intended to be non-linear in the sense that the instructional development could conceivably begin at any point along the flowchart model. The non-linear aspect of the model is depicted by the step called Which Step? Therefore, the logical starting point for applying formative evaluation using the Provus Model is to first identify the entry point(s) on the model for the experimenter and the client and then discuss the operations which occurred in subsequent steps.

Which Step?--For the experimenter, the entry point was Step 1.0 on the model. The experimenter met with the client to discuss the possibilities of a field experience with the BOTP. During the discussion, the client revealed the broad instructional goals of the program. For the client, the probable entry point was the evaluation step (Step 17.0). The client indicated during this initial meeting that he was dissatisfied with the performances of certified breathalyzer operators on recertification examinations. Thus, the client made the decision to reexamine the entire training program with the expectation of identifying the problem and then taking whatever appropriate actions suggested by the evaluation data to improve the BOTP.

Identification of Broad Instructional Goals (Step 1.0).--Two broad goals were identified by the client during the initial meeting. The first goal is to train and certify selected Michigan police officers to effectively operate the Breathalyzer instrument. The second goal is to teach these same police officers how to testify more effectively in court cases involving breathalyzer cases.

Since the broad goals of instruction were clearly delineated by the instructional developers, there was no function discrepancy from the synthesized model on this step.

Specify Instructional Development Objectives (Step 2.0).--In an attempt to demonstrate accountability for the instructional development process, the experimenter specified his instructional goals for the BOTP: (1) significant improvement in student learning or performance, or (2) increased instructional efficiency. Methods for measuring achievement on these two objectives are specified in the two blocks of the model listed at Step 2.0 and the experimental design described in Chapter III. The achievement of these objectives are reported with hypothesis one in this chapter.

Therefore, no discrepancies related to this step were evident.

Collect Data (Step 3.0).--A variety of data was collected during the BOTP instructional development. This data took several forms. First, the experimenter participated as a subject in the October school and monitored parts of several of the other BOTP schools. The client also monitored selected segments of the instruction during all of the schools. Secondly, staff reports from earlier schools were examined and analyzed by the instructional developers. Thirdly, an item analysis was conducted for the instructional developers by a BOTP graduate assistant. This item analysis provided an error frequency count on questions related to the written certification examinations for ten randomly selected schools operated in 1970-71. The experimenter also conducted an error frequency count on checklist items related to the laboratory examinations for each BOTP school. This was used as formative evaluation data for making subsequent instructional decisions. Fourthly, the experimenter, while participating as a student in the October BOTP school, and as an observer during parts of several other schools, solicited informal input from the instructional staff and participants in these schools.

Therefore, it was felt that there were no discrepancies from the requirements of the model on this step.

Immediate Instructional Materials Needed? (Step 4.0).--This step was designed as a decision point for determining if there was a need to develop instructional materials to support the immediate needs of the BOTP while simultaneously considering the long range planning and development represented by the other steps of the model. This decision point in the model "loops" the instructional developer out to a supplemental production sequence of steps designed to produce instructional materials.

This decision point in the model proved useful to the developers during the design and development of immediate instructional materials, i.e., overhead transparencies, 35mm slides, and audio tapes, for the BOTP. Therefore, the experimenter concluded that this step should be a basic part of ID models.

Organize the Management (Step 5.0).--For this study, the instructional development management consisted of the client and the experimenter primarily. At various times, other instructional developers consulted with the client on matters related to the BOTP as well as other developmental problems in the Highway Traffic Safety Center. Although many instructional development models recommend the inclusion of an evaluation specialist as a member of the ID team, there did not appear (to the experimenter) to be a critical need for this type of specialist during the limited cycle of development represented by the field experience.

The instructional management had been organized prior to the experimenter's arrival on the scene as an instructional developer. For example, the following individuals were regular instructors for the BOTP schools:

(1) Dale Dummer
(2) Dr. Robert Howenstine
(3) Sgt. Francis Korpal
(4) Jerry Stemler
(5) Floyd Smith
(6) Robert Mills

The BOTP also had support from their own staff of instructional media specialists who produced materials upon request, and made logistical arrangements for media used during the BOTP schools. However, their capacity for designing materials was limited enough to require the developers to use the services and facilities of the Instructional Media Center. Thus, there was not a discrepancy between the synthesized model and the actual instructional development process used with the BOTP on this step. The management was well organized and included the instructional developers, instructors and auxiliary services. The only discrepancy which should be reported is the model's failure to list instructors and auxiliary support personnel as elements in the organization of management for an ID project.

Identify the Problem (Step 6.0).--During this step of instructional development, the client identified symptoms of the problem. For example, he was concerned about the increased number of certified Breathalyzer Operators who failed to maintain their certification or to perform as well as was expected; the apparent discrepancies that seemed to exist between the BOTP training and the way Breathalyzer Operators functioned in the field; and an intuitive feeling he had that the quality of BOTP instruction was deteriorating.

It is interesting to note that the identification of these symptoms occurred during Step 1.0 of the synthesized model. This may suggest that the Defining the Problem step might also appear at the beginning of an instructional model.

The problem was identified as a performance discrepancy between how the subjects are trained in the BOTP schools and the way they actually perform in the field. The instructional development attempted to find ways to identify the discrepancies and to eliminate the gap between training procedures and operational procedures used in the field.

Thus, the experimenter believes that there were no discrepancies on both identification of the problem and the proper location of this step in an ID model. However, it is important to preface this conclusion by noting that discriminating between symptoms and problems is one of the more difficult aspects of the instructional development process.

Pre-assessment of Entry Skills (Step 7.0).--No terminal performance pre-tests were administered to the subjects prior to or at the beginning of the BOTP schools. Nor were there any attempts to identify prerequisite requirements for successful performance in the school.

Pre-assessment of entry skills was one of the variables which the experimenter found impossible to control during this first cycle of instructional development. The client did not reach the stage of desiring to devote time to this task. However, he did admit the importance of this function in planning for effective instruction.

The experimenter concluded that, along with the functional discrepancies described above, there might have been a sequence misplacement of this step in the model. From the experiences of the study, it appears that pre-assessment of entry skills would more logically follow the specification of behavioral objectives, and not the identification of the problem as shown in the synthesized model. Although the misplacement of this step in the model did not have serious implications for the BOTP development, it could prove to be a real problem during subsequent stages of ID with the BOTP. Any attempt to identify prerequisite skills before stating the behavioral objectives could be counterproductive.

Specification and Measurement of Behavioral Objectives (Steps 8.0 and 8.1) and Identifying Enabling Objectives (Step 11.0).--Specific terminal objectives were evident from the outset of the ID. However, neither the terminal objectives nor the enabling objectives were specified to the complete satisfaction of the experimenter. The difficulty of making significant changes in the original BOTP objectives was compounded by the fact that the instructional developers were functioning independently of the other BOTP staff and administrative units. Efforts by the experimenter to coordinate the planning and extend the ID to include all human components of the BOTP instructional and administrative staff failed to materialize. The client elected, contrary to the suggestions of the experimenter to follow the policy of limiting the ID to only those phases of the instruction which were taught by the client. It was the client's intent to develop his instruction as a "model" for the other staff members to follow in their own instruction. Thus, there was a discrepancy in this step since all elements of the management were not anticipated and represented on the synthesized model.

The enabling objectives were generally reflected in the learning activities of the BOTP but were not as carefully developed and specified as the experimenter would have preferred. Nevertheless, the terminal and enabling objectives were specified sufficiently to enable the developers to make significant headway during this first development cycle.

Therefore, a discrepancy was evident at this early stage of development in that the specific and enabling objectives were never specified to the complete satisfaction of the experimenter.

Conduct Task Analysis (Step 9.0).--The experimenter, in his role as an instructional developer, organized a structure for interviewing certified Breathalyzer Operators in the field for data relevant to developing a task analysis of the functional role and the on-the-job behaviors of instrument operators. However, time constraints limited the task analysis to telephone interviews of approximately one dozen randomly selected certified Breathalyzer Operators. These same time constraints prohibited a follow-through by the developers on the findings.

The client made several attempts to develop task descriptions of the Breathalyzer operation function. However, the task descriptions were not completed during this cycle of development due to time constraints and insufficient task analysis information. The consequence of not completing a task analysis was that the instructional developers remained uninformed of the exact procedures used by the operators in the field.

The experimenter concluded, however, that this step of the model should precede the specification of objectives and follow the problem identification step in the model.

Review and Revise Instructional Content (Step 10.0).--The instructional developers examined the training manuals of several other Breathalyzer programs with the intention of using the information for purposes of course revision. Once again, however, the time constraints imposed on the experimenter by the field experience and the client (because of his other responsibilities to the Highway Traffic Center) resulted in an incomplete execution of this sub-step in the model.

Several significant revisions were made to the BOTP as a result of input information. In November, for example, it was decided to add three hours of laboratory time to the regular schedule to give the subjects, or learners, more time to develop laboratory concepts and skills.

During the same month, a preliminary course syllabus was prepared by the experimenter and a graduate assistant from the Highway Traffic Safety Center. Both enrolled for the BOTP October school and again monitored the class activities in November to collect the data needed to assemble a preliminary syllabus.

The value of the syllabus was that it served to make the BOTP instructors conscious of the curriculum content presented during each segment of instruction. It was hoped that the syllabus would reduce the instructional duplication and overlap in teaching assignments. The experimenter, while monitoring subsequent schools, observed that the regular instructors were more aware of what was being taught by their colleagues and were attempting to minimize unnecessary duplication in their instruction.

Sub-step 10.0.3 of the model called for utilizing student feedback. Since written student feedback was solicited and obtained during the laboratory performance examinations, it was concluded that no discrepancy was in evidence during this step of the ID process as represented by the synthesized operational model. This student input was used to make course revisions.

Technical and Communications Review? (Step 10.0.4).--This step was of value to the instructional developers during the design and development of the instructional materials. Checklist II in the model was useful as a guide for examining the content accuracy and the technical quality of the materials produced for the BOTP.

In conclusion, there was no discrepancy from the model on this step during the instructional development.

Analyze Instructional Setting (Step 12.0).--As indicated earlier in the study, no attempt was made during this limited cycle of instructional development to analyze learner characteristics for purposes of organizing learning experiences to accommodate different student needs while using a variety of instructional patterns, e.g., large group, small group, and individualized instruction. Although its value was recognized by the developers, time constraints restricted significant changes in the overall instructional sequences of the BOTP. These training schedule changes would be unlikely to occur without the agreement and commitment of the staff personnel who were not involved with instructional development.

However, there was no discrepancy in analyzing the physical facilities related to the BOTP. Rooms were reserved well in advance of each school and were of sufficient size to effectively accommodate existing patterns of instruction and group size. The only problem with room scheduling was caused by low ceilings in the laboratory spaces. This caused viewing difficulty when using slide projectors and screens. The problem did not appear to be a significant one in terms of adversely affecting instruction.

The experimenter concluded that there were no discrepancies at this step of the model.

Construct Prototype Test (Step 13.0).--A discrepancy was evident at this point in the process. Many prototype instructional materials had been developed for the BOTP. For example, transparencies were designed to aid the teaching principles related to the Breathalyzer instruction.

An audio tape for breath samples and 35mm slides were introduced into the course development.

Prototype testing, according to the Abedor model (1971), requires that the materials which have been developed as prototypes, should be field tested on a representative sample of learners. Feedback from these learners is then used as a basis for revising the prototype prior to its use in the classroom. The instructional developers in this study found it impossible to test the prototype in this manner for two reasons: (1) the unlikeliness that the client would want (or be able) to find the time to validate materials by "teaching" a relatively long sequence of instruction to a small group of learner; (2) the unavailability of a representative sample of students at times which would be mutually convenient to instructional developers and students.

Therefore, the validity of the materials was evaluated and revisions made on the basis of observations in the actual instructional setting and data from the performance results on items related to the materials or the criterion measures.

In summary, the experimenter concluded that (1) there was a discrepancy from the model on this step because a representative sample of students was not used to validate the instructional materials which had been developed, and (2) it is likely that instructional developers will not always have a representative sample of learners readily available to them for testing the validity of prototype materials. Thus, it is more conceivable that prototype evaluation will have to take place within the context of a regular class(es) or through the use of a representative sample of learner. Subsequent revisions would then be made on the basis of student feedback after the use of the prototype materials.

Determine Teaching/Learning Activities and Methods (Step 14.0).--A discrepancy also resulted at this stage of development. The experimenter did not attempt to analyze the learning activities as required in the Merrill-Goodman manual (1971). The reason for this was that the teaching/learning activities did not significantly change during this first cycle of development; the main changes were in the development and validation of instructional products which were used with the existing BOTP curriculum. It was unnecessary to use the Merrill-Goodman manual in matching media forms with learning activities because, in this study, the media selection was fairly obvious to the instructional developers. It is likely that the manual would become more useful to the instructional developers when that stage was reached where the client was prepared to re-examine and revise the instructional content.

However, the experimenter recognized this discrepancy early enough during the process with the client to make necessary adjustments. Thus, even though there was a discrepancy relative to the proper sequence placement of this step in the model, no problems were caused which affected the ID with the BOTP.

Schedule Support Services (Step 15.0).--No discrepancies can be reported on this step since the developers, without exception, scheduled equipment and instructional materials well in advance of their use date. In fact, the equipment and materials were generally available a day or two before the use date so that they could be checked out beforehand.

Implement (Step 16.0), Evaluation (Step 17.0), Measure Achievement(s) (Step 2.0), and Recycle (Step 18.0).--There were no discrepancies at any of these points in the model. The evaluation (Step 17.0) and accountability components (Step 2.0) are well documented in other sections of this study. Recycling would have been a logical step in the process had time permitted.

Summary Table

Table IV-10 uses a matrix format to summarily review and report discrepancies and incomplete execution of process steps during the instructional development with the BOTP. For those steps left blank, it can be assumed that no discrepancies from the model were evident. The matrix also includes comments designed to further explain the findings.

Summary Conclusions Related to Question 1

Several conclusions can be made relative to the model used during the BOTP instructional development:

(1) On the basis of the ID experiences with the BOTP, the experimenter formed the opinion that instructional models should include a production sequence, e.g., Step 4.0, designed to meet the immediate instructional needs of a program while longer range planning and development is taking place. Figure IV-1 illustrates the various types of instructional materials developed simultaneously with longer range planning activities, i.e., audio tapes, slides, overhead transparencies.

(2) Definition of the problem is probably the most realistic starting point for ID since the client must first recognize and express a

Table IV-10.--Summary Matrix Reporting Discrepancies (D) and Incomplete (I) Execution of Step Functions in the Synthesized Model During the BOTP Instructional Development.

Instructional Model Component	Step No.	Findings	Comments
Which Step?	Entry		
Specify Broad Objectives	1.0		
Specify ID Objectives	2.0		
Collect Data	3.0		
Organize Management	5.0		Model should include staff and administrative assignments as a sub-step.
Identify Problem	6.0		
Pre-assess Entry Skills	7.0	D	Step should follow Step 8.1 in model.
Specification of Behavioral Objectives	8.0		Needs to be re-examined.
Conduct Task Analysis	9.0	I	Insufficient. Step should follow Step 6.0 in model.
Review and Revise Instructional Content	10.0	I	Time Constraints.
Conduct Technical and Communications Review	10.0.4		
Identify Enabling Objectives	11.0		Needs to be re-examined. Follow Step 8.0.
Analyze Instructional Setting	12.0		
Construct Prototype Test	13.0	D	Time Constraints. Unavailability of small sample. Step should follow Det. Teaching/Learning Activities and Teaching Methods.
Det. Teaching/Learning Activities	14.0	I	No significant content changes made. Follow Step 12.0.
Schedule Support Services-Recycle	15.0-18.0		
Immediate Instructional Materials Needed?	4.0		Useful. Realistically depicts what happens in most ID projects.

need for implementing changes in an existing program.

(3) Instructional models are capable of producing significant improvement in student performance even when discrepancies are evident, as was the case in this study.

(4) Operational models must include steps which list and describe how to execute the various functions, as well as criteria checklists for determining how well each step has been executed.

(5) Instructional models should contain a step similar to Step 2.0 of the synthesized model as a way of representing the goals of the instructional developers and procedures for measuring the achievement of these goals.

Instructional Efficiency

Question 2: To what extent did the instructional development with BOTP result in instructional efficiency as measured in terms of (a) an increase or decrease in actual time of the BOTP through the addition or deletion of instructional objectives and/or teaching/learning activities; (b) an increase or a decrease in program costs, and (c) an increase or decrease in instructional man-hours?

Findings.--There was an increase in (1) instructional time; (2) program costs, and (3) instructional man-hours.

The increases in instructional time and instructional man-hours were the result of two additions to the learning/teaching activities in the

BOTP schedule for which the client had direct instructional responsibility. First, a two-hour open laboratory period was added to the BOTP schedule on Monday nights to afford the subjects more time in the laboratory for practice. This schedule change necessitated the presence of laboratory assistants as well as the client on several occasions. The main purpose for the client's presence during the open laboratory period was to monitor the activities while, at the same time, assessing the value of the change. Secondly, the length of the client's instructional segment on the Principles of the Breathalyzer (Monday mornings) was increased by approximately one hour at the expense of the time normally assigned to instruction on the Metric System. This change was the result of a recommendation made to the client by the experimenter after monitoring the October and November BOTP schools.

The instructional costs of the BOTP was also increased by approximately two hundred dollars. This cost increase was attributed to the design and development of new instructional materials to deal with specific instructional problems, i.e., transparencies for teaching the Principles of the Breathalyzer instrument, 35mm slides for laboratory instruction on simulator preparation and Breathalyzer operation, and an audio tape which provided discrimination practice between "good" and "bad" breath samples. However, the one-time cost of producing these materials was quickly amortized and regarded as relatively insignificant as the materials were reused in subsequent replications of the BOTP school. Also, there is no way to estimate what normal costs might have materialized irrespective of the instructional development. It must be noted, too, that the instructional developers, on several occasions, discussed tentative plans for revising and redesigning these instructional materials to make them more amenable to self-instructional applications which would be more instructionally efficient in the usage of staff man-hours. However, the time constraints prohibited the instructional developers from designing and developing any self-instructional packages of materials during the first cycle of instructional development.

Finally, the time devoted to instructional development by the client and the experimenter might be viewed as a negative efficiency factor. Although it was apparent that the client was dedicating himself to long hours of systematic design, development, and evaluation of his instruction, it could not be precisely determined how much more time the client was devoting to instructional development than he did prior to the field experience.

Conclusion.--The findings suggest that the instructional development resulted in increased instructional time, increased program costs, and increased instructional man-hours. This increase in instructional man-hours pertained both to the client's instruction in the BOTP as well as to the time he spent engaged in instructional development with the experimenter.

In retrospect, the experimenter concluded that instructional efficiency is difficult to achieve during instructional development unless: (1) self-instructional materials are designed, developed and implemented into an instructional system, or (2) more students are served with the same staff. These self-instructional materials would have the potential of reducing the instructor's (client) man-hours, in classroom instruction and the effect of amortizing, within a relatively short period of time, the overall costs of the instructional program or system.

Client's Post Attitude Questionnaire

Question 3: What changes in the client's attitude toward instructional development will be revealed in a structured, open-ended questionnaire administered to the client approximately one month after the termination of the experimenter's field experience with the BOTP?

Findings.--Two types of data were collected to report the findings on this question. The first type of data emanated from the responses given by the client on the open-ended written questionnaire in Appendix E. This questionnaire was administered to the client during June, approximately one month after the termination of the experimenter's field experience. The second source of data was direct conversations and associations with the client.

An analysis of the responses on the open-ended written questionnaire shows that the client:

(1) Continued to have a positive attitude toward the instructional development process. This finding is based on the client's written responses to three specific questions. Question 10 asks: "Would you say that your present attitude toward the instructional development process is, for the most part, positive, neutral, or negative?" The client's response was that his attitude toward the process was positive. When asked his reason(s) for feeling this way about the process, he responded

by saying that "It seems to show me logic and results." The client's positive attitude is further confirmed by his response to Question 7 which probed his present impressions of the instructional development process. Although he did not elaborate in detail, the client exhibited signs of positive behavior by stating, "I want to learn more (about the process) and I want to use it." The client's continued positive attitude is also reflected in Question 1 when he notes that he plans to modify or change the BOTP through, as he states, "Reorganization of the total course, applying the ID approach to the extent I am familiar . . . continued development of operational skills and use as example . . . re-evaluation of all training objectives and organize and develop as needed." The only indication of anything other than a positive attitude by the client is revealed in Question 2 when he reported that he had not attempted to convince others of the value of the process. Part of the explanation for the client's response to Question 2 may rest with his belief that he would prefer to diffuse the process and the merits of the process to others through the modeling of instructional development procedures or behaviors in his own teaching and through the presentation of statistical and research evidence to support the effectiveness of the process in improving instruction.

(2) Viewed the value of instructional development as being a process which, as he wrote on Question 8, "commits you and gives you accountability." Failure on the part of the client to elaborate further on this statement exposes its interpretation to different, and perhaps even misinterpretations. Therefore, the experimenter, drawing upon his conversations and observations of the client during the process, exercised the

prerogative of subjectively evaluating the meaning of the response for purposes of clarification and amplification. On several occasions throughout the development the client indicated that his active role in the design, development, and evaluation of new instructional materials increased his sense of commitment to the process. The value of this type of active involvement in product development and validation had an effect on the client by first, his identifying more closely with the instructional materials developed for use with the BOTP instructional program, and secondly, his being more sensitive to the potential importance of the materials to the learning activities of the BOTP. More simply stated, it is quite natural for an individual such as a client to take extra steps to insure the effective classroom use of instructional materials for which he had a direct responsibility in designing, developing, and evaluating, than if the materials had been designed externally and independently of him.

Also, it became evident to the experimenter early during the process, that the client was impressed by the accountability concept of the synthesized model. As a Director of Training, he is personally accountable to his employer(s) to provide visible proof that the instructional development was improving the quality of the BOTP program. This type of visible proof is especially needed to justify significant changes made in the program.

(3) <u>Felt that the most difficult aspects of the instructional development process for him (Question 6) were "teaching concepts and principles"</u> and "pin-pointing objectives." When asked why teaching concepts

were difficult for him to comprehend and/or execute, the client could offer no explanation on the questionnaire. In regard to "pin-pointing objectives," the client highlighted the problem by saying that specifying behavioral objectives was difficult "maybe because I don't really know, or accept what the objectives are." Again, to avoid the possibility of misinterpretation by those unfamiliar with the events which transpired during the instructional development, the experimenter has opted to subjectively interpret the implications of this statement within the proper context. Throughout the entire instructional development process, the client found it very difficult to precisely specify objectives, as many behavioral scientists would expect. However, as reported in the findings under Hypothesis 1, the two specific goals or objectives of the BOTP were identified precisely enough to permit measurability as evidenced by this study. Nonetheless, the experimenter constantly sought to refine the objectives in even more precise terms as the development progressed. Some of the suggestions offered by the experimenter to the client involved significant changes in performance standards as well as the conditions of performance. It is believed that the client was unable, at that time, to comprehend the long-range impact of such a change, thus partially explaining his statement that he "did not know, or accept the objectives." Furthermore, time constraints and instructional development, independent of the other instructors for the BOTP, made it unlikely that significant progress in further refinement of the objectives would materialize during the limited development cycle represented by the field experience.

(4) Reflected the frustrations of many instructors who engage in the process within a limited period of time. In Question 4, the client stated that the least effective instructional development change with the BOTP was "probably the fact that very little got on paper." This statement mirrors the obvious frustration of not having instructional development changes reported on paper. Once more, the time constraints and the early emphasis on instructional materials developed seemed to interfere with the revision of a written course syllabus. Another contributing factor was the inability of the instructional developer to significantly revise the specific and enabling objectives. Without any further clarification of the specific intent of the objectives, course syllabus revisions would have had little meaning and would be subject to further revisions in subsequent instructional development. In summary, the experimenter believes that the changes would have been reflected "on paper" during a recycling of the process. However, the time limitations imposed by the parameters of the field experience was an important factor in prohibiting completion of written revisions.

(5) Recognized that the most significant change (Question 3) resulting from the instructional development was within himself. This finding is supported by the client's response that "Probably the most important change was with myself, recognizing that change should be made, learning the various approaches in making sound changes, understanding (at least somewhat) the importance of the various steps and their relationship to each other and to the total instructional process, and becoming convinced enough to pursue instructional development activities."

Subjective Data

Findings.--The second type of data is subjective and based entirely on conversations between the experimenter and the client.

The client exhibited signs of a continued positive attitude at the conclusion of the field experience by (1) taking the initiative to contact the experimenter for additional explanations of the synthesized model used during the instructional development with the BOTP (several hours were devoted to this purpose); (2) requesting permission (of the experimenter) to photostatically reduce the size of the model from the original art work, for purposes of reproducing additional copies to use in future development in the Highway Traffic Safety Center; (3) asking the experimenter to write a summary report of the findings of the study for use in interpreting the achievements of the instructional development to other staff members; (4) considering the possibility of continuing his graduate studies in the Instructional Development program at Michigan State University as a way of broadening his competency base as a training director; and (5) seeking continued assistance from campus instructional developers on problems related to the Highway Traffic Safety Center.

