HUMAN INFORMATION PROCESSING, LOCUS OF PERCEIVED CONTROL, AND INTRINSIC-EXTRINSIC MOTIVATION AS RELATED TO SUCCESS AND ATTITUDE IN A PROGRAMMED COURSE OF INSTRUCTION

Thesis for the Degree of Ph. D.

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THOMAS E HARRIES

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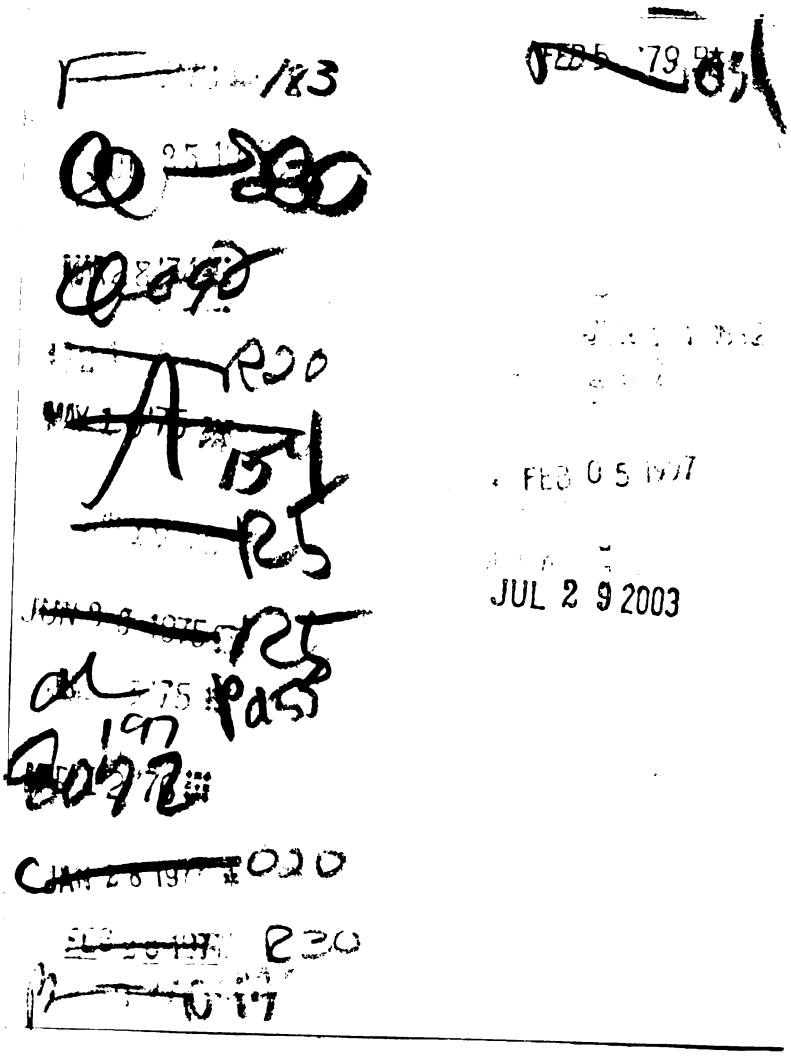

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ABSTRACT

HUMAN INFORMATION PROCESSING, LOCUS OF PERCEIVED CONTROL, AND INTRINSIC-EXTRINSIC MOTIVATION AS RELATED TO SUCCESS AND ATTITUDE IN A PROGRAMMED COURSE OF INSTRUCTION

By

Thomas E. Harries

The research question asked in this study concerns whether or not the effect of student entry behaviors (independent variables)--level of information processing, locus of perceived control, and intrinsic-extrinsic motivation--will be related to student interaction with a programmed cognitive structure as measurable on the following dependent variables--final exam grade on a criterion test, student attitudes toward the programmed course compared with student attitudes toward college level instruction in general, and GPA.

A preliminary study verified that student performance after using the program was significantly ($p<0.01$) improved over conventional instruction, even after the effects of student abilities were removed. The high level of performance attributable to the programmed structure was found to be consistent and stable over several quarters, and thus could be assumed to be a stable base for the main study.

The main study was conducted with a random sample of 50 students (98 per cent female) in HED 171, Basic Consumer Textiles, for which the programmed text had been designed.

The principal findings were:

1. Student attitudes significantly increased in favor of the programmed course over college-level instruction ($p<0.001$).
2. Locus of control was significantly correlated with attitude toward college-level instruction ($p<0.01$), with externals having more negative attitudes compared with students who were internally controlled.
3. There was no correlation between any of the experimental variables with performance in the course, nor with attitude toward HED 171. For the locus of perceived control variable, the effect was attributed to the effect of the programmed cognitive structure.
4. Findings relative to the motivation variable were indeterminant due to methodological inadequacies attributable to the measuring instrument.
5. Failure of the information-processing variable to correlate with the variable of general attitude was attributed to information processing being a multidimensional variable correlated with a unidimensional attitude measuring instrument.

Given the effect of the programmed cognitive structure in significantly increasing performance, in generating consistent positive affect, and in overcoming the negative

effect on externally controlled students, some heuristics for designing instructional prototypes followed by the HED 171 programmed instruction format are suggested.

Based upon the experience in applying the experimental variables of information processing and locus of perceived control motivation to the programmed cognitive structure, recommendations for future research are suggested since these variables are thought to have promise of increasing knowledge of individual differences in student learning environments.

The principal emphasis for future research is based upon dissatisfaction with traditional use of group means to attempt to generalize on multidimensional variables. The suggestion is made that future research using such multidimensional variables use Q-methodology or related approaches, which investigate individual differences, rather than the traditional treatment forms, which yield results based solely upon group means.

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By

Thomas E. Harries

A THESIS

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Michigan State University
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College of Education
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DEDICATED TO

THE STUDENTS OF HED 171

Who contributed in full measure, in fact to many varied measures, such that this study became possible.

May their contribution not be lost on students of the future.

ACKNOWLEDGMENTS

TO: Nancy Garrison Harries; seatmate and fellow traveler on the Good Ship Earth....
who made substantive professional contributions to my professional and intellectual development....
who showed patient understanding of factors relating to stress and strain well beyond the call of duty (i.e., who picked me off the wall on innumerable occasions)....
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CHAPTER I

THE STATEMENT OF THE PROBLEM

Statement of Research Question

The research question investigated in the study asks: "How will a human being interact with a programmed cognitive structure (sequence of programmed instruction) if the human being is defined by the constructs of: (1) level of information-processing ability, (2) nature of motivation (intrinsic-extrinsic), and (3) locus of perceived control (internal-external)?" These entry behaviors or independent variables are examined through their interaction with and their effect upon the dependent variables of: (1) attitude toward college-level instruction in general, (2) attitude toward the programmed instructional sequence in particular, and (3) performance on a standardized criterion test. In general, the study reflects a change in emphasis away from content variables, or how much of what information a student learns, to an interest in process variables, or how the structure and processing of information relate to student attitudes and performance. Following is an introduction and a discussion of some current criticisms of education in general and programmed instruction research in particular, which

suggest a need for a change in emphasis from content to process variables.

Introduction

This chapter proceeds according to the following outline: first, the research question which has been stated is related to some criticism of the status quo in contemporary educational practices. The author interprets this criticism in a way that suggests that the information-processing emphasis being undertaken in this thesis can be useful in helping overcome that criticism. Then research which summarizes some criticism of contemporary research emphasis on programmed instruction is briefly cited in support of the information-processing emphasis of this thesis.

After a general definition of terms, the concept of "structure" is developed as it applies to information-processing variables used in this thesis, and the philosophical assumptions of the thesis are set forth. Research is then cited in the following areas of programmed instruction: programmed instruction compared to conventional textbooks, instructor-determined sequencing, and student-determined sequencing of instruction. The chapter concludes with a brief summary.

General Criticism of Content Emphasis in Education

American educational practices have come under an increasing variety of articular and scholarly criticism, beginning with Goodman (1962) and as recently as Silberman (1970).

Goodman (1962) said of American academic life:

> The objective culture that we have inherited is by now, total confusion; and certainly there is too much of it for anybody to cope with. As if this were not bad enough, the young are kept from learning by rules, task work, and extraneous distractions. They have no conversation and they meet no veterans. (p. 339)

Silberman's (1970) critique amounts to a tour de force of data in support of his claim that, in addition to a certain amount of plain malpractice, there is an absence of relevance in today's schools in comparison to apparent needs of society. In recent years some criticism has become more emotional, but just as articulate, as in the case of a writer such as Farber (1969). Much of contemporary educational criticism can be traced to dissatisfaction (consciously or unconsciously expressed) with the implications of the dominant content-oriented approach. Postman and Weingartner (1969) suggested the need for a "crap detector" to be trained into each student. Rather than simply being able to quote facts, "crap detecting" calls for the ability to process accurately and flexibly a variety of information from the high-information environment in which we live. McLuhan (1962, 1965) suggested that we live in a high-information "global village." He asserted that the information level in the classroom is lower than the information level in the external world, and that students can view the classroom as an interruption in their education. Glasser (1969) expressed his concern for a negative by-product of our content-oriented educational emphasis:

> When easy answers don't work or don't fit, they [students] avoid the issues altogether. To counter the avoidance of intellectual challenge and responsibility, we must reduce the domination of certainty in education. As long as we look at students as empty vessels to be filled with facts, as long as we train them to be computers to give us predictable answers to predictable questions, we are building into the most basic institution of democracy, the educational system, the seeds of its own destruction. (p. 44)

A need for process- rather than content-oriented instructional systems is increasingly being expressed. Berman (1968) stated:

> It is our assumption that all persons are process oriented to some degree and can become more so through planned experiences. Furthermore it is our assumption that it is "good" for persons to have some degree of process orientation. (p. 9)

Likewise, Schroder, et al. (1972) stated even more strongly:

> If our democratic form of government is to survive and prosper in this new age, American education must prepare our children to cope with freedom. It can accomplish this by teaching our youth how to think. (As we will emphasize later, the capacity to think should not be confused with the amount of knowledge a student acquires.) The ability to think -- to cope with problems, to seek information and uncertainty, to process information in new and meaningful ways -- is learned. The development of this creative talent cannot be left to chance. It must become the central goal of education in a new problem oriented, interdisciplinary pedagogical environment. (p. 2)

Schroder differentiated between content learning and process learning. Content learning is concerned with what and how much a person knows. Process learning is concerned with how a person thinks, how he structures what he knows, and how flexibly and creatively he can modify and manipulate the content structure.