In interpreting the attitude of the client after the termination of the field experience, it is important to report a possible "spin-off" effect of the instructional development. During July, the client, as a result of consultations with an instructional developer at the Michigan State University Media Center, decided to apply many of the same strategies used by the National Special Media Institutes (NSMI) in designing training institutes. The Instructional Development Institutes (IDI) USOE proposal, in this case, became a model for revising the original proposal of the Highway Safety Patrol for the training of police officers in other aspects of police work besides breathalyzer training.

The findings make it very clear that the client's attitude toward instructional development continued to be positive even after the termination of the field experience. On the surface, at least, there would appear to be no significant change from the attitude exhibited during the instructional development. However, the difference which appears to be significant is that the client is now, out of necessity, assuming more personal initiative in program development as evident by the subjective data reported in the findings for this hypothesis. As the need arises, the client initiates contact with other specialists whose talents could be used to provide input into program needs.

Thus, it would appear that a client's continued positive attitude toward ID seemed to reflect the client's satisfaction with the student performance improvements which resulted during the instructional development, and his increased confidence in the potential of the process for improving the instructional process.

Client's Attitude Toward ID

Question 4. What differences, if any, will there be between the raw score of the client and the grand mean score of nineteen IDI's on the *Attitude Toward Instructional Development* instrument?

Findings.--The client's score (214) on the *Attitude Toward Instructional Development* (Appendix D) was slightly less than 2 S.D. above the grand mean score (198.77) reported by the nineteen Instructional Development Institutes as shown in Figure IV-2.

Grand Mean X = 198.77
Range = 74-250
Mean Deviation = 7.78
Variance = 97.48
Standard Deviation = 9.88
Client's Score = 214.00

Figure IV-2.--Mean and Raw Score Comparisons Between the Client and the Instructional Development Institutes on the Attitude Toward Instructional Development Instrument.

For the client's score to have been 2 S.D. above the grand mean, a score of 218.53 would be needed. Also important is the fact that the client's score was higher than the mean score of all but one of the Instructional Development Institutes (IDI) which had a mean score of 214.20.

Conclusions.--There is a difference between the client's score and the grand mean of nineteen Instructional Development Institutes is rejected. This conclusion is based on the fact that the client's score was just under 2 S.D. higher than the grand mean of the Institutes and only .2 of a point lower than the highest mean score reported by the Instructional Development Institutes.

The analysis of the findings on this hypothesis might lend support to a broader conclusion that attitude toward ID will be more positive for a client who is directly and overtly engaged in the instructional development process than attitude likely to be exhibited by individuals (or groups) who are exposed to the process in simulated settings.

Client's Entry and Exit Cognitive Proficiency Levels of ID Process

Question 5. What mean score differences, if any, will there be between the client's entry (October, 1971) and exit (June, 1972) cognitive proficiency level of the ID process as measured by the Client's Opinions Regarding Instructional Development instrument?

Findings.--The C's score on the Client's Opinions Regarding Instructional Development instrument (Appendix E) disclosed an entry performance of 4.54 as opposed to an improved exit performance mean score of 2.75 on twenty-eight observations (for both entry and exit) relating to his understanding and/or his use of the instructional development process. The t-test analysis in Table IV-11 reveals a significant mean score gain on exit performance at the .01 level.

Table IV-11.--Corresponding t-test Analysis of Entry and Exit Scores on Twenty-eight Observations on the Client's Opinion Regarding Instructional Development Instrument

	$\overline{X}$	$S_{\overline{X}}^2$	t_c	t_T.01	d.f.	Comment
Entry	4.54	.023	3.31	2.58	54	Significant Difference Between Exit and Entry at .01 Level.
Exit	2.75	.057				

Conclusions.--There is a difference between the cognitive level of the client before and after instructional development. Based on the number ratings explained on the measurement instrument in Appendix E, the client's exit mean score of 2.75 fell into the proficiency category of understanding/or being able to execute the steps of the instructional development process "moderately well" to "a considerable degree" as compared to an entry proficiency level almost mid-way between "did not know or understand the process," to knowing it "only partially" as shown by a 4.54 mean score. Also, the client's exit proficiency level of the process was significantly higher (.01) than his entry proficiency level. Therefore, in this study, the proficiency level of the client regarding instructional development was significantly improved as a result of his involvement with the process during development with the BOTP.

The importance of the conclusion is that the findings suggest that a client using the instructional development process prescribed by the model may be able to learn the ID process--without prior explanation of the exact details of the physical model--by actively engaging in the systematic development of instruction.

CHAPTER V

DISCUSSION

Overview

This concluding chapter has four sections: (1) a summary of the development and application of the synthesized model, (2) the major implications of the study, (3) a discussion of heuristics which emanated from the study, and (4) recommendations for further research.

Summary of the Development and Application of the Synthesized Model

The purpose of this study was to provide a model which could improve the instructional development process and thus the effectiveness and/or efficiency of instruction. The study proposed (1) generating an operational synthesized instructional development model from the review of the related literature, and (2) applying the model to instructional development with the Breathalyzer Operator Training Program for the State of Michigan.

The synthesized operational flowchart model provided a framework for formative evaluation of the model components while engaging in instructional development. The model was applied to the BOTP for the purpose of reporting consistencies and discrepancies between the model and the actual process used with a client as part of a field experience.

The instructional development field experience had both descriptive and experimental components representing the two types of research objectives and questions of the study. The first type of objective focused on explicating the process through which systematic instruction was developed. In this study, the systematically developed instruction evolved from the activities prescribed in the synthesized operational model. The second research objective related to experimentally comparing student achievement and measuring the cognitive and affective development and growth of a client.

Implications of the Study to Instructional Development

The findings of this study tend to suggest several implications for instructional developers in the field:

(1) Instructional development models are effective in improving instruction, in that statistically significant differences favoring the training programs under development were obtained on three of the four dependent measures in BOTP schools under ID from November, 1971 through May, 1972.

(2) There is not necessarily a correlation between instructional effectiveness and instructional efficiency in programs which have not reached the stage of using self-instructional learning activities. The experimenter found a decrease in instructional efficiency on each of the three criteria used to assess efficiency. However, the criteria used in the study were deemed to be more appropriate for use with instructional programs which have reached the stage of using self-instructional learning activities.

(3) Positive client attitude toward the process can be maintained by providing statistical evidence of the effectiveness of ID. On the

open-ended questionnaire the client viewed the statistical evidence useful in justifying (to his employer) continued involvement in instructional development.

(4) The synthesized model was, for the most part, a good representation of the instructional development process. The formative evaluation revealed few discrepancies between the synthesized model and the actual process used during the instructional development with the BOTP.

(5) Attitude toward ID is likely to be more positive for clients using the process in the field than for individuals or small groups exposed to the process in a formal instructional setting. This conclusion is evidenced by the fact that the client's score on a validated attitude instrument was almost 2 S.D. above the grand mean score of 198.77 for nineteen national Instructional Development Institutes.

(6) There is a relationship between the effective diffusion of the ID process to a client and the client's active involvement with the process. The study reported significant growth ($P < .01$) in the client's cognitive proficiency despite the fact that the client had never been shown the synthesized model used by the experimenter during the ID process. The experimenter credits much of this cognitive proficiency to the fact that the client was actively involved in the design, development and evaluation of all learning activities related to the ID. Thus, it appears he may have become familiar with the steps while engaging in them.

(7) Effective instructional development can change people's self-concept. The client in the study stated that one of the most significant results of the process was the change within himself: a recognition that "sound changes should be made in instruction." The client also

reported that engaging in the process made him more sensitive to the quality of his own instructional strategies, thereby making him more effective as a classroom instructor.

The study still leaves unanswered several important questions relating to the ID process. First, how much of the reported improvement in learning and increase in positive client attitudes were due to the interaction between the experimenter and the client? Secondly, how much of the results of the study was due to the model? Thirdly, how much of the results were due to the experimenter and his personality? And finally, what would be the results if someone (other then the experimenter) used the synthesized operational ID model in developing a training program bearing essentially the same attributes of the BOTP?

Any determination as to how much each of these factors might have contributed to the results shown in this study will have to be left to future research.

Heuristics

As a consequence of participating in instructional development with the BOTP, the experimenter learned by successive discovery certain heuristics or rules of thumb, which may be useful to instructional developers. Since these heuristics may be of value to those who might apply the instructional development process or to other researchers in the field, they are presented at this time.

Heuristic 1: Actively involve the client(s) in all design and developmental activities of program development, e.g., developing instructional materials such as transparencies, 35mm slides, etc.

The design, development and evaluation of systematic instruction should be a shared responsibility of the instructional developer(s) and the client. The experimenter believes an instructional developer would be remiss if he attempts to do the product design and development independent of the client. There are two basic purposes served in requiring the client to be directly and actively involved with the instructional development.

First, the client learns the process by doing. He learns what variables have to be accommodated during the process, where to go for specialized design and production services, and how to evaluate or validate products. Thus the process is more effectively internalized by a client through this active participatory approach. Consequently, the client is likely to become independent of the instructional developer in a shorter period of time than would be the case if the client were not directly involved with all aspects of the development.

Secondly, the client is more committed to the instructional development. Instructional materials which are designed and developed represent tangible products of the client's efforts and creativity. Therefore, he has a greater stake in the way the materials are used in the instruction and may take extra measures to assure their maximum instructional value.

Heuristic 2: Advise the client, at the outset of instructional development, of the implications of committing himself to the process.

The experimenter believes it would be unwise for an instructional developer to agree to engage in instructional development, particularly in long range instruction, without first making the client as fully aware as possible of the meaning of this commitment to the process. For example, the client must realize and accept the fact that instructional development takes time, often more time than the client thinks he can devote. The client must be willing to view the process as one which will require on-going design and redesign of teaching/learning activities. Secondly, the client must realize that he will have to become an active member of the design and development team. He should not expect the instructional developer to assume the responsibilities of program development independent of the client. Thirdly, the client must be in a position to commit reasonable financial and human resources to program development. The ultimate success of instructional development will depend heavily on the availability of dollars for making changes in the instructional program, as well as the complete cooperation of the human components of the system.

Heuristic 3: Don't require any more of a client during instructional development than he is ready to give.

The experimenter found it useful to work on the basis of agreement with the client on matters related to what should be done, how, when and under what circumstances. The principal role of the instructional developer, particularly during the early stages of development, should be to advise the client at each step of the process. Nevertheless, the instructional developer must respect the client's option to accept or reject the advice. At the same time, the client should be made aware of the possible consequences of his decision(s). For purpose of maintaining a good working relationship with the client, the instructional developer should be willing to undertake the process under the conditions specified by the client. This will have the effect of strengthening the team effort by giving the client a significant voice in the decision making process. For example, the instructional developer recommended that the client be available in the role of content expert during the design planning of instructional materials at the graphics department in the Instructional Media Center. The one time he was unable to keep a scheduled appointment, the client sent a graduate student assigned to the BOTP to represent him during the planning. Consequently, the materials were designed by people who were not going to be teaching with the materials. Subsequently, when the client attempted to use the materials, he found them to be accurate, but not arranged in the exact instructional sequence he would have preferred. Eventually, changes were made which resulted in additional costs for revising the transparencies, as well as the loss in instructional development time.

Recommendations for Further Research

This study has raised a number of questions which are amenable to further research. These questions may be classified as: (1) improvements or refinements to the model to make the instructional development process still more effective and efficient; (2) determining the generalizability of the model, e.g., whether the model in its present (or a different) configuration can be used for formative evaluation of other types of instructional systems; (3) improvements or refinements to the instruments used to measure the cognitive and affective levels of the client in regard to instructional development; (4) experimentally comparing selected segments of the laboratory instruction with self-instructional modules utilizing the same curricular content; and (5) investigating more effective ways of diffusing the process flowcharted in a model to a client without creating undesirable confusion during the development.

Research Leading to Refinements of the Model

In the context of instructional development, there is a need for research to examine the advantages of using and diffusing a more comprehensive model than is presented in the synthesized operational model used in the study. The research should focus on describing the experiences of an instructional developer using and diffusing a flowchart model which contains heuristics and guidelines for successful instructional development.

On the basis of the study, it is the contention of the experimenter that, during the initial meeting with a client, the instructional developer would be well advised to specify certain guidelines designed to determine if the client is willing to make the requisite commitments for successful instructional development suggested under Heuristic 2 in this chapter. Failure to obtain a commitment from a client on at least these requisites could jeopardize long range development.

In developing a more comprehensive model, it is suggested that research be done to further validate the heuristics of Barson, Alexander and others, as they relate to the instructional development process or models. Effective diffusion of the process must be thorough enough so that the client will be able to use the process independently of the developer and thereby be better able to disseminate the process to others with whom he may work in program development.

Finally, the development of a comprehensive model will also have to include (1) the "how to do" functions of the process, and (2) the criteria for measuring how well each step of the model was performed by instructional development.

Determining the Generalizability of the Synthesized Model

A much larger and yet related domain of exploratory research relates to the generalizability of the synthesized operational model to instructional systems or components of increasing scope and complexity. Using the basic framework of the synthesized model, exploratory research should be conducted to determine its generalizability to instructional systems or components such as lecture, laboratory, group discussion, independent study, or self-instruction.

A second significant area of research would involve comparing the results of an instructional development study which uses no model with the results obtained using the model developed for this study.

The objective of a research program in generalizing the synthesized model would be to develop a set of validated alternative procedures which could be incorporated into a training program for teaching design of instructional systems.

APPENDICES

APPENDIX A

REVIEW OF RELATED RESEARCH

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Instructional Models

The review of instructional development model-building literature and research in this section was designed to be used by the experimenter as the primary source for generating a more operational synthesized instructional development model from the process commonalities evident in the review. Other sources of information for generating the synthesized model were: the experimenter's professional association with instructional developers; a survey of additional literature on the evaluation components of instructional development; and the personal concerns of the experimenter relative to the instructional development process.

The review is organized as follows. First, the models were reviewed, and those which met the minimum prerequisites needed to qualify as instructional development models were reported under three categories. These categories were designed to serve as an organizational framework for classifying those models developed by (1) instructional technologists; (2) psychological and curriculum specialists; and (3) training managers. A fourth category contains non-qualifying but relevant instructional models. Qualifying models have, as a minimum, four features: (a) specification of behavioral objectives; (b) information flow between and among the steps (feedback); (c) flowchart or combination flowchart-narrative description of the process; and (d) a recycling process which permits a continuous re-examination of whatever is developed to determine the instructional effectiveness, efficiency or relevance.

Secondly, the review contains an explication and brief discussion of each of the models. The non-qualifying models are also included in the review because they are models which are designed to improve instruction. It is important to note, however, that this literature review does not encompass all of the ID models which have been developed and reported. Consequently the experimenter, because of time constraints and practical considerations, had to arbitrarily select for review those models with which he was personally familiar.

The third aspect of the review is the composite checklist matrix of the models reviewed in this chapter. The composite matrix lists the components of the synthesized model and identifies models which have those components in common.

The experimenter's concerns, which were reflected in the design and development of the synthesized model, are also discussed.

Finally, the synthesized operational model is presented.

Assumptions Underlying Development of a Synthesized Operational Instructional Development Model

The selection of literature for review and the conclusions reached thereafter were largely based on the assumptions and definitions stipulated in Chapter I. In summary, the most critical of these were: (1) instructional development is a systematic process used by instructional developers in the design, development and evaluation of instructional programs which are effective and/or efficient; (2) the instructional developers in this study were the client and the experimenter; (3) the primary sources of information relative to the design, development and evaluation processes of instructional program development are ID models; (4) instructional development flowchart, or analog, models can handle with less difficulty a multitude of variables and relate their effects on each other in highly complicated ways, thus preserving the integrity of the events under study; (5) the most significant ID models have been developed and reported in the professional literature of instructional media specialists during the past ten years; (6) one important element of instructional development is changing people during the process; (7) the flowchart models reported are, for the most part, too general in detailing the functions of the process; (8) a more operational ID model would have to be comprehensive enough to include the functions on the flowchart representation of the process, thus minimizing the need for supplemental written explications of the model's components, and (9) the synthesized operational model, being a composite of the ID components common in the models reviewed, would have as much potential as any of the models reviewed for improving instructional effectiveness and/or instructional efficiency.

Instructional Technologists' Models

The Barson Model.--Barson (1965) launched instructional media specialists into the vanguard of model-building when he designed the systematic flowchart procedure in Figure A-1 for the analysis of instruction and the implementation of newer media of communications (p. 1).

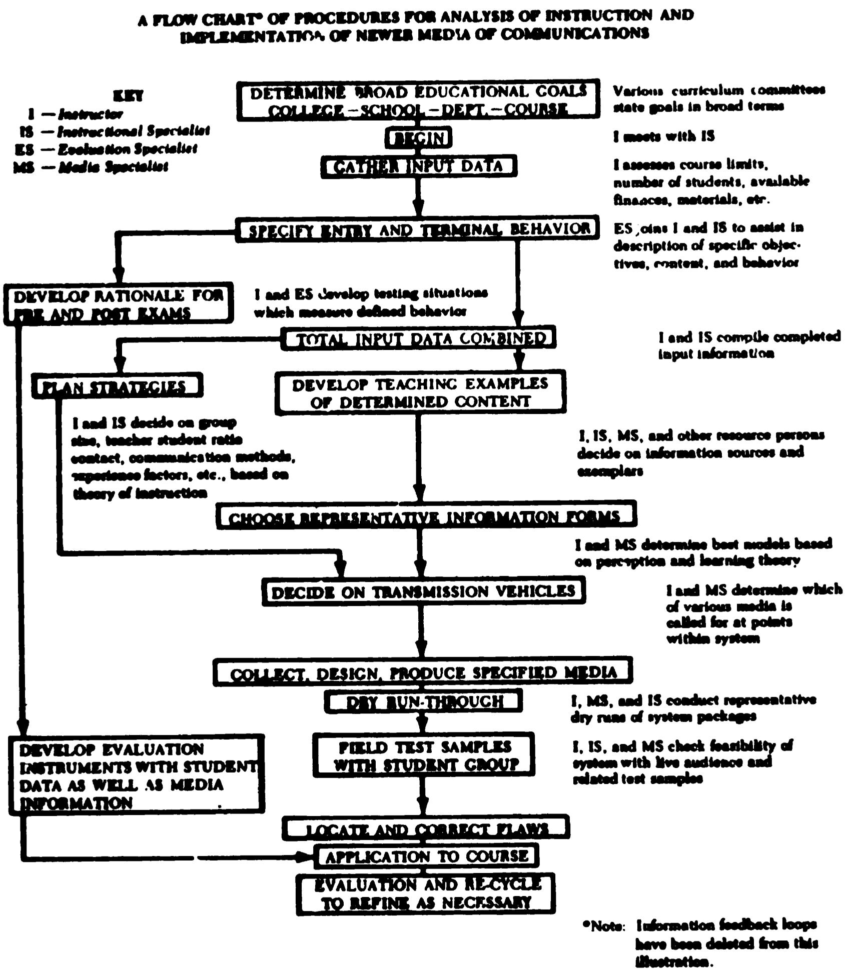


Figure A-1.--The Barson Model, 1965, p. 5.

This model was developed during a two-year project (1963-1965) as a hypothetical model for the systematic development of college-level courses. Subsequently, four major universities--Syracuse University, Michigan State University, the University of Colorado, and San Francisco State College--tested several aspects of the model in 1967 as part of an USOE study directed by Barson. The primary purpose of that study was "to influence educators at institutions of higher education toward employing certain proposed instructional development steps in the design of instruction and the implementation of newer media (p. 13).

The single flaw in Barson's Model, as reported by those who attempted to employ it, was that the steps of the model were not specific enough to enable them to use it effectively and efficiently. His study does not describe the steps in greater detail than shown on the flow-shart. Thus, the operational value of the model is limited.

The Hamreus Model.--Hamreus (1968) devised and graphically displayed an instructional system consisting of twenty-two steps or components (Figure A-2). The steps are divided into three distinct stages in the systems development model.

Stage I of the Hamreus Model is called systems definition and management. This step accommodates "those start-up or lead-in activities that must be planned and organized before the detailed tasks of designing and developing the actual instructional system can begin" (p. I-16). The second stage is termed design analysis. This stage defines the techniques necessary for specifying performance standards, materials specification, and design and operational constraints imposed by the educational industry. Stage III concerns development and assessment procedures. During this stage the prototype is empirically evaluated to determine the extent to which the system achieves its purpose. Corrective iteration of all aspects of development and evaluation is continued until the instructional technologist is satisfied with the performance of the new system. Finally, a feedback line indicates that

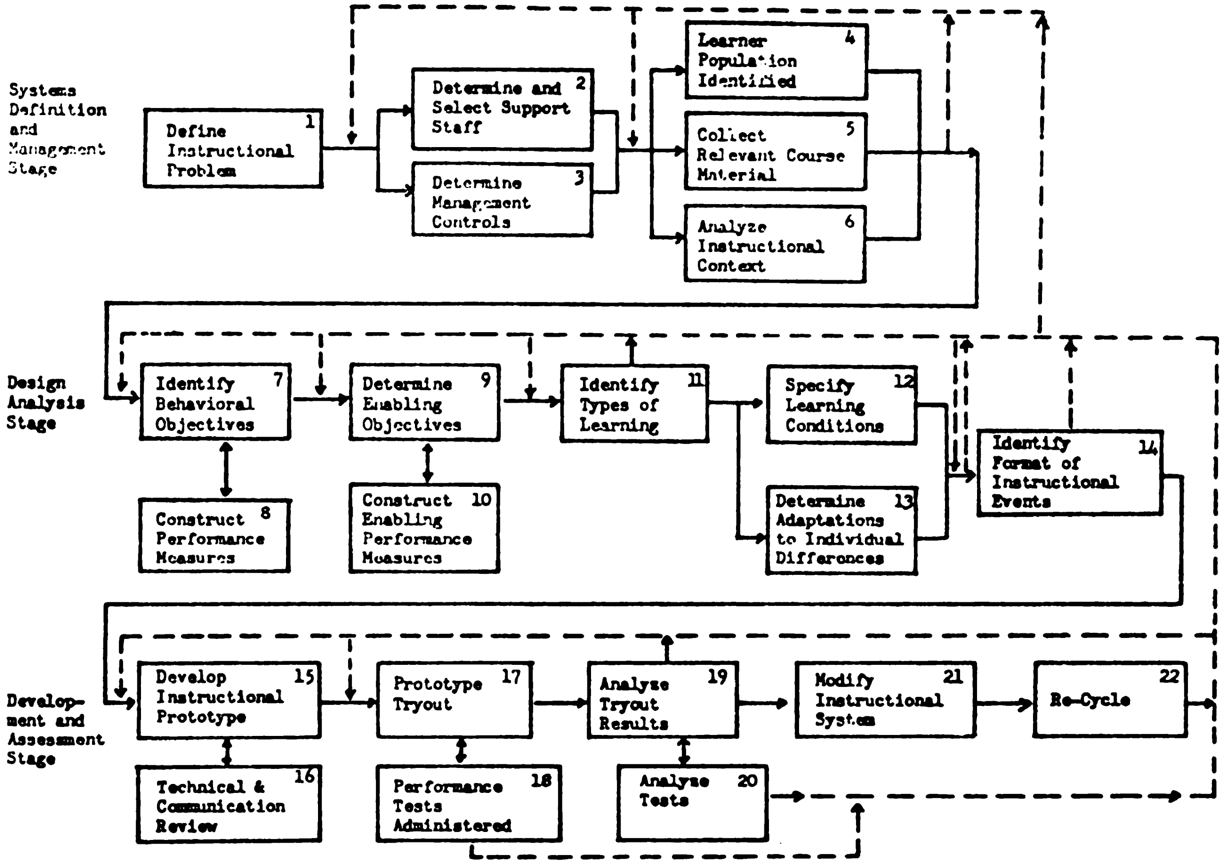


Figure A-2.--Hamreus Systems Development Model (Hamreus, 1968, p. I 20).

information gained in the development-assessment stage is important input into both Stages I and II as a means of providing some organized means of quality control (pp. I-16, I-17).

Within each of the major stages of the Hamreus Model are a number of precise steps which must be considered by the instructional developer using the model. They provide an interpretation of the tasks that need to be attended to within each of the stages. These tasks are illustrated in Figure A-2.

Hamreus' major contribution to model-building theory development may have been the identification of variables in the teaching/learning activities not previously considered, e.g., determine and select support staff, determine management controls, and technical and communications review.

He also is one of the first in the field to explain in detail the input information required for each step of the model (Hamreus, 1968, pp. I-19-I-42). Nonetheless, his explanations related to the steps are not comprehensive enough to be of maximum operational value. Unfortunately, the model also implies that instructional development is a linear process of sequential development activities which begin with defining the instructional problem and are followed, in the order shown on the model, by the other twenty-one steps.

The Kaufman Model.--Kaufman (1968) devised a mathematical model composed of six seemingly discrete but interrelated steps shown in Figure A-3.

Kaufman's model begins with identifying the instructional problem. In this context, "A problem is defined as the requirement to reduce or eliminate a discrepancy between what is and what is required to a specified level" (Kaufman, 1968, p. 416). The discrepancy between what is and what is required represents the need. To Kaufman, need assessments increase the possibility of identifying valid needs and thus relevant problems.