A number of advantages can be gained, according to Schroder, et al. (1972), by following an information-processing approach to meeting some of the contemporary criticisms of education. The most important advantage, from the point of view of this study, concerns the trained, heuristic generating ability of a person to exhibit novel, creative behaviors which are appropriate in the context of the situation which generates them. In addition, there may be advantages to be gained from a fresh approach to programmed instruction research in shifting from content variables to process variables.

Criticism of Current Research on Programmed Instruction

Although the author wishes to look at foundation variables concerned with the process ability, a review of the literature verifies that the major research interest with respect to programmed instruction has been concerned with content variables. Where individual differences are looked at, they are usually examined in relation to content variables, rather than in relation to personality variables (Lumsdaine, 1965; Goldstein, 1964). Even the 1965 revised statement on specifications for programmed instruction (by the Joint Committee on Programed Instruction and Teaching Machines, 1966) made no direct suggestion that developers of programmed instruction demonstrate an accountability for individual differences relating to more process-oriented personality variables which could have interactive effects

with the programmed cognitive structure. Markle (1971), in the most recent summary of the state of the art of programmed instruction, likewise saw process more as a design function, rather than as a variable having as important an effect on the student as content variables. She stated:

> The programing of instruction is a process of designing instructional materials and systems which result if followed to its full extent in a rationally constructed, and empirically validated product or set of procedures. (p. 293)

The product, of course, relates to a content structure. Markle cited five steps which define the programmed instruction. These steps can be seen to relate more easily to content factors than to process factors.

1. Determining the objectives of instruction in order to (a) describe an observable performance of a student who has completed the instruction; (b) make clear the conditions under which the student will demonstrate mastery of the material; and (c) establish a standard of acceptable performance.
2. Designing and evaluating the "criterion measures" which would rate students individually on a scale of attainment of the desired knowledge or behavior.
3. Testing potential student groups to learn their characteristics which will determine, in turn, the design of the lesson.
4. Selecting instructional media and preparing instructional material in draft form.
5. Refining the product through tryouts with individual students until effectiveness reaches satisfactory levels. The process is then continued with increasingly large groups of students until effectiveness proves satisfactory in approximately "real" situations. The materials are then finally "validated" by publication of a complete description of their performance in terms of their effect on specified groups of students under carefully described conditions. (p. 293)

The question at issue in this thesis turns on the implication of the third step, which has to do with the entry

behavior of the students, and on the fifth step, which concerns the criteria selected for validation of the programmed instruction. There is a substantial body of research on the third and fifth steps; this research was reviewed by Stolurow (1969):

1. General intellectual ability compared with KR (knowledge of results): Little, 1934; Porter, 1961; Eigen, 1962.

2. Aptitude compared with sequencing of frames: Cartwright, 1962; Smith, 1962; Stolurow and Davis, 1965.

3. Personality compared with the nature of evaluation: Silberman, et al., 1962; Frase, 1963; Parisi, 1965.

With the exception of the third group, all of these studies examine content implications rather than processing implications. Studies in the third group, which look at individual differences in terms of personality, are significantly in the minority. Further, such studies are done in isolation from other individual difference variables, since typically entry behavior investigations are almost universally content oriented, i.e., focusing upon how much of the requisite behavior the student already possesses, rather than upon how well the student is equipped to identify and process relevant content data. Stolurow (1969) wrote:

> Unfortunately, there is no base rate from other areas of education with which to make comparison of the proportion of studies revealding n.s.d. (no significant difference) between the conditions compared. . . . A serious methodological question here is failure to include individual variables such as aptitude, personality and interests in the design of the study which could be used as correlates of learning sources. (p. 1020)

Stolurow's statement echoes a concern expressed earlier in critiques by Meierhenry (1964), Schramm (1964), and Lange (1967). The author could find no study which was directly concerned with information processing in interaction with programmed instruction.

Even where content variables are at issue, a study by Davis, Marzocco, and Denny (1970) led them to raise important questions suggesting the need for a change in research emphasis on programmed instruction. They summarized some present frustrations that are experienced when a rigorously controlled study fails to turn up significant relationships among content-based variables.

The writers looked at modes of presenting programmed instruction, comparing performance with a wide range of individual differences on entry skills in traditional areas: e.g., scores on Michigan State University (MSU) English Placement Test, MSU Reading Test, College Qualification Test, MSU Arithmetic Placement Test, MSU Mathematics (Algebra) Test, and three nonstandardized tests of special abilities: Memory, Arithmetic Operations, and Search Task Tests.

After their analysis, they found only one area which they felt would permit a "weak generalization that poorer readers do best under covert conditions whereas good readers do best when they respond overtly." (p. 201)

The authors suggested that there may have been a negligible difference in their treatment variables (overt versus covert response, feedback versus lack of feedback,

etc.). Also, they stated a more fundamental criticism:

> In programed instruction, a given independent variable may be defined in widely different ways. Obviously, in the final analysis, the experimental situation defines the independent variable manipulated. But any impartial review of the literature of programed instruction reveals that experimenters mean quite different things when they employ precisely the same terms to describe their experimental conditions, and it is extremely difficult (if not impossible) to make valid generalizations across different studies on the basis of the concepts used. (p. 203)

They concluded:

> Along with a number of psychologists today, we question the utility of measures of general intelligence for prescribing instructional conditions. But, we would go beyond this. At least, for the conditions of this experiment and the population studied, a number of other more specific ability measures appear to be of questionable value. (p. 203)

It is for all of the above reasons, in part, that the author proposes to look at the process-oriented structural variables (cited on page 1) in interaction with programmed instruction, rather than to use the traditional content-based ability variables that Davis, Marzocco, and Denny and others suggested be questioned.

Definition of Terms

Following are basic terms and definitions that are used in this and subsequent chapters of the thesis:

A. Organization: Includes the following concepts (Ashby, 1968a,b):

1. Conditionality -- Any given structure exists in response to some other structure.

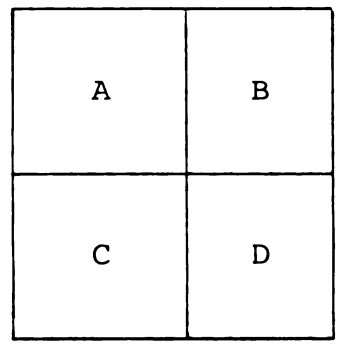
2. Reducibility -- Any given structure can be arbitrarily isolated as existing in reference to some other structure.

In this thesis, the organization of a person's information-processing structure is analyzed as it interacts with the structure of a sequence of programmed instruction (i.e., a particular cognitive structure).

B. Constraint: Constraint exists as the fact of a particular organization of structure, or the existence of a structure predetermines response or interaction in a manner specified by the nature of the structure (Ashby, 1956). In this thesis, a person's response to his environment is looked at in terms of: (1) information-processing style (i.e., a type of structure or constraint, defined below); (2) whether or not the person perceives the locus of control over his own behavior to be external or internal to himself (a type of constraint, defined below); or (3) whether the person's behavior is based on an intrinsic or extrinsic locus of motivation (a type of constraint, defined below).

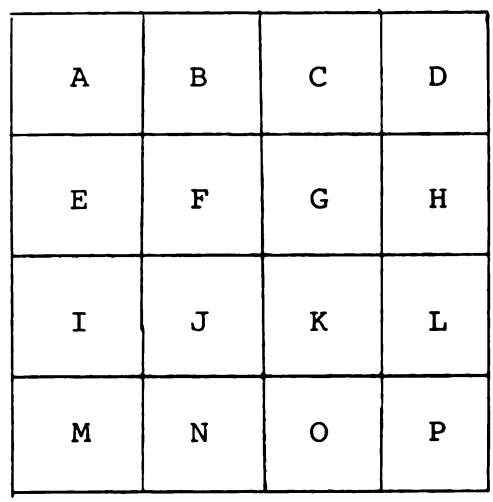
C. Variety: The converse of constraint. Variety refers to the number of distinct elements (complexity) in a given structure (Ashby, 1956). The greater the number of elements in a given structure or organization, the less severe the constraints existing within the

structure. Since organizations (structures) are in constant interaction with each other, this thesis asserts that when there is variety in human information processing, there is flexibility in coping with a given external structure. Figure 1 contains less potential "variety" than does Figure 2.



Constraint: A+B+C+D = X

Figure 1.--A simple structure.



Constraint: A+B+C...+P = X

Figure 2.--A complex structure.

D. Degrees of Freedom: A description of the relationship of variety and constraint in a given structure. Figure 1 illustrates a condition in which the structure has only three degrees of freedom. Given the stated constraints, "A," "B," and "C" (or any three) must be known before "D" (the fourth) is constrained. Figure 2, however, given its stated constraints, has 15 degrees of freedom. That is, "A," "B," ,C," ... "O" must all be determined before "P" is constrained to have a particular value. There is room for greater variety in Figure 2 than in Figure 1. In information-processing terms, a person (defined below as "concrete") who perceives the environment to be analogous to Figure 1 will perceive that he has fewer degrees of freedom to interact with the environment than will the person (defined below as "abstract") whose information-processing structure perceives the environment to be analogous to Figure 2. Thus, the Figure 2 type of person will perceive more available options, both in the interpretation of and in interacting with his environment.

E. Law of Requisite Variety: Describes the dynamic interaction of variety and constraint within a given system (structure) as defined by the larger structure in which it is embedded. To paraphrase Ashby (1956, p. 207), only variety (degrees of freedom) in one structure can force down the variety in another

structure. If a concrete person "A" (analogous to Figure 1) must interact with structure "B" (analogous to Figure 2), he will have fewer degrees of freedom, be less able to respond, will present more stereotyped response patterns, and will generally be more dysfunctional in interaction with the complex structure "B," than if the situation were reversed. One of the questions at issue in this thesis relates to the differential effects of a fixed cognitive structure (sequence of programmed instruction) on persons whose degrees of freedom, as evidenced by their information-processing structure, are variously like person "A" (defined later as System 1) or person "B" (defined later as System 4).