Thereupon, the designer(s) undertake an analysis of the problem and set goals (Step 2.0). Kaufman classifies the first steps together

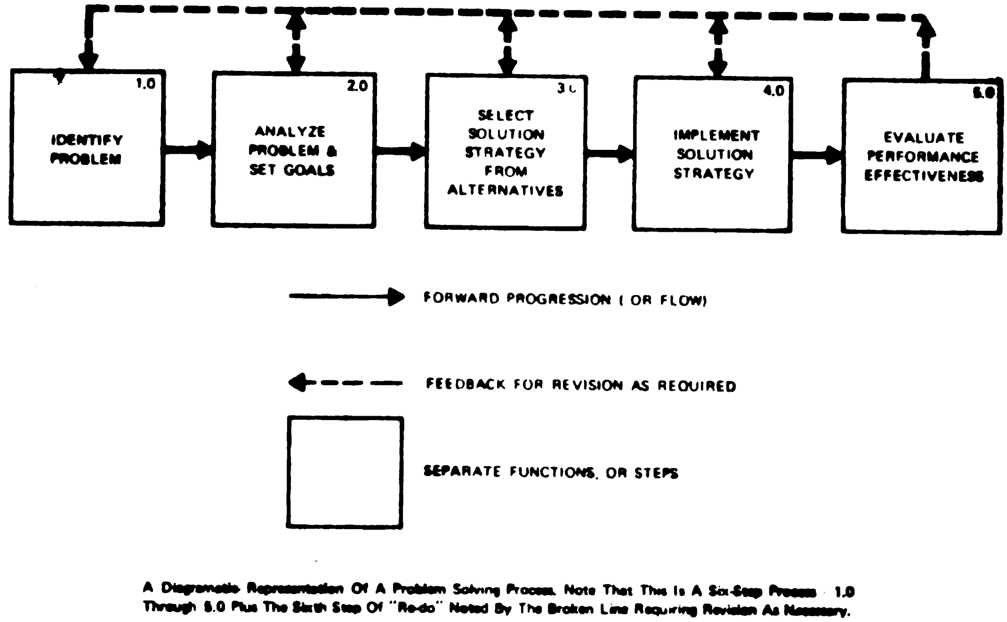


Figure A-3.--The Kaufman Model (1968), p. 417).

into a category he calls systems analysis. The systems analysis procedure includes a number of steps and their associate techniques. They include: mission analysis, functional analysis, task analysis, and method-means analysis as illustrated in Figure A-4.

Mission analysis is a determination of where we are going and how do we know when we have arrived. It includes the steps of identifying an overall mission objective and the specific measurable performance requirements for satisfactory completion of the mission. The mission is what has to be accomplished, or what is required (Kaufman, 1968, p. 420).

Functional analysis and task analysis are quite closely related to mission analysis and consists of breaking down all of the functions

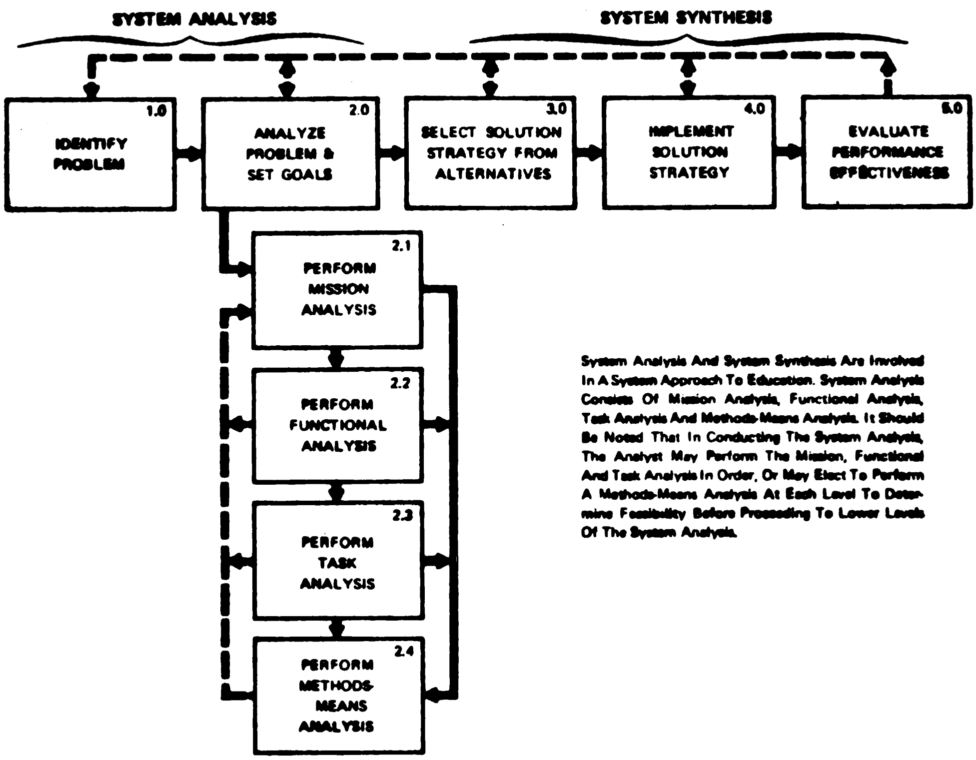
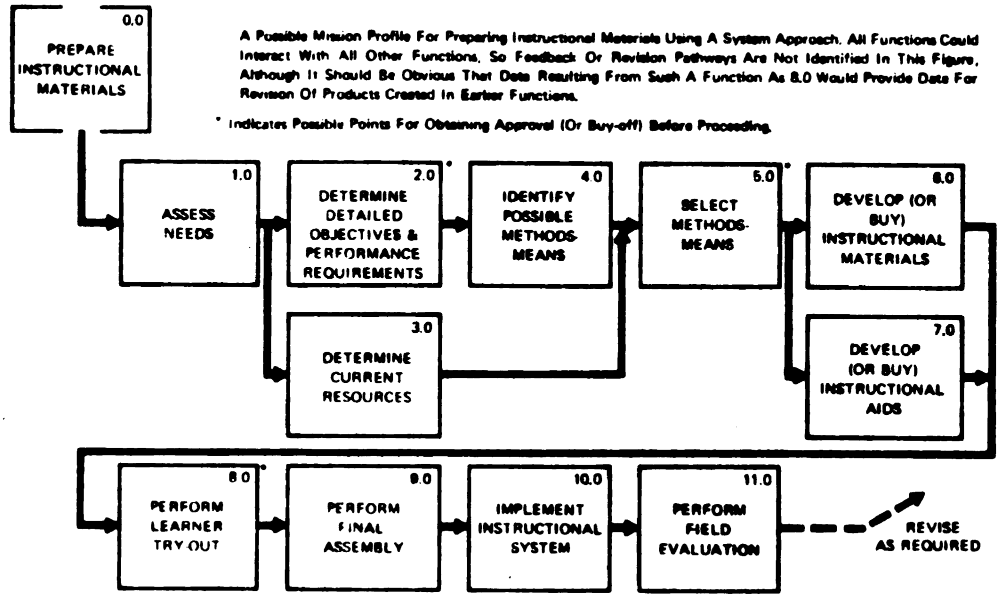


Figure A-4.--Kaufman Model Systems Analysis and Synthesis (p. 418).

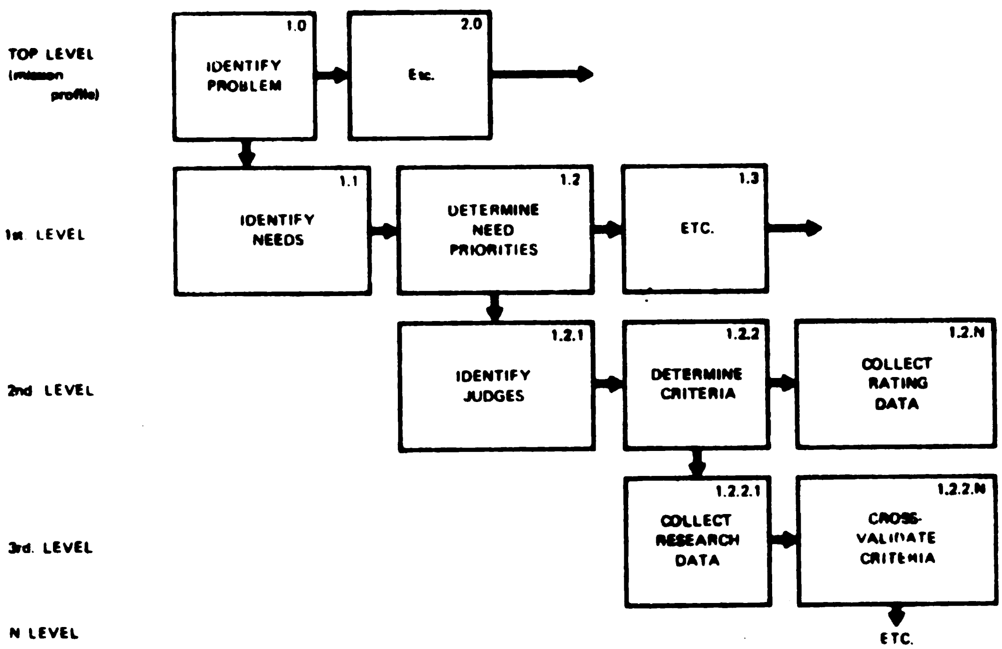
identified in the mission profile into constituent component functions as shown in Figure A-5. Kaufman states that the difference between mission analysis and functional analysis is a difference of degree rather than of kind (p. 422).

The remaining system analysis step in the Kaufman Model is called method-means analysis. The analysis identifies for each performance requirement or family of performance requirements (identified in mission, functional, and task analysis) possible strategies and vehicles for accomplishing the performance requirements. For each of the



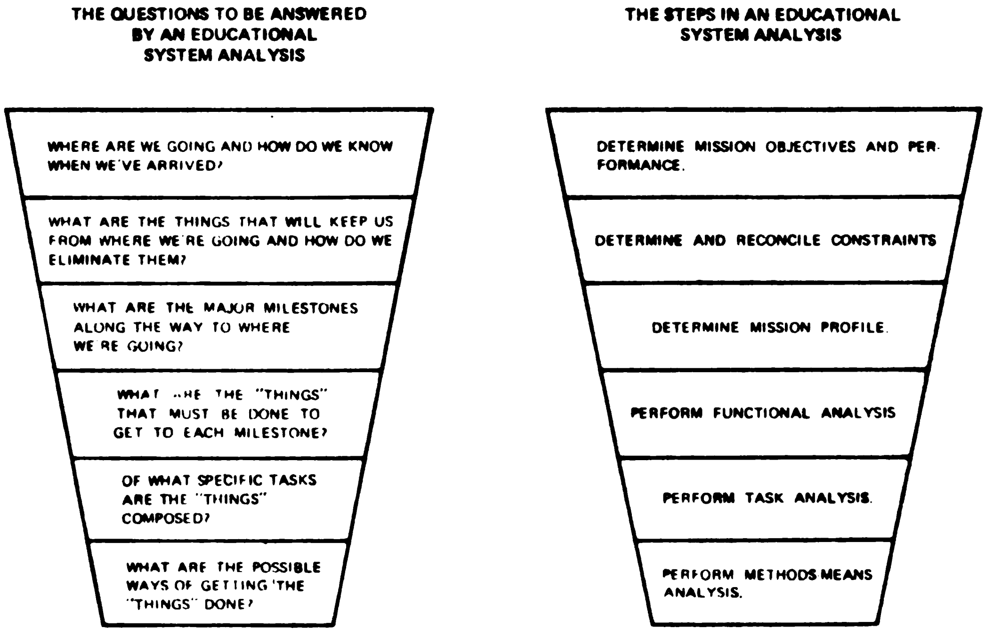
A Possible Mission Profile For Preparing Instructional Materials Using A System Approach. All Functions Could Interact With All Other Functions, So Feedback Or Revision Pathways Are Not Identified In This Figure, Although It Should Be Obvious That Data Resulting From Such A Function As 8.0 Would Provide Data For Revision Of Products Created In Earlier Functions.

* Indicates Possible Points For Obtaining Approval (Or Buy-off) Before Proceeding.



An Example Of A Hypothetical FUNCTIONAL ANALYSIS Showing The Manner In Which Any Function May Be Analyzed Into Lower Level Constituent Functions.

Figure A-5 (cont'd)



The Questions To Be Answered In A System Analysis And Their Relation To The Steps Of Performing A System Analysis.

Figure A-5.--Kaufman Model Functional and Systems Analysis (1968, p. 4).

method-means identified, the advantages and disadvantages of each are listed (Kaufman, p. 422).

Finally, the sixth step, although not formally represented on the model, is called by Kaufman the "re-do" step and is noted by the broken line requiring revisions as necessary.

Although the Kaufman Model contributed some significant new model-building concepts, it too lacks operational value. The flowchart steps are general and the narrative description of what to do and how to execute each of the steps of the model is incomplete. Furthermore, the model seemingly depicts the process as being linear.

The Childs Model.--Childs (1968) assesses his model as a specific set of procedures for the planning of instruction. In Figure A-6, the sequential, detailed set of procedures which must be attended to by the developer are displayed.

Once the broad general instructional goals are identified and specified by psychologists, teachers, administrators and society, the next step in the model requires the specification, by school committees of subject matter specialists, of a learner's observable performance behavior(s). The specification of these behavioral objectives must include: (1) a statement of conditions under which the performance will be observed, and (2) a statement of the level of performance or criterion of performance.

The reason for submitting the specifications developed by the subject matter committees to programmers and materials evaluators is "to relieve the classroom teacher of the mundane and routine task of searching out or developing new materials with which to implement the objectives" (Childs, 1968, p. 9). It is at this point that the instructional team which might consist of: (1) a psychologist, (2) a research analyst, (3) a curriculum specialist, and (4) a media specialist enter the design process. In Child's Model, the programmer and evaluators of materials must make initial judgments based on experience, knowledge, and learning research about the feasibility of mediating the learning leading to the specific objectives. What follows is a go or no-go decision concerning the attempt to conduct the instruction in a mediated form. As Child states:

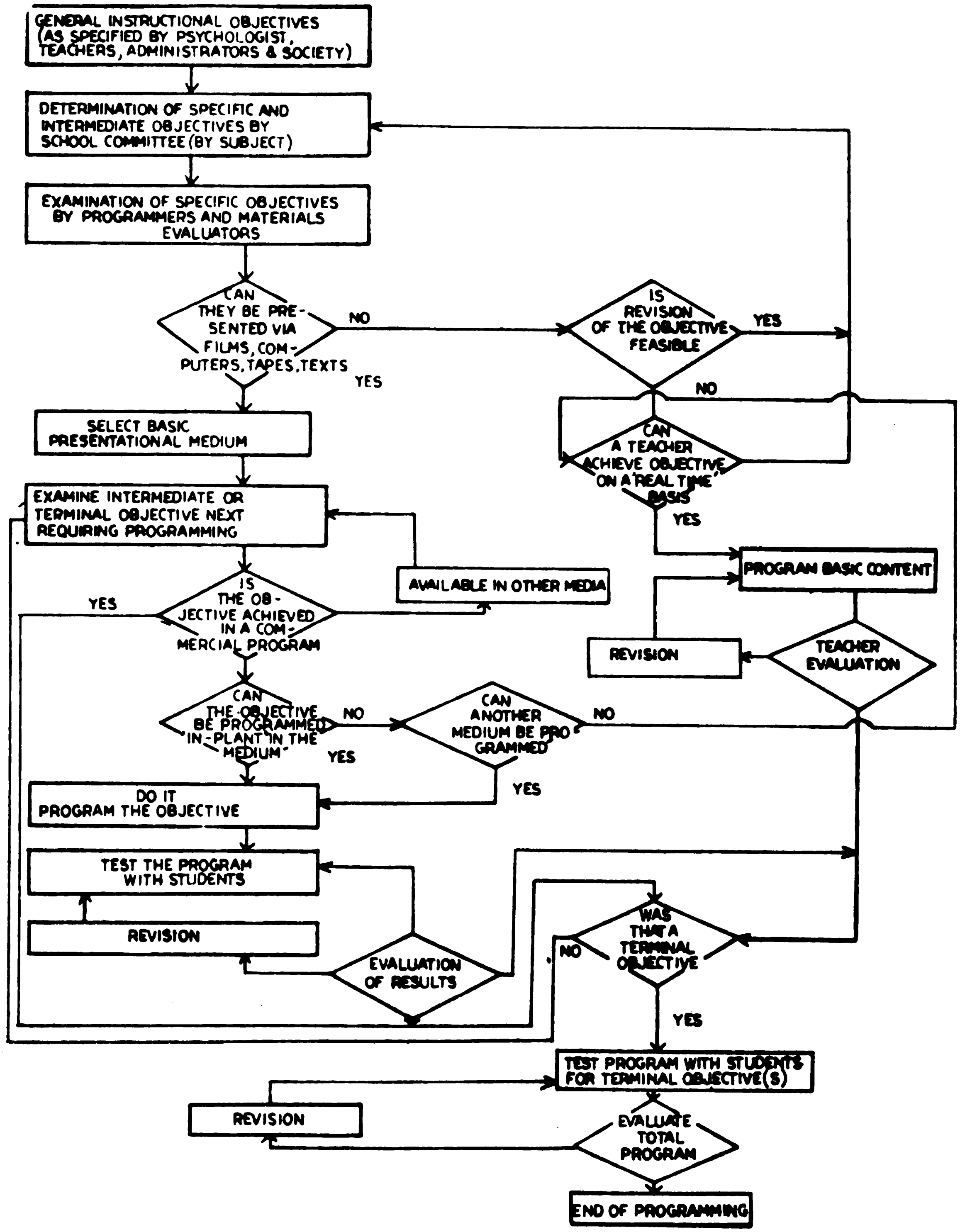


Figure A-6.--Childs Model (1968, p. 8).

> A negative decision at this point will lead to a sequence on the model calling for examination of the objective for possible revision. If a positive decision is reached at this point, then a sequence of development activity follows that selects or produces mediated forms of instruction (p. 14).

It is evident that the Child Model aims at flowcharting procedures that must be considered prior to making decisions relative to media support for the system under development. It states that a negative decision concerning the attempt to conduct the instruction in a mediated form will result in a recycling of the process back to Step 2 for re-examination of the specific objective(s). The other alternative is to consider whether the teacher can achieve the objective on a "real-time" basis. What is meant by real-time is not explained.

Although Child's Model specifies more exact steps and decision points than the earlier models, its main weakness from the standpoint of being an operational model is that the process represented by the flowchart components is not adequately described by the author. For example, "How are the specific objectives and the enabling objectives to be written?" or "How does the team evaluate the program?" Nonetheless, the model is more operational than the preceding models reviewed earlier.

However, two bothersome features of the model are: (1) the implication that once the teacher committee of subject matter experts specify the specific and intermediate objectives, their role as a functional member of the design team is completed while other members of the team, i.e., the instructional specialists, continue to develop the instruction, and (2) like so many other models, the model implies that instructional development is a linear process.

The Banathy Model.--Banathy (1968) views his instructional learning model as a decision-making operation in which decisions have to be made about what should be learned, how, by whom, when, where; how learning should be evaluated and improved, and what resources should be involved in preparing for, providing for, and evaluating learning. This structure provides for orderly development and change of the system using the steps diagrammed in Figure A-7.

In specific terms, the model requires precise attention to the following elements in the system: (1) formulation of a statement that spells out what the learner is expected to do, know, and feel as a result of his learning experiences; (2) development and use of a criterion test based on the objectives, and usage of it to test terminal proficiency; (3) analysis of the learning task to find out what has to be learned by the learner so that he can behave the way described in the objectives specifications; (4) functional analysis to consider alternatives and identify what has to be done to insure that the learner will master the tasks; component analysis to determine who or what has the best potential to accomplish these functions; design of the system by deciding when and where the functions are to be carried out; implementation and test output on the basis of learner performance on the objectives (Banathy, 1968, p. 30).

Banathy's Model is not operationally strong as a flowchart procedure for the design of an instructional system. The flowchart steps are too general to be utilized without a detailed description explaining the functional requirements of the components. It also suggests a linear

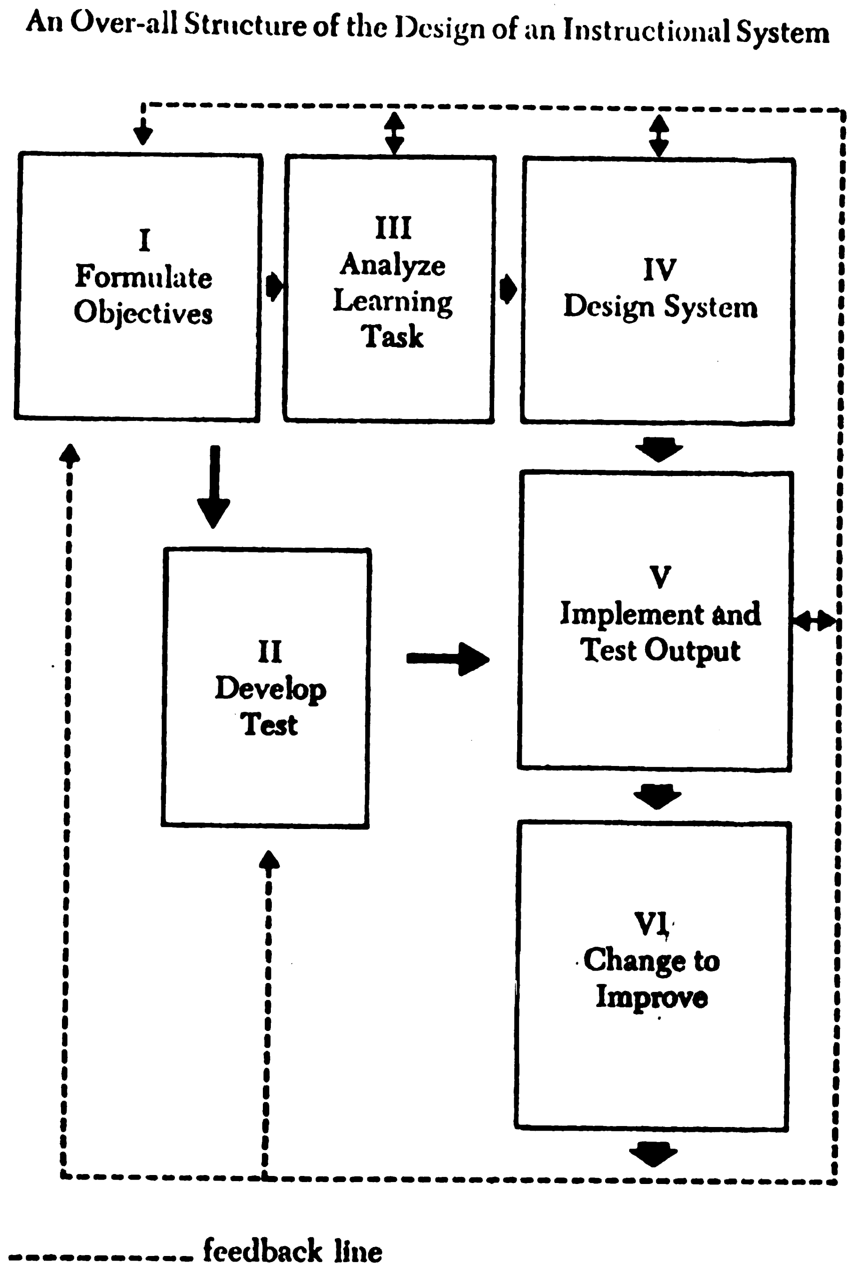


Figure A-7.--The Banathy Model (1968, p. 28).

approach to instructional development and does not contribute any significantly new concepts to model-building theory. One seemingly positive aspect of the Banathy Model is the feedback loop which feeds back and forth from one step to the next in a kind of continuous and unbroken loop. The feedback system emphasizes the importance of output information at each step in the recycling process.

The Stowe Model.--Stowe (1968) edited a graphic model to show the process in course development. This model was developed as part of an Instructional Development Institute at Indiana University 1967-1968 (p. 1).

The process of instructional development devised in the Indiana institute was based on four activities necessary for adequate teaching. These steps are illustrated in Figure A-8. These are: (1) analyze the learner to determine his needs, his prior knowledge, and his unique characteristics; (2) analyze the learning to determine what it is the learner should be able to do in terms of observable skill or ability as a result of the instruction; (3) establish standards and measuring achievement by first, deciding what behavior is desired and secondly, designing a situation to cause the student to display that behavior, demonstrating the degree to which learning has taken place, and (4) structure the learning environment by minimizing irrelevant or distracting stimuli and maximizing those which help to convey the instruction, including those in the physical environment of the student, whether it be a lecture hall, a classroom, a laboratory or in the field (Stowe, 1968, pp. 1-2).