F. Bit: The amount of information which causes a reduction of uncertainty by one-half. Figure 1 contains two bits of information, if a person's task is to find efficiently, with 100 per cent certainty, which of the four cells (A, B, C, or D) contains a dot. That is, only two questions need to be asked to reduce most efficiently the uncertainty to zero:

1. "Is the dot in the top half?" (yes or no)
2. "Is the dot in the right half?" (yes or no)

Figure 2, however, contains four bits of information, hence greater degrees of freedom, but greater uncertainty. A human information-processing structure with considerable degrees of freedom can cope with

great amounts of uncertainty, since his variety of responses can be greater. In effect, the complex information-processing type of person is freer to ask questions of his environment than is a person whose perceptions (and hence whose alternatives) are under greater constraint. A person who perceives his alternatives to be constrained will need to simplify the environment and will tend to think along unidimensional constructs instead of multidimensional constructs. He literally will perceive fewer bits of information present in a structure than will the complex information processor. The use of the concept of "bit" is minimized in this thesis and is confined to the fifth chapter, where some potential applications of this concept are briefly discussed within the context of implications for future research.

G. Information Processing: As used in this thesis, the term refers to Schroder, et al.'s (1967) use of information processing. The concept is developed in detail in Chapter II, and the measurement is discussed in Chapter III. A person's ability to process the stimuli in his perceptual environment can be portrayed as ranging across a continuum from:

1. Concrete (simple), in which there are few perceived dimensions or alternatives in a given situation (i.e., a simple structure), with corresponding few degrees of freedom; to:

2. Abstract (complex), in which any given situation is perceived as having many dimensions and complex relationships and alternatives (i.e., a complex structure), with more degrees of freedom.

H. Intrinsic-Extrinsic Motivation: Intrinsic motivation refers to the inherent curiosity within an individual, which leads to exploratory, curious, or investigatory kinds of behavior which is satisfying in its own right, and is the end and not the means to an end. Extrinsic motivation is behavior which is the means to the end of obtaining rewards which have negligible or coincidental relationships to the behavior at issue.

I. Internal-External Control: Internal control is at one end of a continuum, in which a person believes that his own "self" is a principal causal agent or force in the world, and that events in the world and his own behavior can very much be under his own control. At the other end of the continuum is external control, in which individuals believe themselves to be mostly helpless to do other than respond to external forces, over which they have no direct control or hope of controlling.

J. Cognitive Structure: The internalized symbol system (and associated affect) of the external referent environment, also called "map" or "schemata." The cognitive structure represents a stable internal

reference which is subject to gradual modification, based upon perceived changes in external referents. A sequence of programmed instruction is one way of structuring a complex external referent system into a symbol system for facilitating internalization by the individual.

Theoretical Assumptions Followed in the Thesis

The information-processing model of man followed in this thesis is basically a cybernetic model. "Man" can be viewed as an organization or structure of functional entities coordinated by a neural structure. The neural structure and internal environment are the logical consequences of a millennium of interaction with the external environment in which it has been embedded (La Barre, 1954).

"Man" is a portion of the universe, perceiving a portion of itself with varying fidelity, with concomitant constraints, and with varying degrees of freedom. The neural (information-processing) structure can be conceived of as an internal map (structure) of the external environment (von Foerster, 1968). The input from the outside organization is internalized by the neural structure in such a manner that its internal structure or "map" or "schemata" is subsequently modified (Rosenzweig, et al., 1972). The structure of what is perceived is as much a part of the history of perception (including the genetic legacy within the neural structure) as it is of "what's out there" (Rock, 1966).

"Man" can be conceived of as an information-processing mechanism, constructed to facilitate the integration and differentiation of perceptual constructs of the external world (Kelly, 1955, 1964). The processing mechanism also operates as a function of intrinsic-extrinsic motivation, and, in response to experience, determines whether the locus of perceived control is internal or external.

A sequence of programmed instruction represents a specific kind of constraint or external structure. Individuals with varying levels of information-processing capability, intrinsic motivation, and locus of perceived control may interact in different ways with such a structure. In the following pages, research literature bearing upon programmed instruction as a structure is examined in comparison with a conventional textbook. Structure, as programmed by an instructor, is analyzed. Literature bearing upon structure, as organized by the student, is discussed. This research is discussed in terms of the reported traditional variables applied to programmed instruction and related, where appropriate, to the information-processing concepts under consideration in this thesis.

Structure: Programmed Instruction Compared With Conventional Texts

Leith's (1962) review of the literature led him to conclude that programmed instruction saves time over conventional texts, but produces no significant differences in performance as measured by a final exam. However, Pressy and

Kinzer (1964) reported that it took students eight times as long to complete a 1,710-frame section of the Holland-Skinner (1961) basic psychology program, as it did for a second treatment group to complete a 643-word summary of the same compartmentalized material. Further, the summary group scored higher on the post-test.

In an effort to resolve the contradictory data of these and other studies, Roderick and Anderson (1968), who questioned the methodological rigor of the Pressy experiment, conducted a study controlling or examining the following variables:

1. Student entry behavior (in content) at a low level.
2. Redundancy of steps in the Holland-Skinner (1961) program.
3. Immediate versus delayed post-tests.
4. Short-answer tests compared to multiple-choice tests.