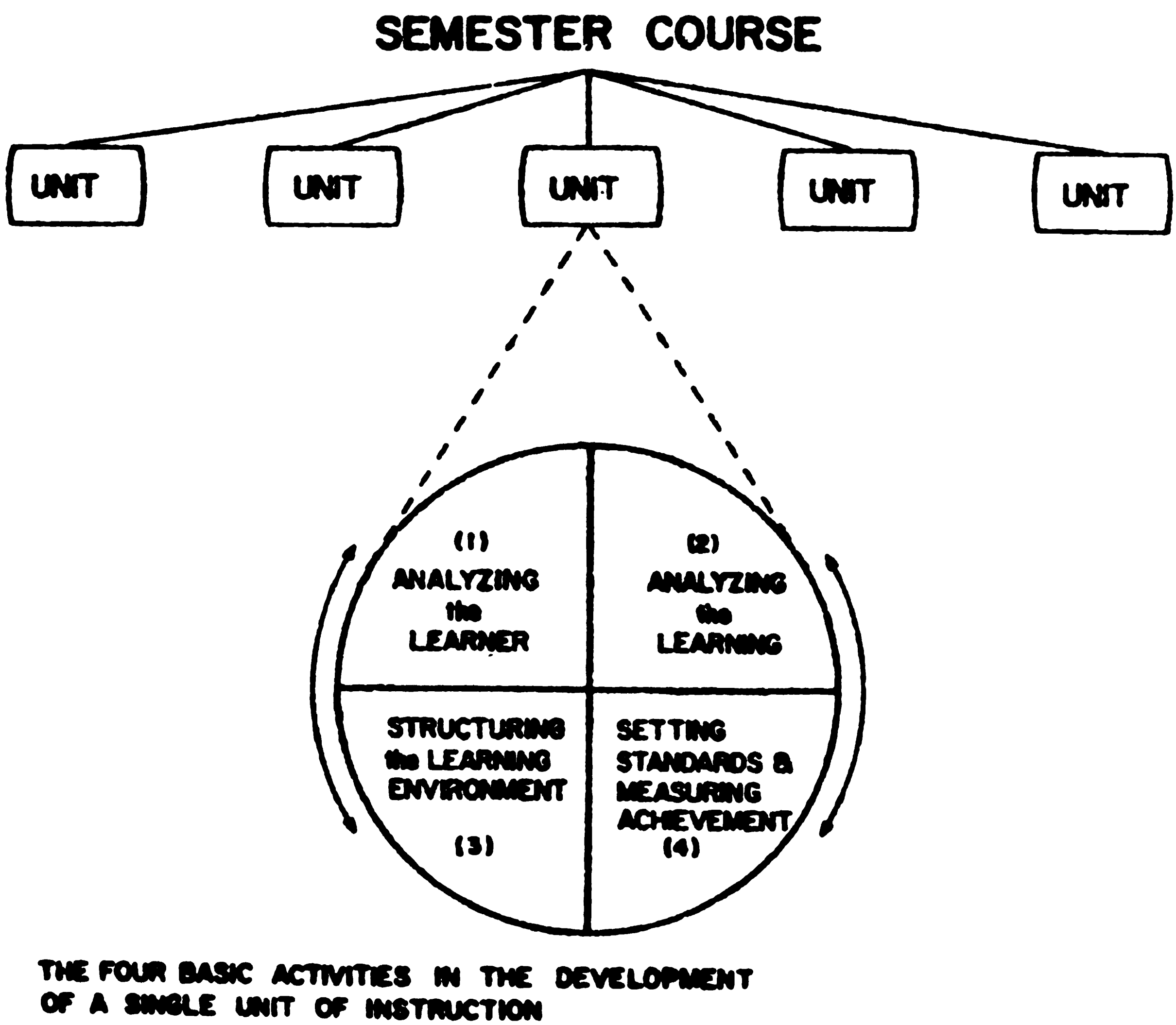


Figure A-8.--The Stowe-Indiana Model (1968, p. 5)

A more detailed analysis of the activities engaged in during the development of a single unit is represented in the twenty sequential blocks of the paradigm in Figure A-9. A close examination of the blocks reveals that all but one (Block 1) coincide with the four basic

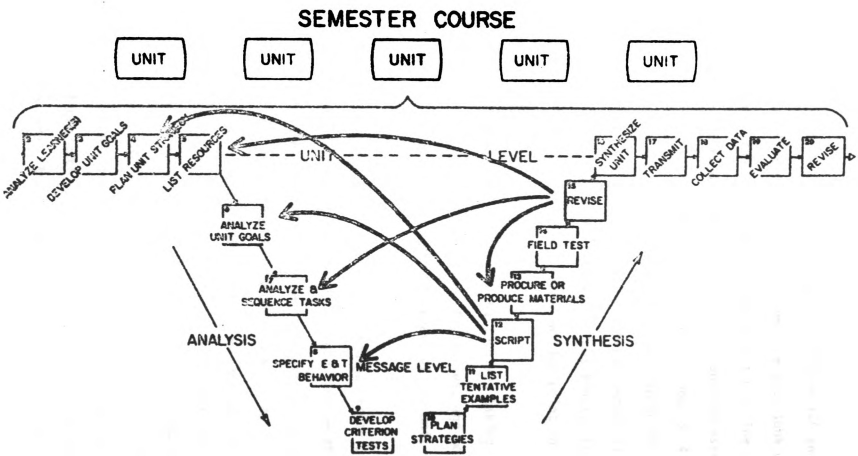


Figure A-9.--The Stowe-Indiana Model (1968, p. 5).

activities described above (Stowe, 1968, p. 2). Blocks 1-5 and 6-10 are pictured on a "unit level", indicating that the decisions represented by these blocks concern one whole unit at a time. The remaining blocks (6-15) are pictured at the "message level", and represent decisions which concern only parts of that unit (Stowe, 1968, p. 4).

The arrows in Figure A-9 denote what the experimenter believes is an essential feature of the process, the "loop back," which allows the instructor to return from any block to any previous block. For example, Block 15 and 20 call for a loop back to some earlier point in the model (Stowe, 1968, p. 4).

Block 5 deals with listing resources and involves taking mental inventory of all resources--manpower, time, facilities, and money--which might be used to increase the effectiveness of the unit of instruction (Stowe, 1968, p. 4).

Block 8 reads in full "Specify Entry and Terminal Behavior." Entry behavior refers to the acts which the learner must be able to perform before entering the unit while terminal behavior is the behavior to be performed subsequent to instruction (Stowe, 1968, p. 4).

According to Stowe, field testing, as represented by Block 14, should occur even when the materials are in their crudest form. This involves the testing of materials with a small sample of the intended student population. Trial with just one student can reveal strengths and weaknesses of the material and suggest certain procedures that would otherwise go unnoticed until a large investment of time and other resources had been made. Thus, when the instructor moves to revision

(Block 15), a "closed loop" is formed in the development process--analysis to synthesis to testing to revision and back to analysis to . . . etc. When the materials prove their ability to bring students up to the specified performance level, they may be synthesized into the unit. The instructor can then proceed to Block 16 for unit synthesis (p. 4).

Block 17 refers to the actual use of the unit with the intended student audiences. As subsequent blocks suggest, the process does not end with transmission; there is still the obligation to measure and evaluate the students' performances and make necessary revisions (Stowe, 1968, p. 4).

Stowe's Indiana University Model appears to be more than adequate for specifying what to do but less than adequate in detailing how to actually execute the functions of the process. Also, it, unlike earlier models reported, depicts the process as one performed by the instructor alone rather than by a team of specialists working with the instructor.

IDI Model.--Hamreus' Model was condensed to nine steps by the National Special Media Institute (Syracuse University, Michigan State University, University of Southern California, and Teaching Research Division of the Oregon State Department of Education) and became identified as the IDI Model (1970). This model is used with the Instructional Development Institute (IDI) program which is designed "to train teachers, administrators, policymakers, and specialists to apply instructional systems development principles to learning and teaching problems" (p. 1).

The purpose of the IDI program is to assist school systems with limited resources (substantial numbers of academically or culturally-deprived students), and a desire to find innovative and effective solutions to consequent learning and instructional problems (p. 1).

The program consisted of approximately forty-hours of instruction involving the participants in the instructional system from the definition through development and evaluation stages of the model in Figure A-10. At the close of the Institutes, the participant teams take a specific instructional problem and develop their own validation plans to teach specific student behavior based on what they learn about the instructional development system under the guidance of the staff (p. 1).

The IDI Model represents a forward step in the development of a self-explanatory operational flowchart model. However, its main weakness may be that it implies that the process is linear and that each of the steps must be followed in sequence. The model also fails to specify the how of instructional development in the various functions represented by the components.

<u>The Briggs Model</u>.--Briggs (1970) designed a ten-step flowchart model intended to be used for the design of instruction (Figure A-11). Unlike the model reviewed previously Briggs' Model indicates that the most logical starting point for the design of instruction is stating objectives and performance standards. The methods, media, and materials are then selected and designed to meet these objectives (p. 1).

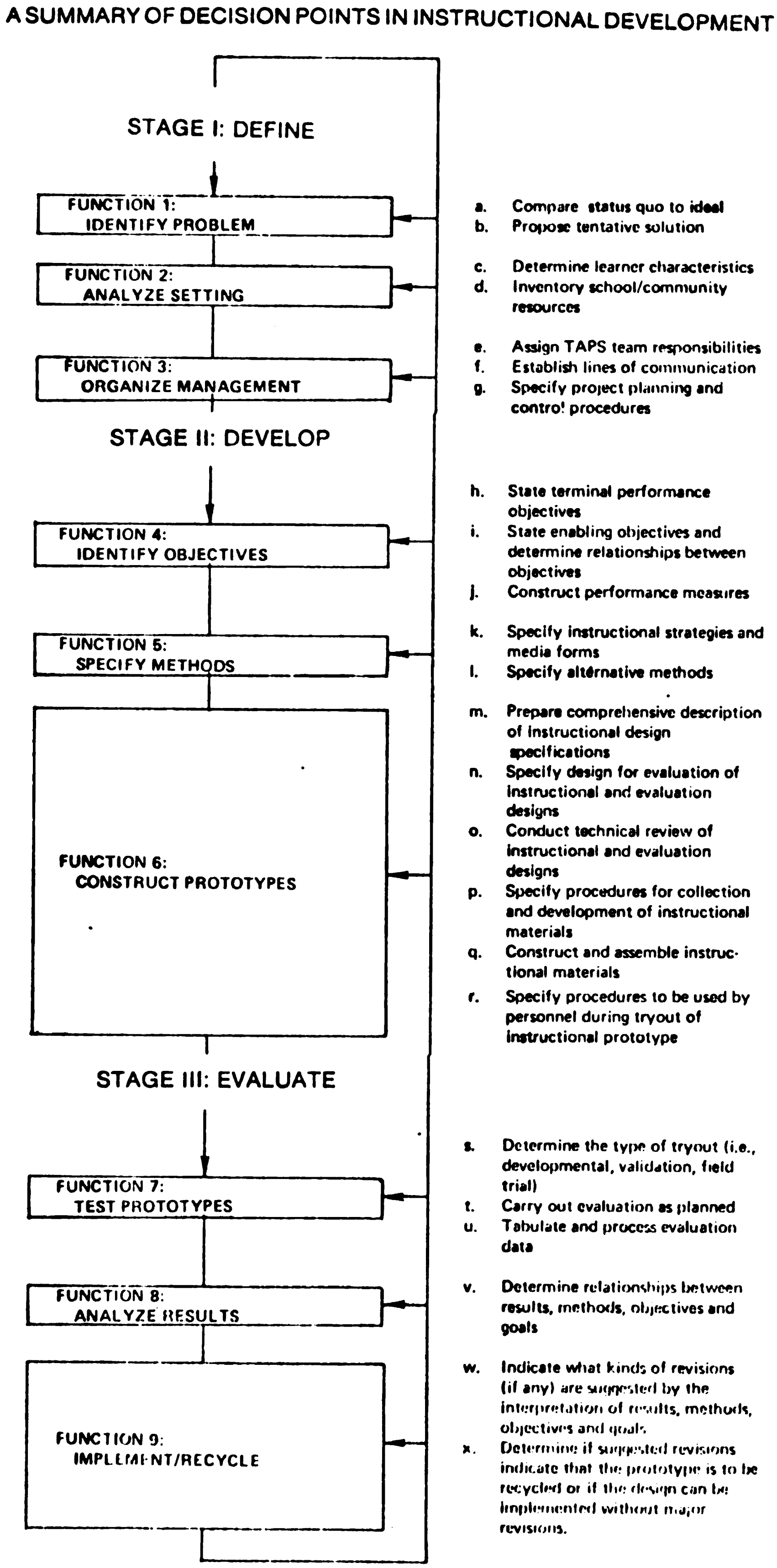


Figure A-10.--IDI Model (1970, pp. 11-12).

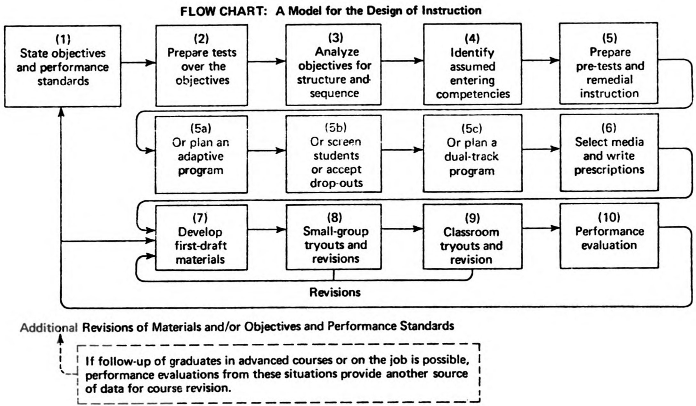


Figure A-11.--Briggs Design of Instruction Model (1970, p. 7).

To Briggs, a formally correct, or behavioral, objective means one written to meet the criteria for behavioral objectives identified by Mager (1962). Mager's three formal criteria are: (a) Given what, the; (b) Student does what and; (c) How well (p. 19). Briggs also identified seven specific sources which must be considered by the instructional developer when selecting objectives. They are: (1) local demands by potential employers who may specify what kinds of skills they can use in their operations; (2) professional societies in various academic disciplines who, through committees, develop specifications concerning what should be taught in specific subject areas; (3) curriculum-development projects which often take the initiative in changing from old to new content; (4) teaching research in the subject area; (5) students who can provide input regarding the relevance of instructional goals; (6) traditional course content, and (7) policy research centers which are designed to predict new skill patterns adults will need twenty to thirty years hence to operate competently in the changing society (pp. 31-33).

The second step of the Briggs model requires the preparation of valid tests over the objectives. Briggs believes that a test is valid if it measures what it is supposed to measure, or if it measures the objective for which it is intended (p. 48).

In reference to the third stage of his model, Briggs identifies three steps in analyzing the structure of the objective.

First, identify subordinate competencies for an objective by asking "What would the learner have to be able to do or to know before he can perform his entire objective, given only instructions as to what he is to do on a test over the objective?" (p. 74). Secondly, identify types of learning as defined by Gagne's Eight Types of Learning (See Briggs, pp. 82-84). The third step is to number boxes for teaching sequences. To do this, you simply start at the bottom and number them in order in which they are to be taught (p. 80). Step 4 requires the designer to identify the learning experiences or skills the student must have already mastered before he will be able to achieve the course objectives. The last step of the design stage (Step 5) for the Briggs Model is to state a plan for dealing with learners who lack the entering competencies. Once these learners are identified using pre-tests, remedial action as well as the three alternatives indicated in Steps 5a, 5b, and 5c of the model can be used to meet the needs of these learners.

In deciding how to produce the desired event, the designer, according to Briggs, must think of the kind of stimulus necessary to produce it: natural objects; spoken words; printed words; theoretical objects or processes described or represented symbolically or in animation; processes (objects in motion); social stimuli (group interaction); etc. Then select a medium (Step 6) which has the right characteristics for presenting the desired kind of stimuli (p. 98).

Briggs defines prescriptions as "directions on how the materials are to be developed for each continuous use of the media chosen" (p. 129). Such precriptions include directions to the film maker or other specialist who is to prepare first-draft materials. They specify the content, as well as the programming techniques to be employed in the way the content is to be prepared. For example, the designer may prescribe "dissolves" for a film (p. 129). For anyone interested in examining this technique in depth, there is a completed example of a media analysis on p. 137 of Briggs.

Step 7 in the Briggs model is the first step in the development phase of instructional design. Here, the designer develops the prescriptions into draft materials, using as much creativity and ingenuity as possible in developing the content for each instructional item. Particular importance is placed on presenting content, posing questions and problems, evoking responses, and providing feedback to the learner and formative evaluation data to the instructor on where a learner has trouble and what the trouble is (p. 164). Briggs offers a list of thirteen suggestions which may be helpful in preparing first-draft materials (pp. 164-165).

Steps 8, 9, and 10 of the Briggs paradigm shows the formative evaluation stage of the development phase. Formative evaluation refers to the practice of conducting try-outs of draft materials with individuals and groups of learners, followed by evaluation tests, to provide an empirical assessment of materials and to identify needed revisions. It also requires the use of performance tests (empirical data) for making decisions long before the draft materials are ready for try-out. The model uses a feedback loop to connect input data for Stepa 8, 9, and 10 for redevelopment of materials, if needed. If the results of the performance tests are below expectations, the Briggs Model assumes that the designer will "loop" back either to Step 7 where he might reexamine the first-draft materials or loop all the way back to Step 1 to reconsider the objectives in light of the performance results and proceed, if necessary, to go through the whole instructional sequence again.

In conclusion, Briggs suggests that input as a result of data from graduate students, in advanced courses or on the job as possible sources of data for course revisions during the development stage.

The main strength of the Briggs Model is the thorough and comprehensive narrative description given to explain the input requirements of each step, stage, or phase of the flowchart model. No other instructional model seems to describe the process as completely as Briggs does in his model. If it has a weakness, it may be that it is not a practical operational model for a developer to use with the expectation of easily diffusing the process to others. The lengthy narrative description (some 200 pages) tends to be overwhelming to professional developers, thus discouraging widespread adoption of the model by design or subject matter specialists. Like so many other models, it too implies a linear process.

The Gustafson Model.--Gustafson (1971) proposed a variation, as shown in Figure A-12, of the IDI Model. The basic difference lies with the emphasis it attempts to place on the fact that the instructional development process is a dynamic, non-linear process which may not necessarily begin with the definition of the problem or the specification of behavioral objectives (pp. 2-6). He summarizes the philosophy behind the model as follows:

> First, there is no beginning or end (or at least there shouldn't be). To commence ID activities should not suggest the beginning of the system, for at least part of it predates the developer's initial effort. Further ID should not have an end since whatever is developed must be continuously reexamined to determine its efficiency, effectiveness and relevance. Another

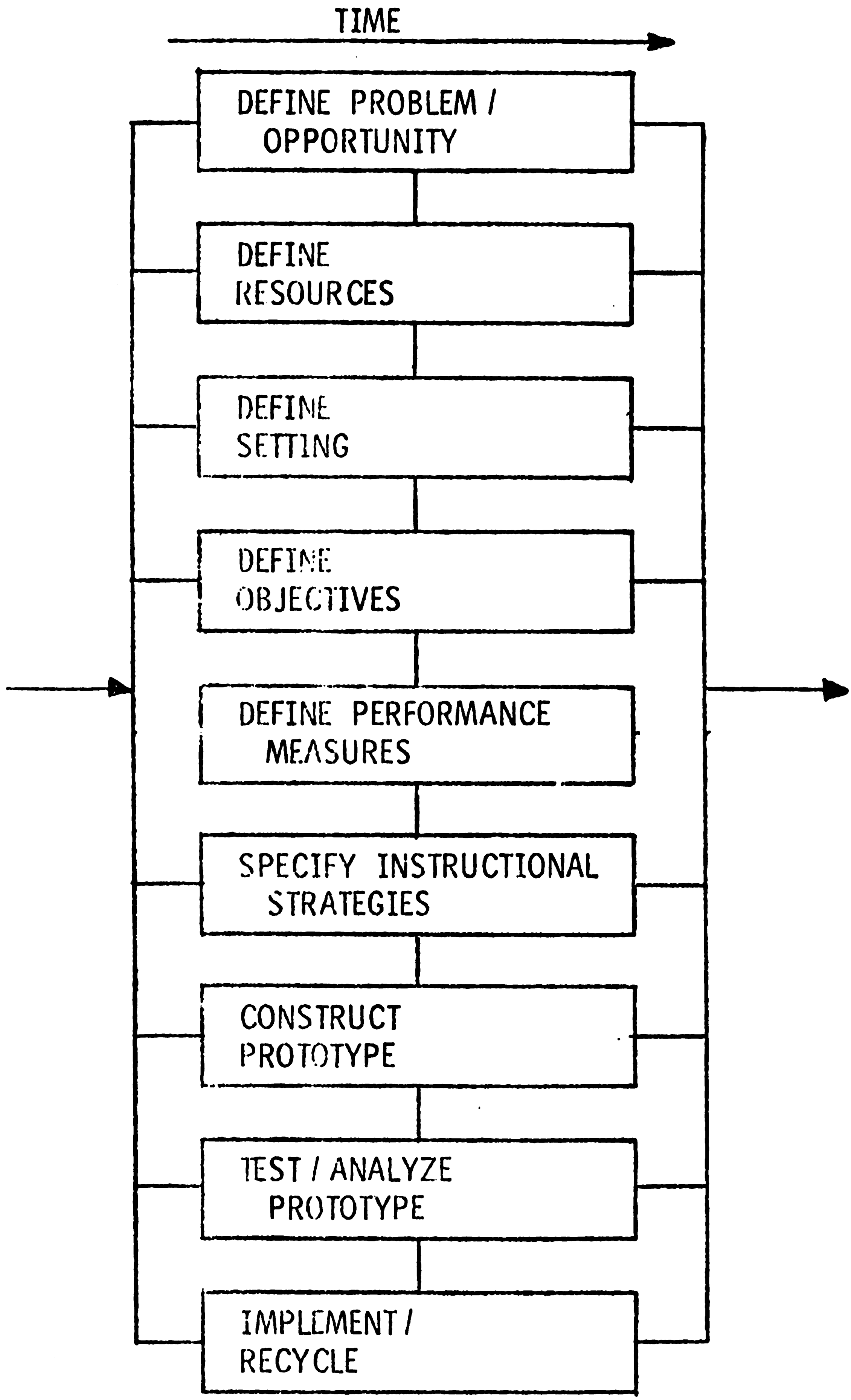


Figure A-12.--An ID Model, K. Gustafson, Michigan State University, 1971.

> systems attribute is the interdependence of the elements of the system. Anyone who attempts ID rapidly finds out that individual elements cannot be singled out for individual attention since their explication depends on information, decisions and consequences occurring within other elements. (Pp. 2-3)

Gustafson isolates, in all, four significant attributes of instructional development: (1) time; (2) interdependence of the elements of the system; (3) information flow between elements, and (4) information flow among elements of the process. In regard to the time factor, he describes the ID process as time-consuming and cites Bachrach's Law "that things take longer than they do" to illustrate the patience required while engaging in the process (pp. 2-3).

Of critical importance to Gustafson is the cybernetic concept of feedback as a means of accommodating information transfer from one element to another. He states that "information must flow in both directions between elements and often among elements simultaneously" (Gustafson, 1971, p. 4). In his opinion there is no more important element to consider when planning an ID project than designing, maintaining and redesigning the information transfer network within the system and with its external interfaces.

This model stresses the importance of human factors in assuring the success of an instructional development effort. Gustafson believes that "without doubt the most important element of the ID system is people . . . to engage in ID is to change people" (p. 6). Ignoring the people one serves during instructional development frequently will result in what he calls "ID casualties" in that they are proud of the product(s) developed but do not wish to go through the ID process again. This is the obvious danger of ignoring the human factor.

The instructional development functions in the Gustafson Model are very similar to the functions of the IDI Model described earlier in the study. Therefore, Gustafson's main contribution to model-building theory would appear to be his emphasis on the human factors in instructional development and the non-linearity depictation and description of the process.

The Gerlach-Ely Model.--This model (1971) attempts to graphically portray an instructional which Gerlach and Ely say is "a guideline--a road map--and should be used as a checklist in planning for teaching" (p. 12). They go on to note that "it shows the major components of the total teaching-learning system, even though it does not portray the fine details of each component" (p. 12). However, it does show the relationship of one element to another, and offers a sequential pattern which can be followed in developing a plan for teaching.

The interesting feature of this model (Figure A-13) is the fact that the content and the objectives are specified or identified before any serious consideration is given to the entry skills possessed by those who are the recipients of the instruction. At this stage the critical factor is the development of behavioral objectives for the content matter which can be precisely measured in terms of student performance upon completion of instruction. Once the instructional designer has attended to these prerequisites he gives consideration to his target audience. The teacher needs to know what each student brings to the course as it begins. Gerlach and Ely contend that "Unless the teacher knows the extent and sophistication of what the students know he must plan his course for an

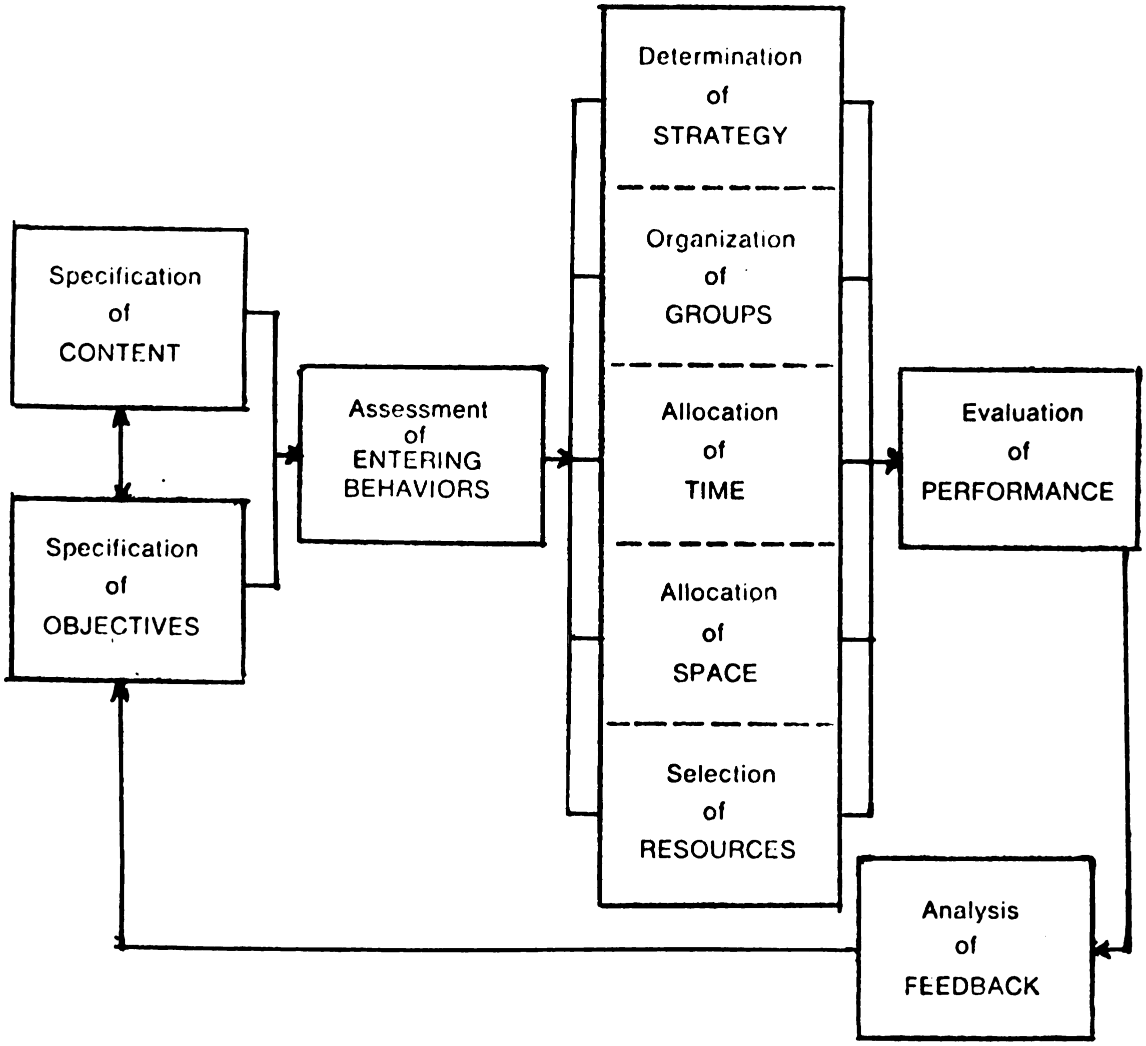


Figure A-13.--A Systematic Approach to Instruction (Gerlach and Ely, 1971, p. 13).

average student" (Gerlach and Ely, 1971, p. 14). Two sources for assessing the entry level of students are cited: (1) use of available records, and (2) teacher-designed pre-tests.

Insofar as the available records are concerned the student's cumulative record will probably include the results of several standardized tests which he has taken. These tests, according to Gerlach and Ely, would reveal valuable information about the student's level of intelligence, his personality traits, and his potential (p. 15). Course grades also indicate potential as revealed by his performance in courses during his school career. A properly designed teacher pretest considers: (1) the student's achievement in the subject to be pursued, and (2) the student's ability to define basic terms in the subject area. It also serves as a checklist on previous learning and is aimed at the fundamental question which must be answered prior to formal instruction: "To what extent has the student learned the terms, concepts and skills which are part of the course?" (Gerlach and Ely, 1971, p. 15).

The next step is to determine the instructional strategy, or method, for using information, selecting resources, and defining the role of students. Two methods are suggested at this point. The first, exposition, the more traditional approach, is one in which the teacher presents information to the student, using such vehicles as lectures, discussions, textbooks, audio-visual materials, student reports, and the teacher's personal experience to present the course information. The second approach is classified as inquiry. Using inquiry the teacher "assumes the role of the facilitator of learning experiences and arranges conditions in such a manner that students raise questions about a topic or event" (Gerlach and Ely, 1971, p. 15). The teacher's role is essentially one of helping the student to be active participants in developing hypotheses which can later be tested by use of additional data. Technique refers to the procedures and practices used to accomplish teaching objectives, regardless of approach. Examples of techniques are lecture, discussion, audiovisual presentations, and verbal and written reports prepared by students (Gerlach and Ely, 1971, p. 17).

The next logical step in the Gerlach-Ely Model is to organize the students into groups for purposes of effective and efficient instruction. To accomplish this, three basic questions must be answered: (1) which objectives can be reached by the learner on his own?; (2) which objectives can be achieved through interaction among the learners themselves, and (3) which objectives can be achieved through formal presentation by the teacher and through interaction between the learner and the teacher? (Gerlach and Ely, 1971, p. 17).

The plan for allocating time for the instruction will usually vary according to the subject matter, defined objectives, space available, administrative patterns, and the abilities and interests of the students. However, the teaching plan must take into account the estimated time for completing each event in the teaching strategies and techniques.

The allocation of learning spaces is also based on learning objectives and the same three basic questions which must be answered in regard to organizing students into groups. Gerlach and Ely identify four formats of learning spaces. They are: (1) the traditional classroom equipped with thirty to forty student desks, arranged in rows with a teacher's desk at the front of the room as the focal point, and built-in teaching tools such as a chalkboard and a bulletin board; (2) large-group spaces to accommodate groups of various sizes from 60 to 300 depending upon the subject matter and the grade level; (3) small group spaces with movable walls which permit the conversion of standard classrooms into several small spaces in a minimum of time, and (4) independent study spaces equipped with audio and visual for individual rather than group instruction.

The final step in the Gerlach-Ely paradigm before undertaking an evaluation of the instructional program to determine its effectiveness is the selection of resources. These resources can be classified into five general categories: (1) real materials and people; (2) visual materials for projection; (3) audio materials; (4) printed materials, and (5) display materials.

Evaluation of performance is one of the last elements of the model, but it should be one of the first concerns of a teacher. Some objectives are simple to evaluate. If they are cognitive, observable, and measurable, there is no difficulty. The real difficulty comes in measuring objectives which are much more complex and fall essentially in the effective domain of learning experiences. However, there are at least two dimensions to evaluation assessments. Gerlach and Ely quote Glaser (1965) who points out:

> One is to provide information about a student's present behavior; measurement for this purpose is primarily designed to discriminate between individuals. The second use is to provide information about the instructional techniques which produced that behavior; measurement for this purpose is designed to discriminate between instructional methods (pp. 27-28).

The terminal step before recycling, if necessary, is to analyze feedback from the students. This analysis may vary in sophistication from simple observing the student's physical reactions to information presented to a formal feedback analysis from measuring instruments designed to measure whether or not the objective(s) was indeed achieved. In discussing the value of feedback Gerlach and Ely state:

> It is important for feedback to occur as soon as possible after a response has been made. Not only is the feedback to the teacher valuable, but the teacher's feedback to the pupils is supporting. If the student's response is correct, the teacher should confirm it. Research indicated clearly that such practice facilitates learning. Delay in feedback decreases its effect. . . . The student knows immediately whether his response is correct. . . . He does not have to wait for his paper to be corrected. The feedback is almost instantaneous (p. 30).

Finally, after analyzing the feedback, the Gerlach-Ely model brings the instructional developer back to the specification of objectives stage for a reexamination of the original objectives and possibly even the content of the course.

The limitations of the Gerlach-Ely model are: (1) it relies too heavily on a narrative description to explain the functions of the skeletal graphic model; (2) it implies linearity in the process, and (3) it is not designed with the view that a team of developers would be assisting the teacher during development.

The Douglas Model.--Douglas (1971) describes his model as "an operational plan for Instructional Development within a given institution" (p. 46). Specifically, the model (Figure A-14) was developed for use with staff at Burlington County College in Pemberton, New Jersey. Like so many other models, it is comprised of three phases or parts.

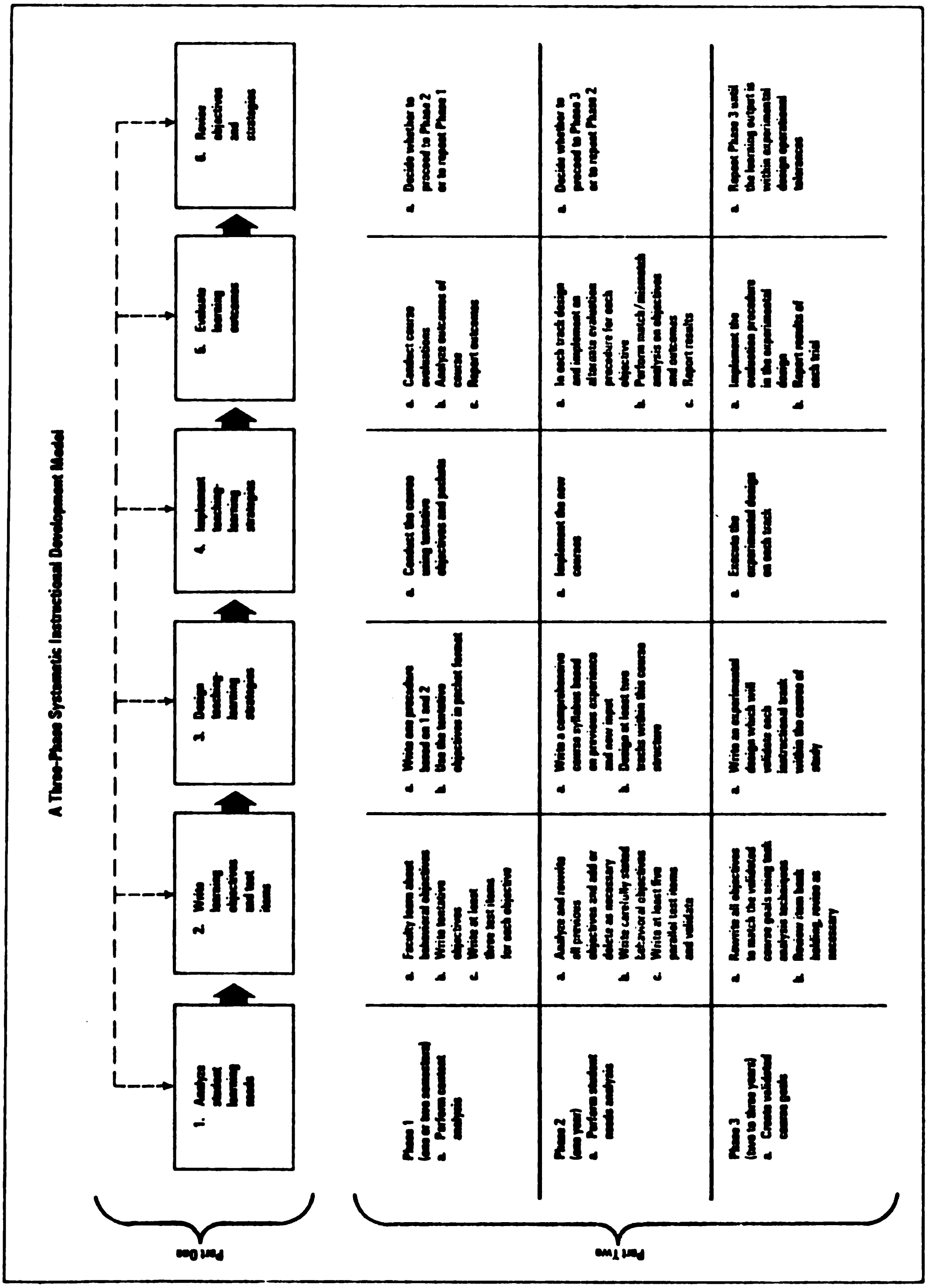


Figure A-14.--The Douglas Instructional Development Model (1971).

Part I is concerned with the functional level analysis of what a teacher should do when offering a course of study to his students. It starts with an analysis of student needs, dealing with such factors as: (1) is the content relevant for the student, (2) are societal needs being met by the course, and (3) content requirements (p. 48). The key design element is represented in writing measurable learning objectives and test items before designing and implementing teaching and learning strategies. Douglas believes that, "Evaluation is one of the most crucial parts of the whole procedure" (p. 49). Evaluation has two main purposes: (1) evaluate the student learning as it occurs, and (2) evaluate the effectiveness of the instructional design. The evaluation is an on-going instructional development activity.

The complexity and the specificity of the Douglas Model become apparent as one examines the three phases of the basic model format just described. Douglas describes the phases as:

> The steps in each of the phases relate directly back to the functions outlines in Part One. This means that each time an instructor proceeds through one of the phases of instructional development, he will be repeating the same functions, out at a more complex level of sophistication. In this regard, instructional development must be considered a cyclic, spiraling phenomenon, in which each cycle is based upon the previous cycle, but is distinct in terms of complexity and exactness. (p. 49)

A Phase One project is usually designed with only one instructional track. Instructors may use different instructional modes, but every student in the course will generally perform the same learning activities in reaching the objectives of a course. Evaluation of a Phase One project usually centers on such factors as drop-out rate and grade distribution, but an equally important factor is how well the students mastered each of the stated objectives. This analysis furnishes the foundation for deciding to repeat Phase One the next time the course is offered or to proceed to a Phase Two instructional development project (Douglas, 1971, p. 49).

Phase Two is a much more precise, experimental type of instructional development. It is characterized by the concept of validation. Each step is predicated upon the idea that the learning experiences provided should prove themselves to be valid when they are carefully reviewed. Each part should function adequately to insure that acceptable levels of learning are being attained (Douglas, 1971, p. 49). This level is different from Phase One in that the instructional development projects are of a comprehensive course syllabus and a multiple track instructional design. The syllabus is a very explicit statement of knowledges, skills, and attitudes which are to be developed during the course of study. It is equally explicit as to how the course is organized and the activities which a student must accomplish in order to complete the course. As in Phase One a decision must be made at the end of the evaluation stage as to whether to modify and repeat the project, with the other option being to move to a Phase Three project or implement as is. From the standpoint of time it is estimated that Phase Two projects take up to a year to complete.

Phase Three is a highly experimental procedure in which the entire development process is completely reviewed, and research and experimental techniques are utilized at the application level. Learning needs are assembled in terms of institutional philosophy and goals, appropriate content, student input, and societal impact. Validated course goals are generated which take each of these factors into consideration (Douglas, 1971, p. 50). Whereas, Phase One and Phase Two deal with more immediate instructional needs, Phase Three projects are definitely long-range propositions. They may take two to three years to complete.

This model represents a new concept in the model-building theoretical literature in that it presents alternate and systematic strategies for developing curriculum over an immediate, intermediate, and long-range basis. Its only apparent weakness is that it depicts only the what to do and not the how to do functions in the process.

The Kemp Model.--And finally, Kemp (1971) devised a plan for instructional design which consists of eight discrete steps: (1) List topics, stating general purpose for each one; (2) Enumerate the important characteristics of the student group for which the instructional will be designated; (3) Specify the learning objectives to be achieved in terms of measurable student behavioral outcomes; (4) List the subject content that supports each objective; (5) Develop pretests to determine the student's background and the present level of knowledge about the topic; (6) Select teaching/learning activities and the necessary instructional resources that will treat the subject content to achieve the objectives; (7) Coordinate such support needs as budget, personnel, facilities, equipment, and schedules to carry out the instructional plan, and (8) Evaluate student learning in terms of the accomplishment of the objectives, with a view to revising and reevaluating any phases of the plan that needs improvement (p. 9). Upon completion of the evaluation stage, the designer recycles back to the appropriate step list in the model represented in Figure A-15.

Kemp's process is somewhat inadequate as an operational flowchart instructional design model. Without the narrative descriptions (of the steps) which accompanies the model, an instructional developer would be hard pressed to execute the sequential functions identified and depicted linearly in the model in Figure A-15.

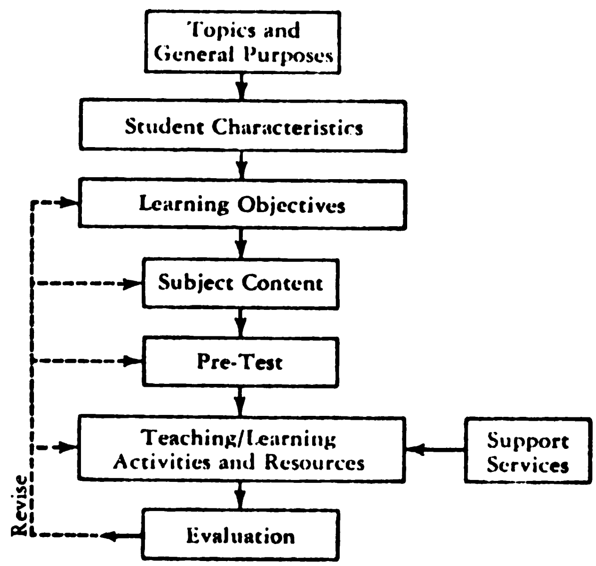


Figure A-15.--Instructional Design Model (Kemp, 1971, p. 10).

Curriculum and Psychological Teaching Models

Gagné Model.--Gagné (1962) devised a model which plans for the human components in a system development. It divides systems development into three principal stages: the design stage, the development stage, and the system testing and operation stage. These stages are graphically displayed in Figure A-16.

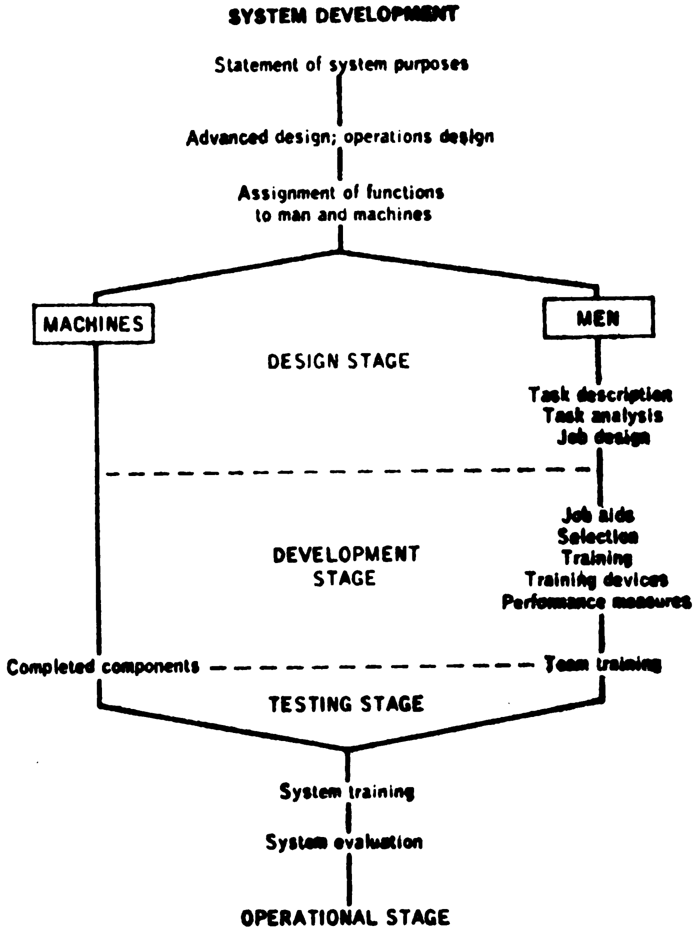


Figure A-16.--Procedures Used in the Development of Human Components of Systems (Gagné, 1962).

Systems design begins with a statement of purposes for the system, one or more "missions" the system is expected to perform. The purposes set the stage for the derivation of what the system's characteristics will be. Before going any further, systematic plans must be made for how the system is to work, and this means not only that the machines must be conceived functionally, but that there must also be a design for operations. Operations are prospective events that human beings do with and to machines. At this stage wise decisions must be made regarding the functions of the subsystems, the major parts of the total system, and the ways in which they may be connected together to fulfill the system goals. Along with these decisions, some highly important judgments are made with regard to human beings (Gagné, 1962, p. 3).

Assuming that wise decisions have been made at this early stage of planning, the process of design and development is now ready to follow two parallel paths: machine components and human components, both of which interact at many points as development proceeds (Gagné, 1962, p. 5).

Once the purpose and function of a subsystem has been stated, the designer of the human components can then proceed to describe in specific terms the nature of the human functions. This job is the task description, whose basic role is to provide the kind of information to which all subsequent plans for human beings in the system must constantly be referred. These are the statements which specify exactly what it is that the man-machine combinations comprising the subsystem are doing (Gagné, 1962, p. 5).

Task descriptions lead to the two activities that underlie the rest of the designer's work: to design jobs and to undertake the task analysis which makes possible decisions about the techniques to be used in achieving the human behavior required for these jobs. In regard to designing jobs, consideration has to be given to the number of tasks, their length, and their physical location within the subsystem. The analysis of task is undertaken to determine to what extent each kind of human behavior required can be achieved with the use of the various techniques available: by providing job aids (job "supports"), by selection, by training (Gagné, 1962, p. 5).

Finally, according to Gagné, the designer of the human components has to ask some basic questions. For example, can the required behaviors be achieved by providing job aids to facilitate human performance? Can they be obtained by selection of people with the right kinds of fundamental abilities? Or to what extent must the capabilities needed be established by training? (Gagné, 1962, p. 5).

During the development stage Gagné identifies several procedures. Job aids can be developed to provide for storage of information beyond the capacity of the human memory, or to serve as external cues for the instigation of behavior required in systems tasks. Most commonly, these additions take the form of checklists and instructional manuals. Aptitude tests can be developed or chosen from existing stock to measure the basic abilities that have been identified with a program of personnel selection and classification. And procedures can be designed for individual training, based upon psychological principles of learning relevant to the kinds of performances needed (Gagné, 1962, p. 6).

A variety of purposes must be served by procedures of training: (1) individual training which pertains to the performance of a man in relation to a machine or to a set of tools, (2) team training designed to train men to communicate with others in ways which will bring about the most efficient attainment of system goals under a wide variety of conditions, (3) system training which focuses on the idea of having human beings acquire and refine their competencies in interactive and communicative techniques, while considering the system as a whole.

Training devices have an important role to play at this stage. They not only establish the specific skills of machine operation, but also, in the form of simulators, for the conduct of team training as well as systems training (Gagné, 1962, p. 7).

The final consideration at the developmental stage are performance measures. A means must be provided to measure the results of training--to determine whether the desired capability has in fact been established.

In the Gagné model two other characteristics should be noted. The first is the fact that interaction between the lines of development for machine and for man must occur all along the way, and secondly, "testing" throughout every stage of development. Gagné notes that these two characteristics are often referred to as the "human engineering evaluation" (pp. 7-8).

Once the design and the development are complete the system is ready for implementation and subsequent evaluation. The testing stage provides the data needed to make decisions regarding any desirable revisions. It is essential to know what it is that human beings are supposed to do, even if they are highly skilled. This means that standards of human performance and measures of human performance must enter crucially into the decisions that are made during the testing of a system.

The final function of a systems development is the human function. Gagné describes the human function as "varieties of transformations which the human being, considered as a systems component, performs upon inputs to produce outputs" (p. 53). Once they have been identified and described by considering a typical unitary response system, composed of a human being who is presented with an equipment array and a set of controls that include manipulable buttons and knobs, the human function becomes one of transmission of information into the system.

The flowchart for the model is of limited operational value to an instructional developer without the elaborate narrative description Gagné provides to explain each component. Also, the model, like so many others, is characterized by a definite process linearity. The primary contribution of the model is the emphasis on the human factors and their relationship to the machine components of a system.

DeCecco Teaching Model.--On the assumption that the best substitute for a theory of teaching is a model of teaching, DeCecco (1968) modified a stripped-down teaching model developed earlier by Glaser (1962). The DeCecco model divided the teaching process into four uncomplicated components which conceptualize the teaching process (p. 11). The model is graphically depicted in Figure A-17.

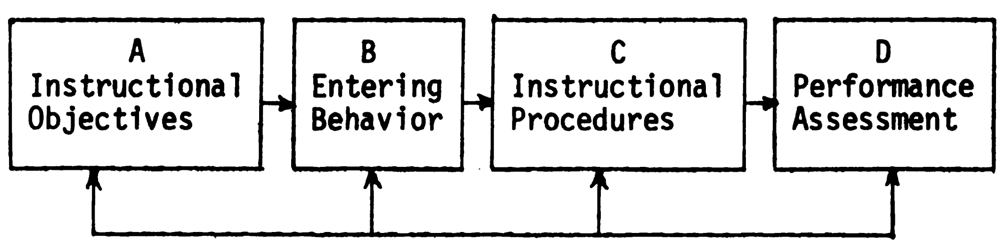


Figure A-17.--A Teaching Model (DeCecco, 1968).