The writers found that for college undergraduates, the results approximately replicated the Pressy findings, with scores of 83.9 per cent (programmed group) and 84.9 per cent (summary group) on the immediate post-test, with the programmed group taking approximately four times as long. However, with high school students there was a marked superiority of performance for the programmed group. The programmed group was also found to be superior to the summary group on the delayed post-test rather than on the immediate

post-test. This effect was held to be attributable to the additional practice given on the immediate post-test. The researchers found short answers gave results superior to the multiple-choice questions.

Daniel and Murdoch (1968) used the same Holland-Skinner (1961) program, and compared it with a textbook judged to be equivalent in content (Skinner, 1953). The variables in the Daniel and Murdoch experiment were:

1. Multiple-choice testing:
    a. Knowledge of specific content
    b. Knowledge of concepts
    c. Response to novel material
    d. Generalization to everyday life
2. Free-recall-format testing:
    a. Free recall to novel material
    b. Free recall as generalized to everyday life
3. Essay exams asking for a Skinnerian analysis of "value of money" and "treatment of fears"

The Daniel and Murdoch experiment generally demonstrated the superiority of the programmed text over the conventional text. The authors concluded that the specific content is better learned from the programmed text and that the superiority transfers better on the more abstract kinds of exams. All of the objective-type questions were found to be homogenous in their ability to account for the program/textbook differences. An analysis performed on the essay questions, however, suggested that for the essay exams,

knowledge of specific content and application to everyday life are not both able to account for the textbook differences, in that statistical significance was not achieved.

In regard to the above studies, assumptions about information processing could be stated in terms of the individuals who participated in the experiment. For example:

1. Given that there is increasing maturation of the neural structure with age (Piaget, 1946),
2. and that there is increasing structural capacity as the result of certain experiences (Schroder and Suedfeld, 1971),
3. and that a sequence of programmed instruction represents a kind of cognitive structure with elements of redundancy lacking in a comparable textbook,
4. it would be consistent to expect differential performance on the part of individual persons as a function of:
    a. age, given identical information-processing capacity, and
    b. information-processing capacity, for an identical age.

Each of the above studies can claim that "N" students perform at a certain level, but the data tell us nothing about the information-processing ability of students in interaction with the differential stimulus material.

Practice in writing responses serves to internalize external structure within the neural "map." This, in turn,

leads to improved performance on subsequent post-tests, as verified by Roderick and Anderson (1968). The findings are consistent with a study by Williams (1963), who found covert responding inferior to overt (greater internalization) responding.

Information-processing theory holds that more information processing would be required for students to construct open-ended responses to questions than to identify correct alternatives in multiple-choice items (a fixed structure), which is given support from Daniel and Murdoch's (1968) findings. However, the apparent inconsistency reported by that study, in which the investigators were unable to account for the difference between the textbook and programmed instruction on the one essay exam, is also consistent with information-processing expectations. On an essay exam, the internalized cognitive structure is freer to "float" so that more of the student appears in the written behavior. There is more likely to be a discrepancy between the more organized structure of the instructor and the less organized (by comparison) structure of the student, leading to inconsistencies of evaluation which would be difficult to account for on a strictly empirical basis. The greater flexibility of responses permitted by the essay exam would mask the possible effect of the very highly organized programmed structure, when compared with the less organized summary. Thus, it is difficult to attribute variance to either the programmed or the textual structure, or to the interpreter (instructor) of the essay exam.

In the context of this thesis, the author would ask different questions of the same data. For example, if a comparison is made between a highly structured cognitive structure (programmed) and a less organized structure (text):

1. Given a performance difference in either treatment, to what extent is there a correlation with the cognitive complexity or individual ability to process information?
2. To what extent is the student's integration of the cognitive structure (at any performance level) consistent with the student's level of intrinsic motivation with respect to the content material?
3. What effect would there be at any given performance level, to the extent that the student perceives control of his own life resides more within himself (internal control) than in the environment and over which he has little power (external control)?
4. Given differing levels of integrative complexity, intrinsic-extrinsic motivation, and locus of perceived control, what would be the nature of the affective involvement with the programmed cognitive structure as a function of performance?
5. To what extent can the internalized cognitive structure be expressed as creative applications by individuals with differing levels of information-processing capacity?

Comparison between a programmed sequence of instruction and a textbook sequence of instruction is one way of investigating the effect on students of differences in external structure and information. Another way is to compare the effect of organization of information when prestructured by the instructor, with the case in which the student is free to structure the information himself.

Structure: Instructor-Determined Order of Presentation in Programmed Instruction

Using Gagne and Brown's (1961) study of a guided discovery program, Brown (1970) sought to pin down the effect of sequencing variables in an instructional program.

Brown cited Niedermeyer's (1968) analysis, which summarized the conflicting data as to the effect of sequencing. The data supported the idea that sequencing is not an important variable in learning. Niedermeyer (1969) set forth three hypotheses, which were reviewed by Brown (p. 41); the hypotheses state that sequencing effects depend upon:

1. The nature of the subject matter being taught.
2. The learner's ability (high-ability learners can overcome the effect of poor sequencing more than low-ability learners can).
3. The age of the learner (according to Gagne, 1970, a student becomes more immune with age to the effects of poor sequencing).