Instructional objectives (Box A) are those the student should attain by completion of a segment of instruction. In theory, objectives can vary in scope and character from the mastery of a spelling list to the acquisition of Greek virtue. DeCecco uses Mager's criteria for writing good behavioral objectives. Entering behavior (Box B) describes the student's level before instruction begins. It refers to what he has previously learned, his intellectual ability and development, his motivational state, and certain social and cultural determinants of his learning ability. Although the model gives priority to the selection of instructional objectives over the assessment of entering behavior, in practice these two components must interact (p. 12). Instructional procedures (Box C) describe the teaching process; most decisions a teacher makes are on these procedures. DeCecco contends that instructional procedures must vary with the instructional objectives. Also, instructional procedures must vary depending on whether the teacher is teaching skills, language, concepts, principles, or problem solving. A complete strategy is presented for dealing with each type of learning activity in the narrative description of the model. Finally, performance assessment (Box D) consists of the tests and observations used to determine how well the student has achieved the instructional objective. If performance assessment indicates that the student has fallen short of mastery or some lesser standard of achievement, one or all of the preceding components of the basic teaching model may require adjustment. The feedback loop shows how the information provided by performance assessment feeds back to each component (DeCecco, 1968, p. 12).

The DeCecco Model is of doubtful value as an instructional development model. Perhaps its best use is as a model which delineates one substep of a total instructional development model, i.e., the teaching process.

GMI Model.--The General Model of Instruction (1965) is a procedural guide for designing and conducting instruction. The model is, as others claim it to be, applicable to all levels of education (e.g., elementary, secondary, higher), all subject matters (e.g., English, science, art, vocational), and any length of instructional unit (e.g., one hour, one week, one semester) (Kibler, Barker and Miles, 1970, p. 2).

According to Kibler et al., the major philosophical premise underlying the model is:

> The goal of instruction is to maximize the efficiency with which students achieve specified objectives. The model is based on a technology of instruction which has developed in the past several years from the research and development in three areas--experimental psychology, military training, and programmed instruction (p. 2).

The three individuals who have contributed most to the development of the GMI Model are Robert Gagné (1965), Robert Glaser (1965), and James Popham (1965) (p. 2).

The two major functions of the model are (1) to guide instructional designers and teachers through the major steps in designing and carrying out instruction; and (2) to provide an overall structure with which to view and study the instructional process (Kibler, Barker and Miles, 1970, p. 2).

A flowchart diagram of the model is shown in Figure A-18.

The model presupposes that the function of behavioral objectives is for planning instruction, not for informing others of instructional intentions. The selection of appropriate objectives usually is based on

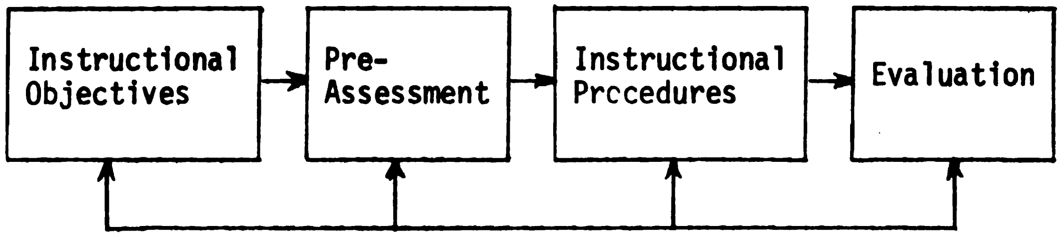


Figure A-18.--A General Model of Instruction (Kibler, Barker and Miles, 1970, p. 3).

the following factors: (1) what the students are able to do before beginning the unit; (2) what the student should be able to do in instructional units that follow the unit of concern, and what they should be able to do after completing their education; and (3) the available instructional resources, including the instructor's capabilities with his subject matter. During the selection the classification taxonomies of Bloom, Krathwohl, Gagné, Guilford and other are applied to determine the level or type of human performance desired. Once a set of objectives has been selected, the instructor should perform a behavioral analysis in which he determines what a student will do to demonstrate achievement of the objectives. The actual components to be examined in a behavioral analysis are: (1) the important stimuli to which a student responds; (2) the important responses made; and (3) the criteria which the responses must meet to be considered successful. Such an analysis can be performed by observing students who have already achieved the objectives as they exhibit the desired behaviors. Previous students can be interviewed, and the products (tests, paper, etc.) they produced can be examined (Kibler, Barker and Miles, 1970, p. 4).

In specifying behavioral objectives under the GMI model the three elements recommended by Robert Mager in "Preparing Instructional Objectives" (1962) are used: (1) observable behavior; (2) conditions under which the student will be expected to demonstrate achievement of the objective; and (3) criteria for evaluating the success of the student's performance.

Prior to beginning a unit of instruction, it is desirable to determine (1) how much of what is to be learned in the unit they already know; (2) whether they have the necessary behavioral capabilities for the instruction to follow; and (3) the instructional activities that should be prescribed for each student. Of course, the assessment should be based on the specific instructional objectives specified for the unit. The results of this assessment should indicate (1) whether any students may omit any of the objectives of the unit; (2) whether any students should be required to master prerequisite skills before beginning the unit; and (3) what specific instructional activities should be provided for specific students (Kibler, Barker and Miles, 1970, pp. 6-7).

The design of instructional procedures involves selection of available instructional materials, preparing new instructional materials when necessary, and developing a sequential plan which appears to be the most efficient for achieving the stated objectives. Decisions should be based upon research evidence when it is available.

At this third stage of development, the model list ten generalizations, or principles, based on research evidence which should be consulted in designing instructional activities. They include:

(1) pre-learning preparation of the student; (2) motivation; (3) providing a model of terminal performance; (4) active responding by student; (5) guidance by the instructor; (6) practice using newly learned behaviors; (7) frequent and prompt knowledge of student responses; (8) graduated sequencing of instruction from the simple to the complex, from the familiar to the unfamiliar; (9) accommodations for individual differences in students; and (10) classroom teaching performance skills in stimulating interest, explaining, guiding, identifying and administering reinforcers, and managing classroom behavior (Kibler, Barker and Miles, 1970, pp. 8-9).

When students complete an instructional unit, they are evaluated to determine whether the instruction was successful in achieving the unit's objectives. Typically, evaluation involves using tests and instruments to measure the acquisition of knowledge, skills, and attitudes. Frequently, it is necessary to specify or describe student achievement. Changes in the objectives, the pre-instruction evaluation procedures, the instruction, or the post-instruction evaluation are to be made on the basis of the evaluational results (note the feedback loop on the flowchart). In addition to making changes based on observed results, instructors should make modifications on the basis of new developments in materials and techniques, new research findings, and changing values (Kibler, Barker and Miles, 1970, pp. 13-14).

The results of evaluation also can be used to inform students and other interested parties regarding the degree of success each student achieved in the unit. However, since all students may be required to master all the objectives, this information may consist of only an indication of the different lengths of time each student took to complete the unit (Kibler, Barker and Miles, 1970, p. 14).

The General Model of Instruction is graphically uncomplicated and therefore useful as a general decision-making guide in planning instruction. A major contribution of the model is the list of ten generalizations or principles regarding effective instruction.

CER Model.--Alexander and Yelon (1969) designed an instructional system which involves going through the series of stages shown in Figure A-19.

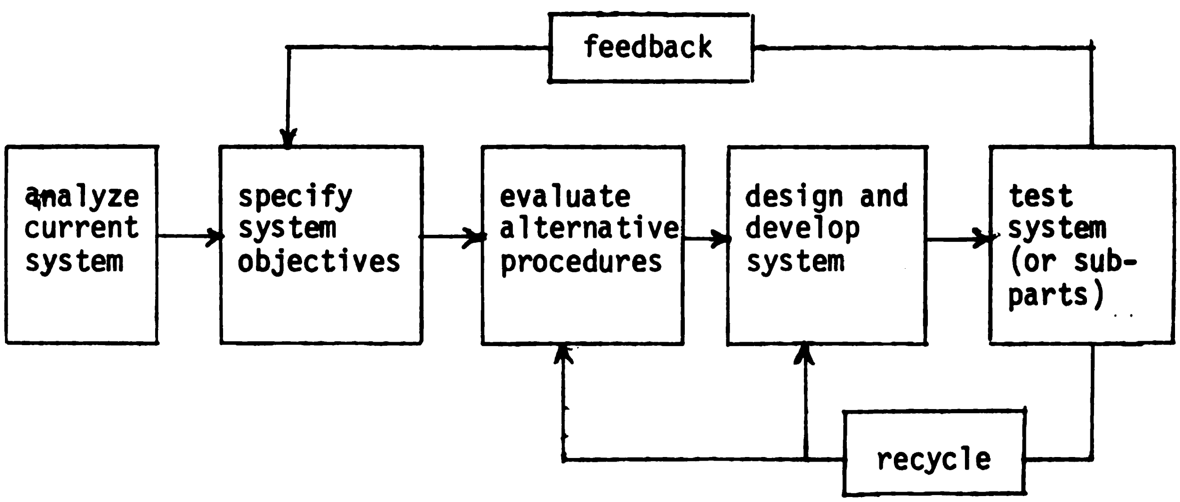


Figure A-19.--Stages in the Instructional System Design Process of the CER Model (Alexander and Yelon, 1969, p. 45).

The model, although conventional in many respects, makes a significant contribution to model-building theory. It is the contention of Alexander and Yelon, for example, that the model should serve only as Common Experiential Referent (CER) for the development of mutually acceptable strategy by which a design team can undertake instructional development. The model assumes that each member of the instructional design team enters into the team effort with different backgrounds and different ways of approaching the task. Furthermore, Alexander and Yelon believe that "often each employs a different vocabulary, or technical language, derived from his particular area of training or competence, which also impeded communications" (p. 44). Thus, the purpose of the CER is to facilitate communication among the members of the design team, speed up the design, development and productive process, and to increase mutual satisfaction of the team members with the ultimate product (Alexander and Yelon, 1969, p. 44). In essence, the model serves, as Alexander and Yelon insist, as a springboard for model acceptance or revision by team members, thereby gaining greater understanding of and commitment to the process by the members than would otherwise be possible.

The strategies related to gaining a commitment to the process from the design team members is a valuable feature of the CER Model. The limitations of the model are much the same limitations recognized with many of the earlier models reported in the study: (1) implied linearity of the process; and (2) limited operational value, other than as a strategy for obtaining agreement from the outset of the instructional development.

Models Developed by Training Managers

Tracey Model.--Tracey, Flynn and Legere (1968) applied the systems approach to the improvement of vocational education in secondary schools.

Their systems model is flowcharted in Figure A-20 and shows a "closed loop" system which is self-correcting and contains fifteen steps.

Their model is a modification of the MINERVA Model (1967) which was developed as a United States Army instructional systems program to analyze and renovate the total training efforts of the United States Army Security Training Center and School.

The cycle starts by analyzing market needs and ends by evaluating the student after graduation in a continuous process of evaluation and revision.

There are three major phases in the cycle: (1) Determination of systems requirements; (2) System development; and (3) System validation.

In determining the system's requirements several types of input information will assist the designer(s) in establishing the goals and functions of the vocational training program. Since the specific mission of a vocational school is to produce the kind of skilled workers needed nearby, the logical starting point is to analyze the consumer market. An analysis of local needs should embrace (1) firms within commuting distance of the school, and (2) skills needed by industries which the community hopes to attract. The analysis must answer several questions: (a) What skills are required? (b) Where do the skilled workers come from now? (c) How well-trained are these workers? and (d) Will public and private organizations cooperate in developing new educational programs? (Tracey, Flynn and Legere, 1968, p. 19).

Secondly, if vocational programs are to do their jobs, they must be based on an analysis of job requirements, not what someone recalls that

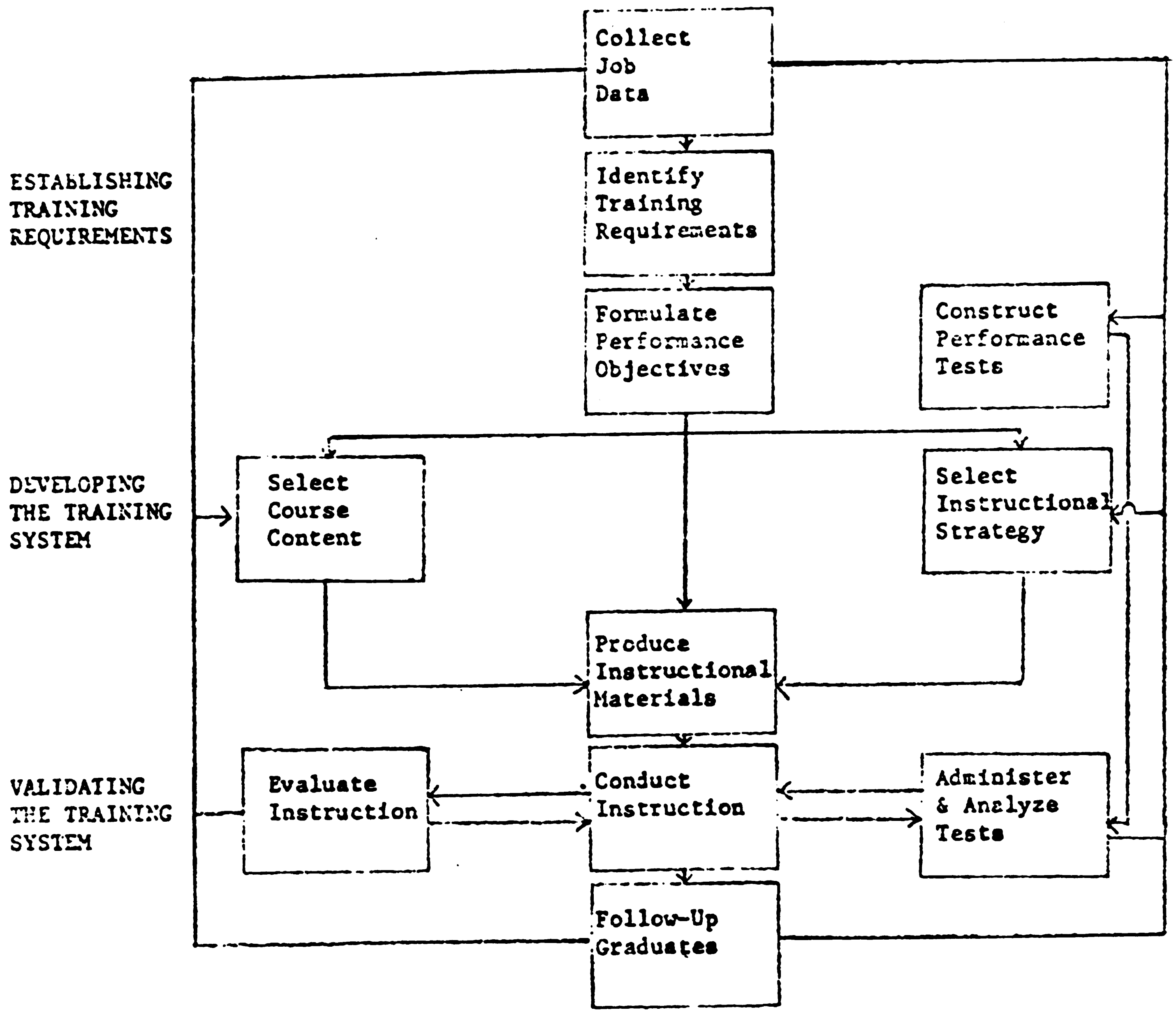


Figure A-20.--Tracey, Flynn and Legere Model, 1968.

he did or may think a graduate should know. Useful job data is obtained from a person at work in a factory, office or farm. The information should be collected by a job/task analyst, who can be trained in workshops or seminars. The data must record everything related to a job and be collected using what Tracey et al. call, "structured, open-ended forms for both interview and observation" (p. 19).

After detailed information has been collected about job requirements it is necessary to weed out learning activities which a vocational school need not teach. Three criteria are applied during the weeding out process: (1) The skills and knowledge to be taught must be required of all students regardless of where they will be employed; (2) The skills and knowledge must be difficult enough to make it unlikely that the student would acquire either on his own; and (3) The skills and knowledge taught should be those most frequently required on the job (Tracey, Flynn and Legere, 1968, p. 20).

Thereupon, the designers must make judgments on which instructors are best suited for the training job as well as a determination of which prerequisite skills or knowledge are mandatory.

Tracey, Flynn and Legere insist that "the goals of a vocational program should be stated in precise terms" (p. 21). Their position on specifying behavioral objectives is related to the assumption that learning is defined as a change in behavior and that jobs require behavior which can be observed or described (p. 22).

The behavioral objectives make it possible to design criterion measures to see whether or not a student has successfully completed a course. When the student has successfully completed a course, he reaches a performance level called minimum qualifying; there are no grades or other ratings given (Tracey, Flynn and Legere, 1968, p. 22).

The standards to be met can be established in terms of the: (1) time it takes to do something, or how long a person can do something; (2) quantity, or number of work products or services produced; and (3) quality, as expressed by accuracy, completeness, format, clarity, sequence or tolerances (Tracey, Flynn and Legere, 1968, p. 22).

Thereupon, the course content, the first step of the systems development stage, is considered by the developer. The course content consists of the subject matter to be learned, the knowledge supports, and the skills necessary to perform a job. Selection of content involves judgment but certain suggestions for selection might be considered: (1) The content is clearly task relevant; (2) The content is consistent with the experience and ability of the student; (3) Knowledge and elements of skill contribute significantly to the achievement of the objectives; (4) Content that is too detailed, too complex, or too technical is excluded; and (5) Unnecessary duplication and overlapping are avoided (Tracey, Flynn and Legere, 1968, p. 23). Instructional sequence is usually determined by an internal logic in materials, by chronology, or by an order of task performance (p. 23).

An instructional strategy is usually devised for a combination of teaching methods, mediating devices and ways of organizing students and teachers. The term "method" used here includes the conventional lecture, demonstration and discussion, as well as individual study, programmed learning, case studies and simulation. Mediating devices include audiovisual aids, teaching machines, closed-circuit television, student response systems and the like. Organization includes the conventional random grouping of students, homogeneous groups and such systems of organization as team teaching and learning (Tracey, Flynn and Legere, 1968, p. 23).

The concluding steps of the development stage are the production of instructional materials and the setting of a time allocation for each unit. Materials may consist of instruction programs, lesson plans, programmed materials, audiovisual aids, guide sheets, work sheets and any other documents needed to conduct instruction or manage the educational process. Such materials must be checked against job and task data, and against accuracy before publication (Tracey, Flynn and Legere, 1968, p. 24).

The first step of the system validation stage of Tracey, Flynn and Legere Model is the selection of students and instructors. Students selected must have the full range of aptitude, ability, knowledge and skills which can be expected from future groups. If the group is not representative it is impossible to draw conclusions about how well the complete system, or any of its parts, is working. In the selection of instructors the main criterion is that the ability of the instructor be matched with each learning activity (p. 24). For example, for those instructors who are most effective in small group environments, efforts should be made to use their strengths to advantage when scheduling classes. By the same token, the instructors with the strongest background in certain instructional content, should be matched with those areas of instruction relative to their special expertise.

After the instruction has been implemented, it is possible to evaluate whether the content, strategy, supporting facilities and instructional materials are doing the job. Periodic observations of classroom instruction, student surveys and interviews with students afford valuable insight into how the system is operating.

Performance tests, employing predetermined performance criteria, must be administered regularly, not to grade the student, but to let the student know his progress and to give feedback in the form of problem solution, critiques, ratings or test scores, which must be analyzed to discover which objectives have been met and where the system failed and needs revision. Analysis of these measures is an important quality control tool if inept students are to be eliminated early (Tracey, Flynn and Legere, 1968, p. 24).

The final step is to interview at least a sample of graduates where they work to determine how well the graduate is doing his job. This procedure permits: (1) objective judging of the system's effectiveness, and (2) identification of new job and task elements which need to be covered in the course. When a sufficient amount of information is gathered, the system is revised (Tracey, Flynn and Legere, 1968, p. 24).

The closed loop which interconnects and allows recycling and feedback is one of the most important aspects of the model. Thus, the interrelatedness of the system's components is graphically portrayed by the paradigm. The major weaknesses of the model, as identified by Hamreus, are: (1) failure to consider the management and control of the context within which the training program is to be imposed, and (2) omission of steps for determining the enabling and prerequisite skills essential to attaining terminal performances (Hamreus, 1968, p. I-45). The model may also be faulted for implying that, during the development, only summative evaluation is used. For a systems model to be effective, there must be an on-going formative evaluation during each step and this information used as the basis for making decisions on subsequent development.

Gordon Model.--Gordon (1969) proposed the overall systems flowchart model in Figure A-21a for civil defense, with emphasis on civil defense training and educational activities (p. 39).

He points out that the model is a "generalized model and, therefore, not specifically related to any particular level of government and would apply to many large-scale complex organizations" (Gordon, 1969, p. 39).

Steps 1.0 and 2.0 require the developer to specify the broad objectives (system mission) for the training program and to identify and analyze the specific tasks required in civil defense training. The third step (3.0) is operationally performed by attending to the model requisites in the subsequent steps of the Develop Training Programs submodel shown in Figure A-21b.

BUIC II Model.--Figure A-22 shows in flow diagram the way in which military systems analysis typically operates. This model has been used for the development, among others, of the BUIC II Air Defense System (1969) devised by the Systems Development Corporation.

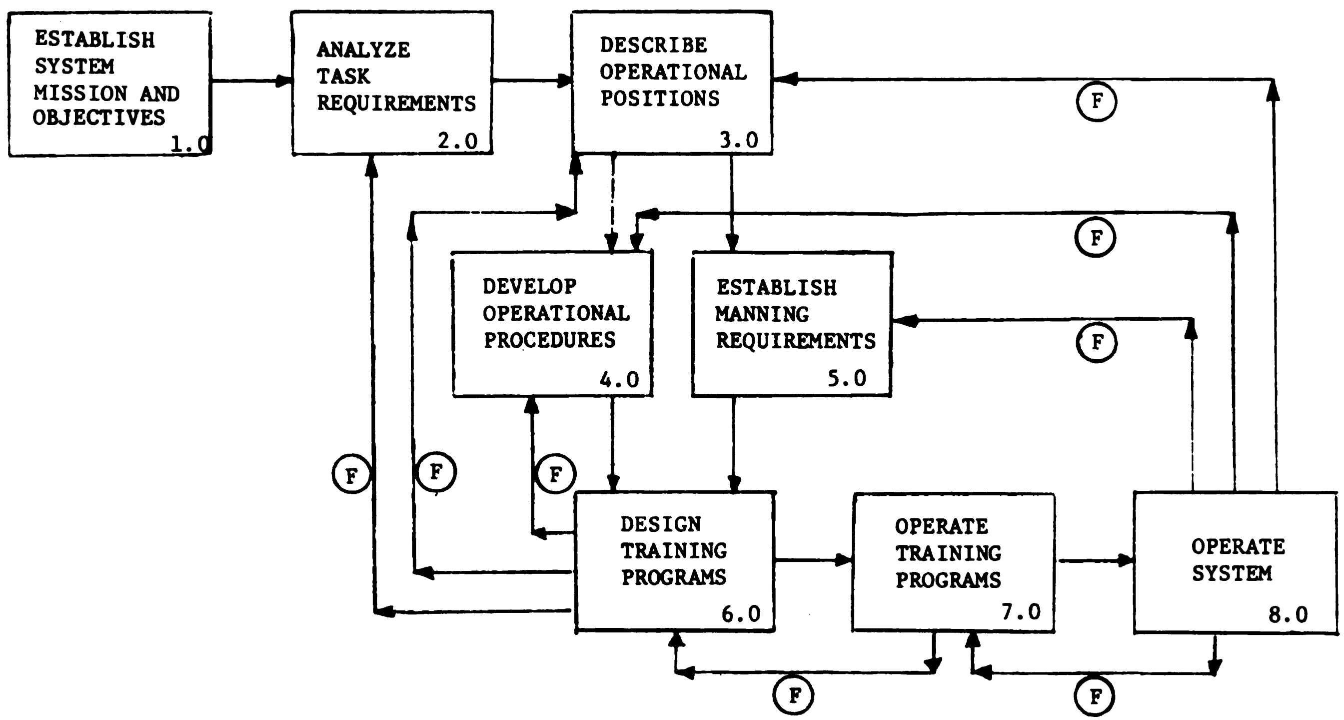


Figure A-21a.--Civil Defense Flowchart Model at First Level of Detail (Gordon, 1969, p. 40).

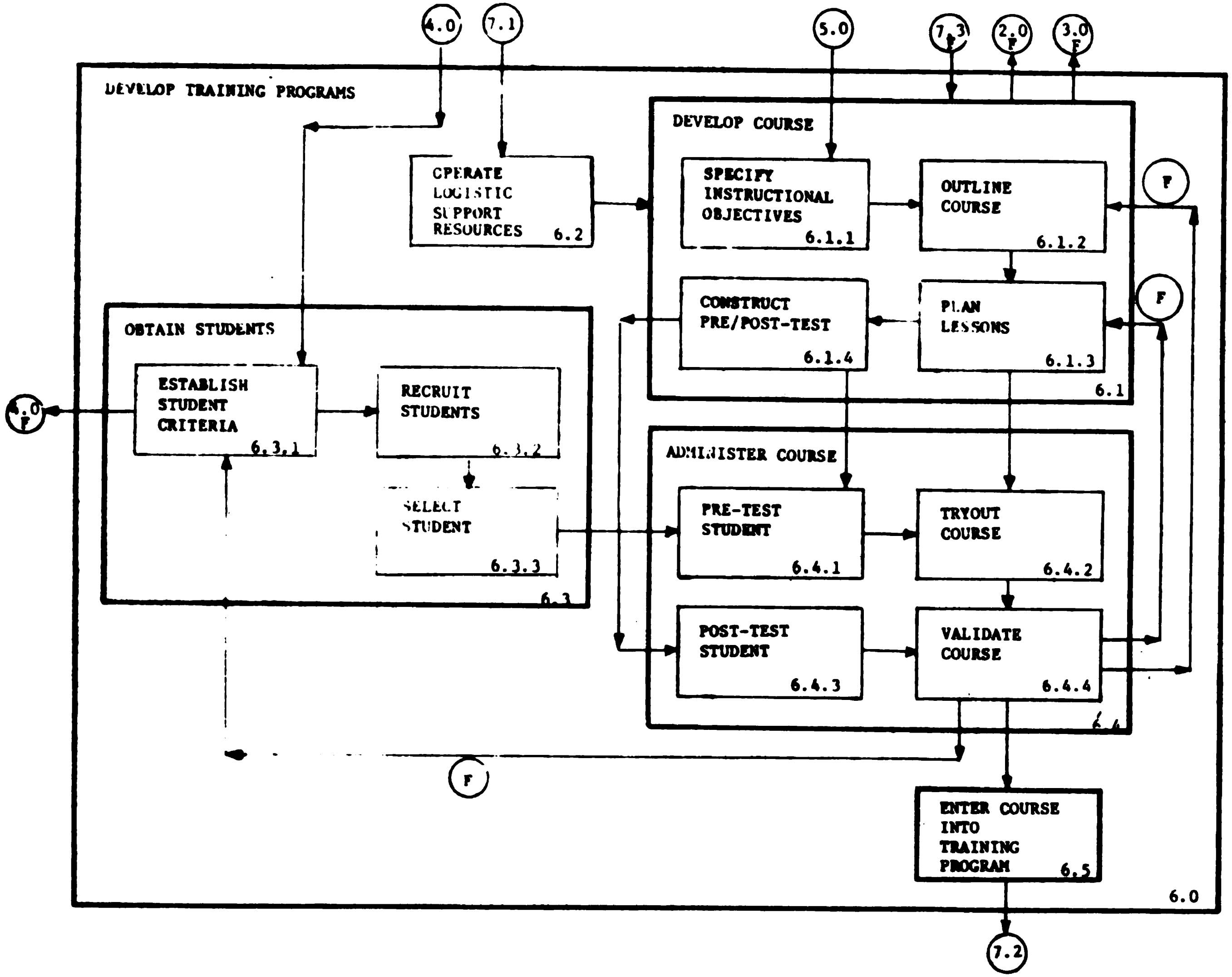


Figure A-21b.--Develop Training Programs Subsystem Model
(Gordon, 1969, p. 41).

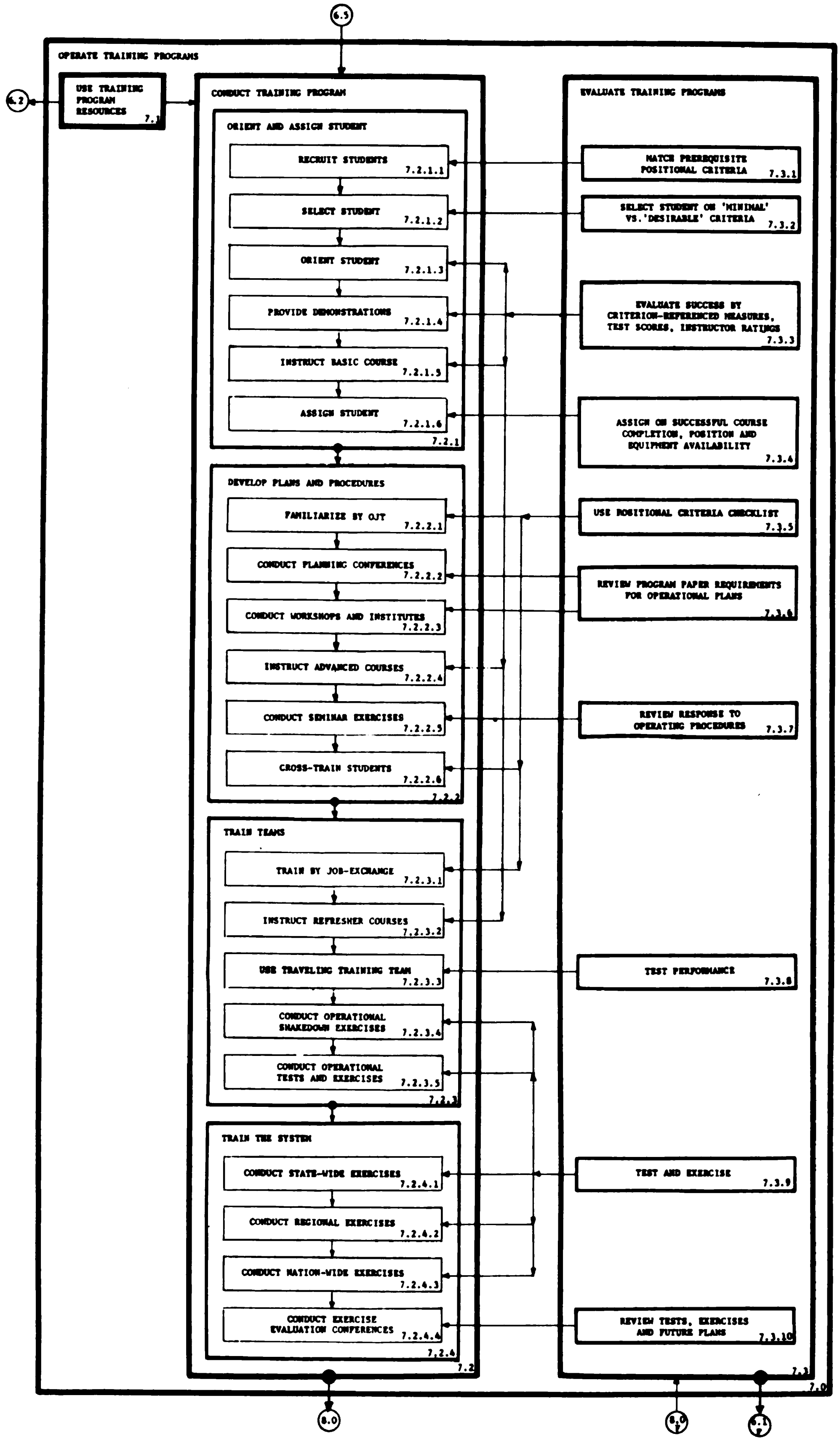


Figure A-21c.--Operate Training Programs Model Subsystem (Gordon, 1969, p. 42).

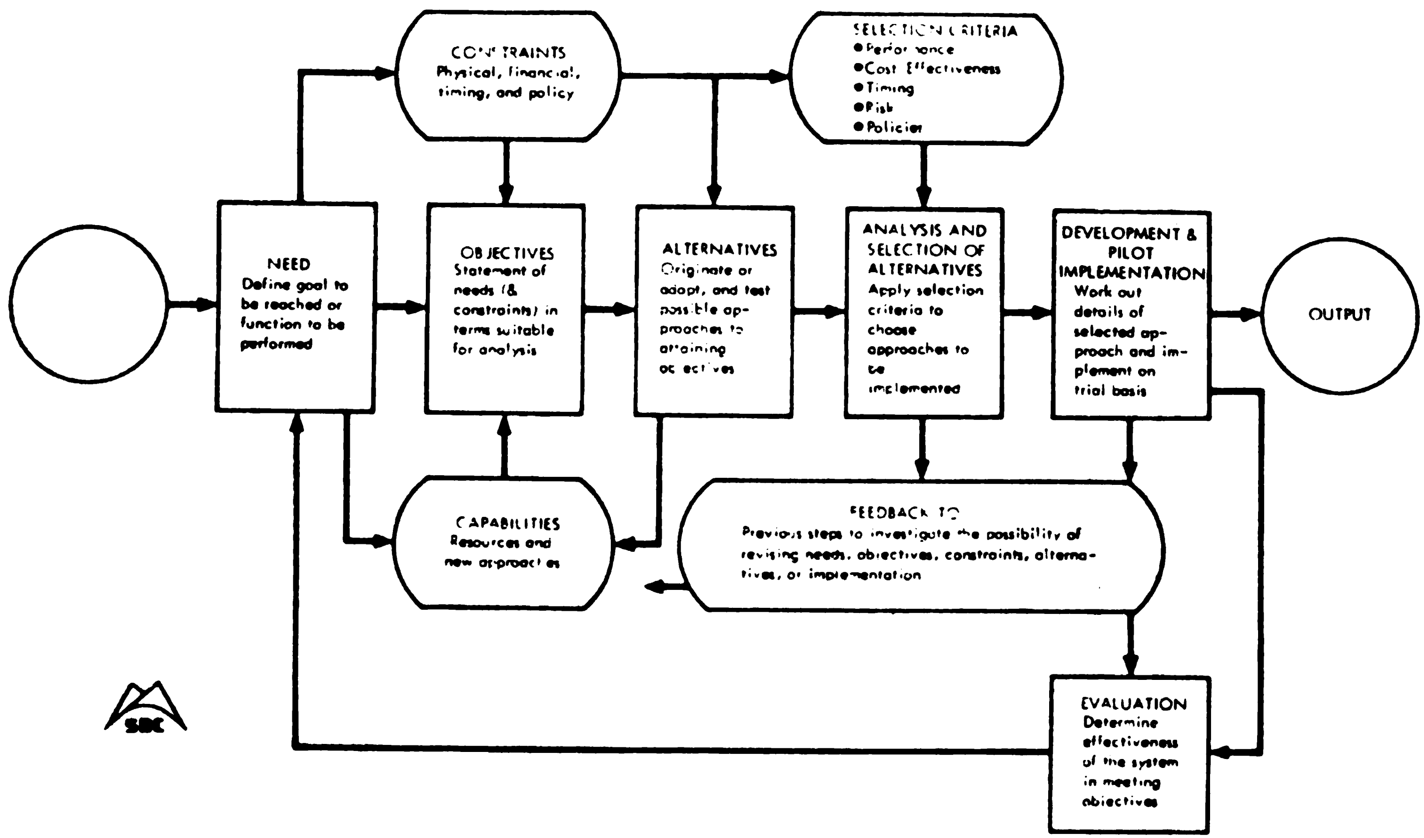


Figure A-22.--The BUIC II Air Defense System Model
(Carter, 1969, p. 23).

The "what to do" requirements are clearly delineated in the individual boxes of the BUIC II model. Regrettably, however, the model does not explain how to execute all the steps of an implied linear sequence of steps.

Other Related But Non-Qualifying Models

The Taba Model.--Taba's Model (1962) is based on an assumption that there is an orderly process which will result in a more thoroughly planned and a more dynamically conceived curriculum. This order might be as follows:

Step One:	Diagnosis of Needs
Step Two:	Formulation of Objectives
Step Three:	Selection of Content
Step Four:	Organization of Content
Step Five:	Selection of Learning Experiences
Step Six:	Organization of Learning Experiences
Step Seven:	Determination of What to Evaluate and of the Ways and Means of Doing It. (Taba, 1962, p. 12)

Step One refers to diagnosing the gaps, deficiencies, and variations of the backgrounds of students as a prerequisite for determining the level on which objectives can be reached by a particular group of students and the emphasis that may be required in the light of their experience.

Formulation of clear and comprehensive objectives (Step Two) provides an essential platform for the curriculum. Perhaps the most difficult task of this step is to translate the general objectives into specific objectives in light of what the unit encompasses and what the analysis of needs indicate (Taba, 1962, p. 350). In large part the objectives determine what content is important and how it should be organized. A unit is likely to generate rich learning if the areas of objectives for it are fairly comprehensive and include some materials on each of the following: (1) Concepts or ideas to be learned; (2) Attitudes, sensitivities, and feelings to be developed; (3) Ways of thinking to be reinforced, strengthened, and (4) Habits and skills to be mastered (Taba, 1962, p. 350).

Step Three requires selecting the content. Basic consideration must be given to the central topic and its dimensions, the focusing ideas in light of which the topic or the unit will be developed, and the specific facts and details which will serve to develop the focusing ideas. Topics must be worthwhile and have a rationale to support their significance. In determining the structure of the topics, the criteria of significance and validity of the content are applied and implemented, as are the criteria of learnability and appropriateness to the instructional needs and the developmental levels (Taba, 1962, p. 352).

In providing perspective to particular areas of content and ideas, according to Taba, represent "the essential knowledge that all students should master" (p. 354). These ideas guide the selection and organization of specific information and its interpretation. For all practical purposes, a list of ideas provide a check against including the irrelevant and insignificant, whether introduced by the teacher or by the students (p. 354).

The specific content should be a valid example of the general idea, have a definite logical connection to the idea, and not just be vaguely related to the topic (Taba, 1962, p. 356). Finally, the development of ideas and the sample content requires the assistance of a content specialist to evaluate the validity and significance of the ideas and to check the adequacy of the sample.

In organizing content in the Taba Model (Step Four), the content needs to be arranged so that the dimensions of inquiry are in a sequential order according to a feasible learning sequence. The topics, the ideas, and the concrete content samples need to be arranged so that there is a movement from the known to the unknown, from the immediate to the remote, from the concrete to the abstract, from the easy to the difficult (p. 359).

The first rule to observe is selecting the learning experiences (Step Five) for each idea and its sample content is that each idea should serve some definite function. The learning experiences must have a definite relationship to the objectives (Taba, 1962, pp. 363-364).

Generally speaking, a sequence of learning experiences involves at least three main stages (Step Six). At one stage the learning activities are essentially introductory, for opening up, for orientation. These include activities which (a) provide diagnostic evidence for the teacher, i.e., feedback from students on strategies for studying a unit, (b) help the students make a connection with their own experiences, (c) arouse interest, (d) provide concrete descriptive data from which to get a preliminary sense of the problems to be dealt with, and (e) create involvement and motivation. In this sense an opener has a broader meaning than the usual setting of an environment for learning. Much of the key for success at this stage lies with planning with the students (Taba, 1962, p. 365).

At the second stage learning activities are designed to develop various aspects of the subject and to provide the needed factual material: reading, research, analysis of data, committee work; study of various kind. Development and analysis need to be followed by the type of assignments and activities which help the students to generalize, to put their ideas together and reformulate them in their own terms, to compare and contrast, or to formulate conclusions. While the developmental activities require much individual or small group work, it is more profitable to formulate generalizations and discussion by the entire class (Taba, 1962, p. 367).

Finally, there are activities designed to apply what has been learned to assess and evaluate, or to set what has been learned into a larger framework. What do these ideas mean? How do they relate to other ideas? How did we work? What could we do better, or differently, the next time. Another form of summary, testing, or synthesis of what is learned is applying what is known to a new situation, in a new context (Taba, 1962, p. 367).

Evaluation (Step Seven), according to the Taba Model, consists of "determining the objectives, diagnosis, or the establishment of base lines for learning and appraising progress and changes" (p. 377). Naturally, all this is much more accurate and objectives if the evaluator's judgments are based on evidence. Much evaluation is actually continuous diagnosis, accompanied by comparison of results (p. 377).

After the outline of the unit is completed in writing, it is necessary to check the overall consistency among its parts (Step Eight).

Are the ideas pertinent to the topic? Does the content outline match the logic of the core ideas? Is the sampling of detail as sharp as it could be? Do the learning activities provide genuine opportunity for the development of the content ideas? Does the sequence of content and learning experiences flow? Is there proper cumulative progression? Is there a proper balance and alternation in the modes of learning: intake and synthesis and reformulation, reading, writing, oral work; research and analysis? Are there a variety of expressions, such as dramatization, creative writing, construction, painting? (Taba, 1962, p. 379).

A check is also needed as to whether the organization is sufficiently open-ended to provide alternatives both for content detail to be used and for ways of learning to allow for special needs. Some students may need an abundant opportunity just to open up and talk. Other groups may be beset with interpersonal difficulties. They may require considerable emphasis on training in the ways and means of groups work (Taba, 1962, p. 379).

Finally, there are practical considerations. While it is important to conceive a unit of work first in the most ideal terms, its final shape should take due account of the limitations of a given school situation, of which there are many. For example, needed materials may not be available, or teachers may lack the proper background for teaching certain things (Taba, 1962, p. 379).

Taba's Model is equally limited in operational value. First, it does not graphically show the relationship of the components to each other, nor the feedback process commonly associated with the process. Secondly, the length of its narrative description of the eight steps precludes facility in applying the model during development. Thirdly, the model places too much emphasis on process linearity. Lastly, the Taba Model is more comprehensive in discussing what to do as opposed to how to do it.

The Popham Model.--Popham (1970) proposed an empirical teaching model which is similar to the GMI model and is based on the notion that a teacher should be, among other things, a highly skilled technician who systematically improves the quality of his instructional efforts (p. 9). The model is illustrated in Figure A-23.

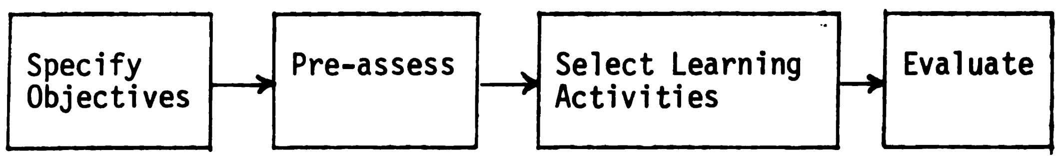


Figure A-23.--An Empirical Instructional Model (Popham, 1970, p. 19).

Instructional decisions in this approach are based on what happens to the learners as a consequence of instruction. The first step is determining what is to be achieved by specifying objectives. According to Popham, the teacher should describe his instructional objectives. The objectives should be stated in terms of how learners are to behave after the instruction, that is, what they can do after instruction. In other words, objectives should be stated in terms of observable student behavior. The final requirement of this step is to apply certain learning principles, drawn largely from psychology, to increase the probability that learners will attain a target behavior (p. 14). An example of a learning principle is: giving the learner an opportunity to practice the behavior called for in the instructional objective.

A second step in the systematic planning of instruction is to pre-assess the learner's entry level (Popham, 1970, p . 12). This step may reveal that pupils already possess the behavior the teacher had originally hoped to teach. In this case, the original objectives can be revised upward or new objectives can be substituted (Popham, 1970, p. 13).

After the teacher has modified his instructional objectives according to the results of pre-assessment, the third step is to select learning activities which would achieve those objectives. For example, there are certain learning principles, drawn largely from psychology, that have been shown to increase the probability that pupils will attain a target behavior. The skilled teacher will master a number of these principles and will select learning procedures accordingly (Popham, 1970, p. 14).

The final step in the empirical instructional model is evaluation. Evaluation is accomplished by observing post-instructional behavior of pupils. Poor post instructional performance by pupils generally reflects inadequacies in the instructional sequence and/or the quality of the instruction (Popham, 1970, p. 17).

Popham maintains that the value of the empirical scheme is that, regardless of an individual's teaching style, it provides a procedure whereby the teacher, as a technically skilled expert, can, over time, systematically improve the quality of his instruction (p. 20).

The model is even less specific than the general Model of Instruction about the functions of the four stages of instructional design. Consequently, its operational potential to an instructional developer is questionable. Another limitation of the Popham Model is that it does not contain a recycle or feedback step.

The Air Training Command (ATC), located at Randolph Air Force Base, is responsible for over 3,000 basic and advanced training courses. Over 200,000 enlisted and officer personnel are enrolled in these courses each year. In meeting their responsibilities, the ATC has introduced a number of strategies designed to individualize Air Force instruction with media. One of the more significant strategies is the Instructional Systems Development process which has six components:

(1) Analysis of system requirements. Data secured by questionnaire interviews, job observation, and information provided civilian hardware suppliers are used for analysis. The analysis includes a delineation of the job itself, the personnel required to perform it, and the environment in which the job is conducted. The results are utilized to develop a task list (Neft, 1972, p. 37).

(2) Definition of the educational or training requirements. This step involves the delineation of the nature of the specific student population. In addition, the cost of their training is estimated (Neft, 1972, p. 37).

(3) Development of objectives and tests. Behavioral objectives are developed according to Mager's model and criterion reference tests are employed to measure student attainment (Neft, 1972, p. 37).

(4) Planning, development and validation of instruction. Instructional sequences are derived from analysis of objectives developed above. A variety of instructional strategies are employed to achieve these objectives. All strategies employ active responding and student feedback.

Validation is sequentially conducted with individuals and small groups before operational tryout (Neft, 1972, p. 37).

(5) Conducting and evaluating instruction. Courses are evaluated by two methods--internal and field. Internal evaluation involves review of course documents, observations of training, and the evaluation of student responses. The field method involves evaluating the graduate's job performance in a field command (Neft, 1972, p. 37).

(6) Feedback. All the five previous steps are linked by a feedback loop. Modifications are made as appropriate (Neft, 1972, p. 37).

This model, however, is of limited operational benefit to instructional designers since it fails to consider completely enough the how of the process. A second serious drawback is the exclusion of enabling objectives as the vehicle component for attaining the terminal objectives.

Abedor Model.--Abedor (1971) developed and validated a flowchart or analog model prescribing specific formative evaluation procedures for tryout and revision of prototype multi-media self-instructional learning systems.

After devising an initial model developed from a review of the literature on formative evaluation, Abedor used feedback from interviews with seven faculty members who had previously developed (and revised) multi-media lessons as the framework for devising two revised versions of the model. The first was what he called the MK II "mini" model shown in Figure A-24. The "mini" version, according to Abedor, is "highly simplified in order to facilitate conceptual understanding of the process" (p. 77). The second revised version, the "maxi" MK II model in

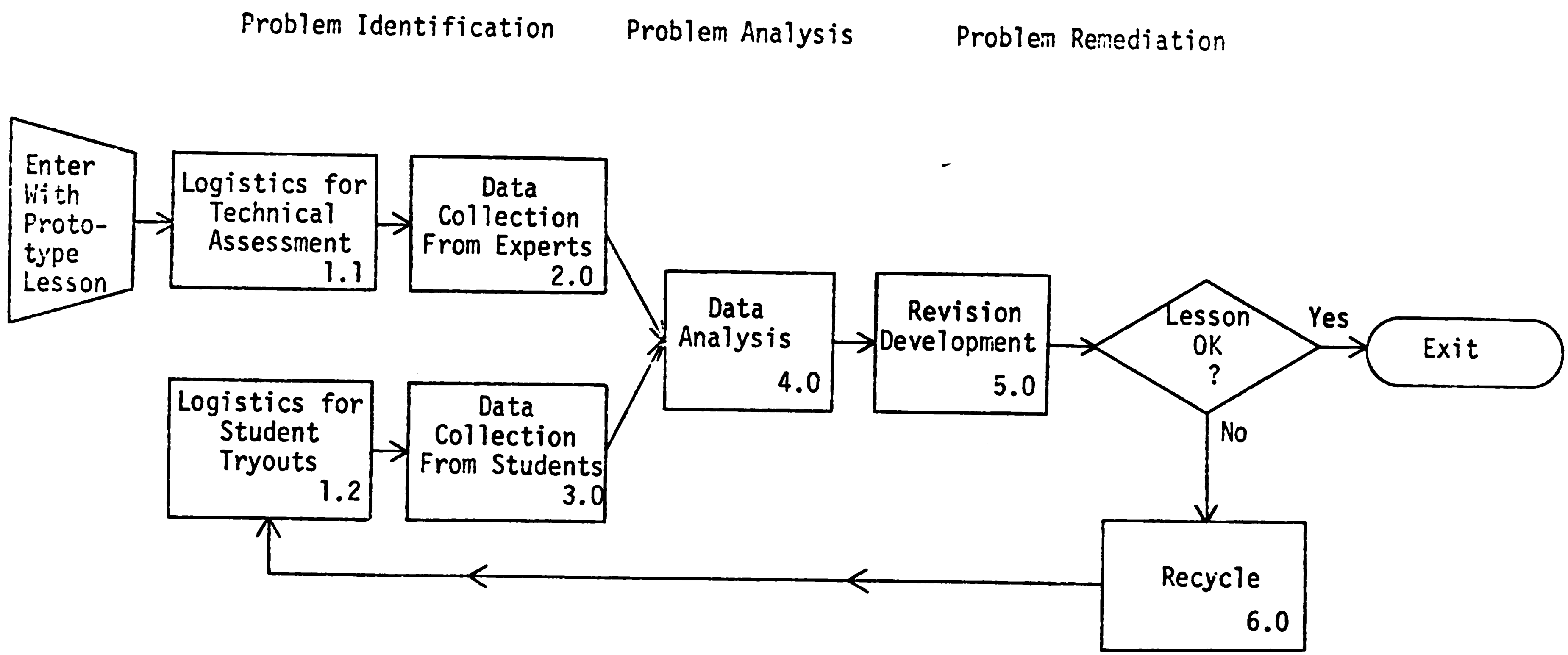


Figure A-24.--"Mini" Model (Abedor, 1971).