The Brown study yielded the following findings:

1. Verbalizable skills and intellectual (nonordered) skills are learned in different ways.
2. For problem-solving tasks (ordered), high-ability subjects were better able to "unscramble" the information presented to them, and thus overcome sequencing effects.
3. Short programs are more immune to sequencing effects than are longer programs.

The findings are consistent with assumptions of information-processing theory. As stated in the third finding, there is less complexity in a short program; hence a person will have less difficulty in internalizing the programmed structure with his own cognitive scheme. For high-complexity levels, however, the full integrative ability of the individual is called to task; hence sequencing (structure) becomes more important, especially for those individuals who have information-processing structures that are relatively undeveloped or inflexible. Problem-solving tasks require a higher order of information processing; hence there should be more difference effects among individuals according to information-processing ability. Both the question of length of information sequence and those of application to various problem-solving tasks are fair game to the application of information theory.

Other studies of related variables to be manipulated by an instructor, such as "chunking" (Furukawa, 1970), "gap," "irrelevancies," and "masking" (Moore, 1968), can also be

investigated using information theory concepts. A study by Tobias (1969) is highly consistent with information theory expectations. Creative subjects learned more under all conditions -- there is a correlation between creativity and level of information processing, but not with creativity and intelligence (Schroder and Suedfeld, 1971); but the constructed response group achieved more on technical than on familiar subject matter. "Technical" information has a more novel structure than does the "familiar" structure which, by definition, is already well internalized. By requiring a person to construct responses (structure) to the technical information, there would be greater internalization of the novel information, according to information theory predictions. Such a requirement leads to the question of the effect of the student controlling the construction of his own internal structure.

Structure: Student-Controlled Order of Presentation

A first consideration would relate to the student's entry behavior as explicated through personality variables (related to information processing) rather than content competence.

A study by Ripple, et al. (1969), comparing students' use of conventional textbooks with programmed instruction, failed to show significant interaction effects among all personality variables (anxiety, compulsivity, and exhibitionism). An effect for "anxiety" was associated with lower

criterion scores. This effect is consistent with the information-processing research reported by Schroder (1967). Anxiety has the effect of temporarily reducing a person's information-processing level so that there would be less internalization of novel constructs. Student sequencing of information would allow the student an opportunity to control for anxiety, and could yield differential performance if taken into account.

Sutter and Reid (1969) reported another study which underscored the importance of looking at individual differences in terms of basic learner personality variables. They looked at individual differences in attitudes of students interacting with a sequence of computer-assisted programmed instruction. They found no significant differences in attitudes of students working together, compared with students working alone. However, when individual performance and attitudes were compared and then correlated with individual differences as defined by test anxiety, sociability, and dominance, significant differences among the subjects' attitudes were revealed in regard to performance and to their preference for working in association with certain personality types. Such studies (although few in number) justify the attention being given to personality variables in this thesis.

A second consideration relates to the dynamics of how students actually structure information when allowed to do so according to their own internal organization.

Beginning with a series of studies by Mager (1961), Mager and McCann (1961), and Mager and Clark (1963), the researchers demonstrated that student control of sequencing yielded (after initial student cynicism had abated): (1) higher levels of involvement than that found when cognitive structures are arranged for students by instructors, (2) that the students proceeded through the instruction sequence more quickly and with more internal cooperation than did a traditional class, and (3) the progress of the information acquisition or structuring progresses from integral structures of a simple nature to integral structures of a complex nature. This is a different phenomenon than the traditional assumption that learning progresses from discrete parts to integral wholes. The questions asked by students reflected a concern with how (in the overall structure) things are related (i.e., process questions), rather than with what makes something work (i.e., discrete questioning).

A series of experiments by Campbell (1964) supported the findings of Mager, et al., as did a series of studies by Grubb and Selfridge (1964).

Fry (1970) conducted an extensive review of the literature regarding programmed instruction prior to conducting his own investigation into student-controlled sequencing. He summarized the most common hypotheses relating to student sequencing of instructional materials:

1. Learners who are highly motivated are able to overcome poor sequences (Briggs, 1968).

2. High-ability learners are able to overcome the poor sequencing (Neidermeyer, et al., 1969).

3. If the content structure is of a low-order hierarchy, it can be learned in any order.

4. If content is too short and too redundant, it can be learned in any order (Payne, et al., 1967; Briggs, 1968).

5. The learner can set his own pace and thereby sort out any confusion (Payne, et al., 1967).

6. The learner is kept more alert during random sequencing (Roe, et al., 1962).

Fry stated, in reporting the research of Grubb and Selfridge (1964):

> The highly dynamic, interacting, responsive environment with its immediate feedback during problem solving also contributed to consistently high motivation on the students' behavior. (p. 11)

However, after completing his review of the literature on programmed instruction, Fry also concluded that:

> Although it is true that programed instruction is individualized instruction and potentially permits student control (e.g. self-pacing) according to Campbell (1964), it tends to give the learner even less control than he has with an ordinary textbook. (p. 24)