Figure A-25 is highly detailed and intended for use by consultants or with faculty who are intimately familiar with the "mini" version (p. 77). A detailed explanation of the "maxi" model was included in the Appendix section of the Abedor Study and is summarized in the following paragraphs.

The model begins with a prototype which specified that all the instructional materials have been completed without having obtained feedback from technical experts, or students of the target population (Abedor, 1971, p. 172). In Box 1.1.1 the evaluator must decide whether he wants feedback on technical problems in the form of a verbal debriefing, a written report, a rating scale, questionnaire, or other device. When these decisions have been made, three types of consultants--subject matter experts, media specialist, and evaluation specialist--are selected (Box 1.1.2) and briefed about the type of information desired and the format to use in obtaining feedback (Abedor, 1971, pp. 173-174). The prototype materials and content are then reproduced and distributed to the selected consultants (Step 1.1.3).

Step 2.0 reflects the technical review data required of the consultants as they interact with the prototype materials. The components are precise and relatively self-explained by the model.

The Collect Student Tryout Data Step (3.0) is performed chronologically after one complete cycle. The discrepancies in the prototype materials are analyzed (Step 4.0) on the basis of the feedback data. Deficiencies are then listed in rank order of their seriousness (Step 4.1), after which a tradeoff analysis is conducted to determine the rank order of the problems, assess the probable causes, and select a feasible

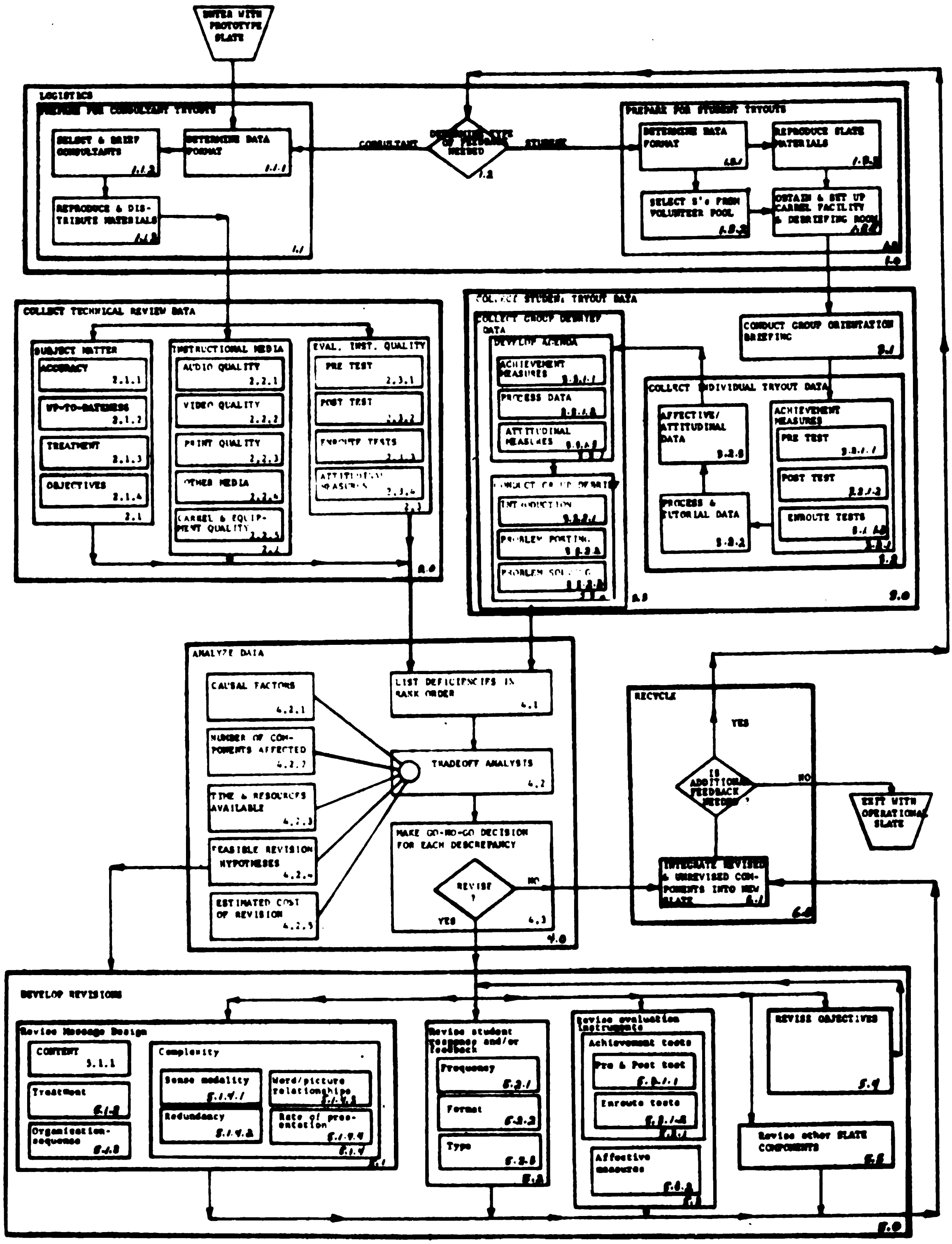


Figure A-25.--"Maxi" Model (Abedor, 1971).

solution within the constraints of the formative evaluator's resources and ability. For those problem and solution thus selected, a decision is made to "go," to commit additional resources to remediation, and the process enters the DEVELOP REVISION stage. For those problems which did not warrant revisions, e.g., a "no-go" decision, the process enters the RECYCLE step (Box 6.0) which asks the question: Is the prototype material ready or is additional feedback warranted? (Abedor, 1971, pp. 184-185).

At this point in the process, the formative evaluator must develop revisions (Step 5.0). Content and the treatment related to overall style of presentation, e.g., inductive, deductive, humorous, satiric, or expository, are submitted to revision in message design on the basis of feedback from students during the debriefing. Thereupon, the message complexity is evaluated to assess whether or not there is information overload to a learner's information processing capacity. Some dimensions of message complexity are sense modality, redundancy, word/picture relationships, and rate of presentations. Sense modality refers to whether the audio and visual sense modalities are used simultaneously or sequentially. Redundancy is the repetition of an idea with a sense modality. Word/picture relationships are examined to insure that either words or pictures are related and do not dominate or compete with each other in the message. Rate of presentation is defined as words per minute or visuals per minute, irrespective of language difficulty or visual complexity, or idealogical content of the message. The best source of information on the rate of presentation is the learner (Abedor, 1971, pp. 186-187).

Box 5.2 deals with frequency of response, format for responding, and response type. In general, responses and feedback should be frequent enough so that the learner is aware of his progress and deficiencies. Again, the student debriefing is the ideal source of information to determine optimal response/feedback frequency. A response and feedback can be accomplished in a number of ways: erasing answer sheets, write-in, multiple choice, or a motor performance. Response type may be classified as "enabling" or "criterion." Enabling responses are designed to allow the student practice on the component learning tasks. Success on enabling responses followed by a failure on "criterion" responses indicates insufficient practice (Abedor, 1971, p. 189).

The final step is to revise evaluation instruments, objectives, or the materials depending on the feedback obtained from the debriefing.

The validation strategies of the "mini" and "maxi" versions of the MK II model are of significance to the instructional developer who is looking for specific methods of testing prototype materials. For example, the variables for collecting technical review data are not specified as clearly in other models as in the Abedor study. There are no apparent weaknesses in the process other than the difficulty, in some cases of instructional development, of getting a representative sampling population of students to validate materials. Often, students are not readily available, or time will not allow this kind of careful validation procedure called for in the model. Ideally, the strategies for prototype materials validation are excellent.

APPENDIX B

PRINCIPAL AND NON-PRINCIPAL TEST ITEMS IDENTIFICATION FOR WRITTEN CERTIFICATION EXAMINATION

APPENDIX B

Michigan Breathalyzer Operator Certification Examination 1971-1972

Principal Test Items (Numbers)		Non-Principal Test Items (Numbers)	
White Test Form	Pink Test Form	White Test Form	Pink Test Form
4	1	1-3	2
7	4	5	3
8	9	6	5-8
9	10	10-18	11-15
19	16	21	18-20
20	17	22	22
23	21	24	24
25	23	28-34	26
26	25	37-39	27
27	28	41	29
35	31	42	30
36	32	48	34-36
40	33	49	38-40
43	37	51-53	42-44
44	41	55	46
45	45	57-60	48
46	47	62	50
47	49	67-70	51
50	52	75-78	53
52	55	80	54
54	60	81	56
56	62	83	57-59
61	64	84	61
63	67	85-87	63

continued

Principal Test Items (Numbers)		Non-Principal Test Items (Numbers)	
White Test Form	Pink Test Form	White Test Form	Pink Test Form
64	69	97-100	65
65	70	103-106	66
66	71	112	68
71	74		72
72	76		73
73	78		75
74	79		77
79	80		82
82	81		83
83	84		89-91
88-96	86-88		93
101	92		95
102	94		96
107-110	97		98-100
113	101		103
114	102		104
	104		106
	105		112
	107-111		
	113-115		

APPENDIX C

LABORATORY CHECKLIST

APPENDIX C

MICHIGAN BREATHALYZER OPERATOR
TRAINING PROGRAM

Laboratory Evaluation Sheet

Name____ Date____________

Department____

s = satisfactory
n = need improvement
u = unsatisfactory

Simulator Preparation

1. Rinse flask____________________
2. Handle vial cap carefully____________________
3. Rinse out vial twice____________________
4. Replace vial cap when rinsing____________________
5. Level of meniscus____________________
6. Mix solution properly____________________
7. Recheck level of meniscus____________________
8. Rinse flask when finished____________________
9. Wet rubber gasket____________________
10. Check simulator for leak____________________
11. Check temperature of simulator____________________
12. Equilibrate simulator____________________
13. Place mouthpiece between simulator and breathalyzer____________________
14. Adequate sample____________________

Breathalyzer Operation

15. Fill in preliminary information on test form____________________
16. Check galvanometer lock____________________
17. Zero galvanometer if needed____________________
18. Check temperature____________________
19. Read both ampoules____________________
20. Record control number____________________
21. Gauge both ampoules____________________
22. Wipe both ampoules clean____________________
23. Leave ampoule in gauge when breaking____________________
24. Use protection when breaking____________________
25. Properly dispose of ampoule cap____________________
26. Regauge test ampoule____________________
27. Handle bubbler tube properly____________________
28. Check length of bubbler tube____________________
29. Proper adjustment of b ubbler tube____________________
30. Balance from left to right____________________

continued

31. First pointer setting__________
32. Proper timing purge__________
33. Adequate purge__________
34. Second pointer setting__________
35. Recognized "bad" sample__________
36. Replace breath tube__________
37. Proper timing-sample__________
38. Interpret reading properly__________
39. Record reading__________
40. Sign report form__________
41. Remove test ampoule and bubbler__________
42. Replace rubber sleeve__________
43. Dispose of test ampoule properly__________
44. Remove comparison ampoule__________
45. Flush out instrument when finished__________
46. Turn selector valve to "OFF"__________
47. Move carriage to left__________
48. Use of check list:
    - Delayed start__________
    - Ahead or behind with checks__________
    - Does not check properly__________
    - Other__________

Comments & Recommendations:

____

Examiner

APPENDIX D

ATTITUDE TOWARD INSTRUCTIONAL DEVELOPMENT

RATING SCALE

APPENDIX D

Check One

Male ☐

Female ☐

Check One

Teacher ☐

Administrator ☐

Specialist ☐

ATTITUDE TOWARD INSTRUCTIONAL DEVELOPMENT*

Definitions

Instructional Development or I.D. is a systOm approach to solving instructional problems. It involves a definition stage where the problem and all related instructional elements and resources, including management organization are identified; a development stage where the behavior necessary to solve the problem is specified in measurable terms and a prototype learning experience is developed which employs the most effective methods and media that learning theory and practical experience can suggest; and finally, it involves a testing and application stage where the prototype system is tried out and revised repeatedly until some version(s) successfully teaches the desired behavior. Only then is the resulting system used by teachers who have been thoroughly trained to use it properly with qualified learners.

Instructions

When you answer the following statemynts please try to express the way you honestly feel about this idea of instructional development or I.D. Your answer is correct if it expresses your true opinion. PLEASE ANSWER EVERY ITEM. In each case encircle the letter which represents your own ideas as follows:

SA if you agree completely with the statement
A if you agree in general but wish to modify it somewhat
U if your attitude is undecided
D if you disagree but with certain modifications
SD if you completely disagree

*Produced under a grant from the U.S. Office of Education, Bureau of Libraries and Educational Technology, Division of Educational Technology, Media Specialist Program. Produced for the National Special Media Institutes by Jack V. Edling.

Unit 10 Module 3

1. I.D. should be a part of the professional preparation of all teachers.	SA	A	U	D	SD
2. I.D. places too much emphasis on programming, media and technology.	SA	A	U	D	SD
3. I.D. makes one realize that you have to be specific on problems and objectives to communicate effectively.	SA	A	U	D	SD
4. I.D. really gives primary consideration to the learner's needs.	SA	A	U	D	SD
5. I.D. is a waste of time.	SA	A	U	D	SD
6. I.D. is so significant that it is urgent to promote its wide adoption.	SA	A	U	D	SD
7. I.D. allows each child to start from where is is and progress as far as he is capable.	SA	A	U	D	SD
8. I.D. enables children to find capabilities within themselves that they wouldn't have been able to find without it.	SA	A	U	D	SD
9. I.D. is nothing new.	SA	A	U	D	SD
10. I.D. seems like a better solution to our problems than anything else currently being considered.	SA	A	U	D	SD
11. I.D. will be ineffective unless all members of a team have a thorough understanding of the system and are committed to it.	SA	A	U	D	SD
12. I.D. is a flexible approach that allows for expansion and change.	SA	A	U	D	SD
13. I.D. is simply the old problem-solving method.	SA	A	U	D	SD
14. I.D. is the most challenging idea in education at the present time.	SA	A	U	D	SD
15. I.D. is the only really effective way to evolve a relevant curriculum.	SA	A	U	D	SD
16. I.D. requires too many alternatives to be practical.	SA	A	U	D	SD
17. I.D. enables the teacher to better see the purposes of his instructional program.	SA	A	U	D	SD
18. I.D. cannot be compared with traditional approaches to improving instruction.	SA	A	U	D	SD

19. I.D. will work only when everyone directly involved in instruction is favorable and familiar with it.	SA	A	U	D	SD
20. I.D. requires concentrated effort at first but it becomes less demanding as it becomes better understood.	SA	A	U	D	SD
21. I.D. is something every educator can use.	SA	A	U	D	SD
22. I.D. enables people to better work together to meet the needs of students.	SA	A	U	D	SD
23. I.D. enables teachers to develop new and more effective methods for meeting student needs.	SA	A	U	D	SD
24. I.D. may have some advantages but I haven't been sold completely on it.	SA	A	U	D	SD
25. I.D. is the most productive in-service training that I can conceive.	SA	A	U	D	SD
26. I.D. is the best answer yet for teachers who are looking for an objective method for attacking curriculum problems.	SA	A	U	D	SD
27. I.D. is a boring and uninteresting activity.	SA	A	U	D	SD
28. I.D. is the means to reduce the gap between "what is" and "what should be."	SA	A	U	D	SD
29. I.D. provides a means for "getting a handle" on the problems facing school districts.	SA	A	U	D	SD
30. I.D. can be the change agent that will elevate us from the morass of problems that blind, confuse and befuddle us.	SA	A	U	D	SD
31. I.D. is fine but I couldn't do it by myself.	SA	A	U	D	SD
32. I.D. is right on target--there is no better way or more opportune time than to move on it right now.	SA	A	U	D	SD
33. I.D. enables you to get the most effect for the money available.	SA	A	U	D	SD
34. I.D. has recognized and structured a systematic way to resolve problems and all educators should become committed to it.	SA	A	U	D	SD
35. I.D. is a giant step forward.	SA	A	U	D	SD

36. I.D. really makes one think about all aspects of the educational task.	SA	A	U	D	SD
37. I.D. provides a method to assess the goals of an instructional program realistically in terms of available resources.	SA	A	U	D	SD
38. I.D. has taken curriculum improvement from the abstract to tangible evidence in dealing with educational objectives.	SA	A	U	D	SD
39. I.D. is a procedure that will result in the improvement of an instructional program.	SA	A	U	D	SD
40. I.D. is long overdue -- think of how many children we have failed and blamed them for their failure.	SA	A	U	D	SD
41. I.D. is a "must" for every administrator who assumes the role of instructional leader.	SA	A	U	D	SD
42. I.D. helps teachers who have had little training on how to plan systematically.	SA	A	U	D	SD
43. I.D. and the resulting more systematic instruction has become essential since the educational process has become so complex.	SA	A	U	D	SD
44. I.D. is not an end in itself, but simply a means that educators can and must use to update schools.	SA	A	U	D	SD
45. I.D. is the best alternative we have to accomplish the task at hand.	SA	A	U	D	SD
46. I.D. seems to be the way to go.	SA	A	U	D	SD
47. I.D. is essential to get the support so often refused because we're always dealing with generalities.	SA	A	U	D	SD
48. I.D. is what we have been needing for years.	SA	A	U	D	SD
49. I.D. will succeed because it places primary emphasis on the learner and learning.	SA	A	U	D	SD
50. I.D. is the nearest thing we have to a panacea in education.	SA	A	U	D	SD

<u>Idaho Falls</u> (August 9-14, 1971)

Attitude Tests

n = 57
M = 188.2
R = 102 → 244
S.D. = 3.4

<u>Chemawa</u> (August 23-28, 1971)

Attitude Tests

n = 68
M = 190.14
R = 74 → 234
S.D. = 3.03

<u>Baton Rouge</u> (August 5-10, 1971)

Attitude Tests

n = 51
M = 174.26
R - 103 → 234
S.D. = 4.84

<u>Albuquerque</u> (February 8-16, 1972)

Attitude Tests

n = 39
M = 201.35
R = 142 → 250
S.D. = 3.48

<u>Albuquerque #2</u> (February 29, March 1-3, 6-8, 1972)

Attitude Tests

n = 37
M = 186.7
R = 135 → 239
S.D. = 4.28

<u>Bucknell</u> (January 7-9 and 14-16, 1972)

Attitude Tests

n = 31
M = 201.5
R = 147 → 240
S.D. = 4.04

<u>East Greenbush</u> (November 12 and 13, 16-20, 1971)

Attitude Tests

n = 32
M = 199.87
R = 167 → 244
S.D. = 3.5

<u>Jacksonville #1</u> (November 8013, 1971)

Attitude Tests

n = 24
M = 203
R = 153 → 237
S.D. = 4.44

<u>Jacksonville #2</u> (February 15-18 and 21-23, 1972)

Attitude Tests

n = 34
M = 214.2
R = 166 → 243
S.D. = 2.74

<u>Mt. Edgecumbe</u> (November 10-12 and 15-18, 1971)

Attitude Tests

n = 35
M = 198.9
R = 135 → 234
S.D. = 4.19

<u>Plattsburgh</u> (October 25-30, 1971)

Attitude Tests

n = 35
M = 207
R - 169 → 242
S.D. = 2.43

<u>Richmond</u> (November 15-19 and 22-23, 1971)

Attitude Tests

n = 27
M = 210.6
R = 183 → 246
S.D. = 3.66

<u>Pocatello</u> (August 16-21, 1971)

Attitude Tests

n = 45
M = 188.9
R = 154 → 226
S.D. = 2.52

<u>Mobile</u> (April 25-29, 1972)

Attitude Tests

n = 20
M = 202.0
R = 171 → 241
S.D. = 3.95

Gallup (April 24-29, 1972)

Attitude Tests

n = 44
M = 198.7
R = 148 → 241
S.D. = 2.98

San Jose (March 23, 24, 27-30, 1972)

Attitude Tests

n = 21
M = 199.2
R = 93 → 232
S.D. = 6.57

Statesboro (February 17-18, 21-25, 1972)

Attitude Tests

n = 27
M = 213.19
R = 158 → 244
S.D. = 4.8

Toledo (January 24-28, 31 and February 1, 1972)

Attitude Tests

n = 30
M = 190.5
R = 151 → 209
S.D. = 2.94

Union Endicott (January 10-15, 1972)

Attitude Tests

n = 43
M = 208.5
R = 172 → 240
S.D. = 1.57

APPENDIX E

CLIENT'S OPINION TOWARD INSTRUCTIONAL DEVELOPMENT

RATING SCALE

APPENDIX E

Client's Opinions Regarding Instructional Development

DIRECTIONS: Please indicate your opinion of your level of understanding and/or use of the instructional development process at the time of your entry (before October, 1971), and at the present time June, 1972) by writing the appropriate number (see the numbers given below) in the proper spaces following each item listed below.

The meanings of the numbers are:

1. You knew (or know) its meaning and/or how to execute this step of the instructional development process.
2. You knew (or know) its meaning and/or how to execute this step of the instructional development process to a considerable degree.
3. You knew (or know) its meaning and/or how to execute this step of the instructional development process only moderately well.
4. You knew (or know) its meaning and/or how to execute this step of the instructional development process only partially.
5. You did not (or do not) know its meaning and/or how to execute this step of the instructional development process.

EXAMPLE:	Your Opinion of Your Performance Level at	
As a result of the experience(s) I have had with instructional development, I feel I know (or knew):	Entry	Exit
0. That instructional development is a process which takes a great deal of time.	5	1
1. How to identify and/or write broad instructional goals.	___	___
2. How to identify useful sources of data for decision-making on instructional problems, i.e., staff reports, staff and learner interviews, monitoring instruction using audio and/or video tapes, statistical analysis of tests, examining course materials, etc.	___	___

	Your Opinion of Your Performance Level at Entry	Exit
3. What is meant by the term organize the management.	___	___
4. Who the individuals were (or are) who comprised the management during the instructional development with the BOTP.	___	___
5. How to distinguish between symptoms of a problem and the problem itself.	___	___
6. How to analyze the discrepancies between what is and what should be when identifying the problem.	___	___
7. What is meant by preassessment of entry skills.	___	___
8. How to preassess the entry skills of learners using a terminal behavior test.	___	___
9. What a terminal behavior pretest is.	___	___
10. What is meant by a behavioral objective.	___	___
11. How to write behavioral objectives which describe what the learner will be doing at the end of instruction, the conditions under which he will do them, and the criteria of successful performance by the student.	___	___
12. What is meant by task analysis.	___	___
13. How to do a task analysis.	___	___
14. What is meant by a task description.	___	___
15. How to write a task description.	___	___
16. What the essential questions to ask when doing a task analysis.	___	___

	Your Opinion of Your Performance Level at	
	Entry	Exit
17. What is meant by a technical and communications review for instructional materials.	___	___
18. What factors to consider when doing a technical and communications review during instructional development.	___	___
19. What an enabling objective is.	___	___
20. What the difference between enabling and terminal objectives is.	___	___
21. What is meant by analyzing the instructional setting, i.e., learner characteristics, physical facilities, instructional materials available, staff and support personnel.	___	___
22. What is meant by a prototype test.	___	___
23. How to construct a prototype test.	___	___
24. How to select the media form to use with the type of instruction planned.	___	___
25. What support services have to be checked out prior to instruction, i.e., scheduling of equipment and materials, availability of paraprofessional support personnel, instructional materials available.	___	___
26. How to evaluate the achievement of the instructional program.	___	___
27. That the instructional development process is non-linear.	___	___
28. What is meant by recycling in the instructional development process.	___	___

APPENDIX F

CLIENT'S POST-ATTITUDE QUESTIONNAIRE

APPENDIX F

QUESTIONNAIRE

DIRECTIONS: Please use your experiences with the instructional development process as the basis for responding to the following questions. If you need more space than is provided, continue your response(s) on the back side of the page.

1. What instructional development plans, if any, do you have for modifying or changing the Breathalyzer Operator Training Program.

2. Have you attempted to convince others of the value of the instructional development process?

   ___ Yes ___ No

   Explain briefly who and why.

3. What were the most effective instructional development changes made in the Breathalyzer program during the past several months?

   Explain why.

4. What were the least effective instructional development changes made in the Breathalyzer program during the past several months?

   Explain why.

QUESTIONNAIRE (cont'd)

5. What other instructional development, if any, do you plan to get involved with as part of your responsibilities with the Highway Traffic Safety Center?

6. What aspects of the instructional development process have been the most difficult for you to understand and/or to execute effectively and why?

7. What are your present impressions of the instructional development process?

8. What do you see as the main value, if any, of the instructional development process?

9. With which, if any, of the instructional development process steps do you have reservations and why?

10. Would you say that your present attitude toward the instructional development process is:

    _____ For the most part positive

    _____ For the most part neutral

    _____ For the most part negative

    What reasons do you have for feeling this way about the instructional development process?

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