Some of the reasons he cited relate to: small frames encourage rote learning (Ausubel, 1968); there is the presence of "pall effect" (Feldhusen, 1963; Smith and Smith, 1966; DeCecco, 1963); programmed instruction can be "mechanized, non-thought provoking, anti-insightful, etc." (Roth, 1963); individual differences are not adjusted for (DeCecco, 1964); and control is wrested from the student and given to the programmer

(Smith and Smith, 1966; Pressy, 1963; Ausubel, 1963; Campbell, 1964). Fry concluded:

> Clearly, programed instruction has shown little improvement over other methods of adapting training to the interests, aptitudes, motivations, and background characteristics of the learners. (p. 26)

Although it has been almost 20 years since Skinner's (1953) challenge to education to apply fruitfully the promise of behavioral control, Fry and others continue to make a strong case for deficiencies in the application of programmed instruction using present research variables. As Davis, et al. (1970) pointed out, there is confusion in referent terms, leading to numerous conflicting reports.

Fry's (1970) experiment sought to overcome some methodological deficiency of the earlier studies by controlling for: (1) student-controlled sequencing, (2) fixed sequencing prepared by experts, (3) random sequencing, and (4) absence of instructions to a control group. He found that high-aptitude and high-inquiry type subjects learned more under the expert treatment, and that within the student-controlled sequencing, the more questions that the subjects asked the more they learned and the more favorably they rated the experience. Both of these findings are consistent with information theory predictions; however, a different order of questions could be asked. For example, how would concrete vs. abstract processors prefer the "expert" sequences compared to the student-controlled sequences? Given that high-inquiry and high-aptitude subjects prefer the "expert"

treatment, what is the relationship of "high inquiry" to information-processing-related personality variables? The following chapter explores the relationship of three such variables to the research question set forth in this thesis.

Summary

Contemporary criticism of educational practices has pointed up some underlying deficiencies in instructional emphasis. Schroder, Berman, and others suggested that a change from a preoccupation with content variables to a new emphasis on processing variables would have beneficial effects on the schools, which would transfer to society in general.

Scholars in the field of programmed instruction, which is presently exerting a major influence on academic programs of instruction, have suggested that traditional variables, which at present comprise the bulk of the research literature, have served their usefulness and a new approach is in order.

The author proposes to follow a process model, using information-processing variables rather than the traditional content-based variables, which have fallen under criticism. The variables to be examined are: information processing, intrinsic-extrinsic motivation, and internal-external control as they interact with a fixed cognitive structure in the form of a sequence of programmed instruction.

The chapter included a review of some of the programmed instruction literature as "structure," and a discussion of the relationships between the traditional content variables and the processing concept of structure as it relates to this thesis. Research variables bearing upon programmed sequences compared with conventional textbooks, instructor-controlled sequencing, and student-controlled sequencing were reviewed.

Overview

The following chapter discusses the literature bearing upon the independent variables at issue in the study. These are: level of information processing, intrinsic-extrinsic motivation, and internal-external locus of perceived control. Ten hypotheses relating these variables to student attitude, performance on a criterion test, and cumulative grade-point average are set forth.

In Chapter III, the methodology of the study is presented. The sample of textile students who participated in the study is discussed. A preliminary study which was conducted on the programmed instructional system is described; in this discussion data are presented to justify the use of the program as a basis for the "after-only" treatment applied in the main study. The procedures and statistical analysis of the main study are also set forth in Chapter III. Finally, a factor analysis of three of the questionnaires is briefly described.

The results of the main study are discussed in Chapter IV.

Chapter V contains an analysis of the conclusions of the main study, a critical evaluation of the study, and implications for further research.

CHAPTER II

REVIEW OF LITERATURE

The preceding chapter looked at some relationships between research using traditional programmed instruction variables and research using some variables suggested by information processing. In this chapter, information-processing variables used in this study are looked at in detail. Since programmed instruction is grounded in certain "drive" theories of the behavioral school of psychology, these classical drive theories are briefly discussed, along with some criticism that has been directed at them. Then human sensory processing is discussed in terms of a cybernetic model of "drive" used in this thesis. Hunt's concepts of intrinsic-extrinsic motivation, Schroder's concept of level of information processing, and Rotter's concept of locus of perceived control are then developed. Finally, the theoretical hypotheses are presented and discussed in view of the literature that has been cited.

Classical Drive Theories of Motivation

Three major questions have been asked in the motivation literature in order to interpret the dynamic complexity of human behavior (Hunt, 1960):

A. Why does a person become active?

B. Why does a person act one way rather than another?

C. How can you change a person's behavior to become more appropriate?

Much of the psychological literature has been produced on the assumption that external factors are responsible for human behavior. Man is "pushed" or "driven" to satisfy primary needs. Freud (1938) developed the theoretical constructs of the analytical school in which the ID (basic animal primitive drives) were counterbalanced by the EGO (practicality, rationality, trade-offs) and the SUPER EGO (moral concepts of good and evil). Normal through neurotic through psychotic anomalies of behavior could be interpreted as the logical outcomes of frustrations arising from the suppression of basic drives or thwarted behavior. This theoretical structure did not lend itself to reliable experimental manipulation. The behavioristic theoretical school emerged, with a strong emphasis and base in scientific controls (Brodbeck, 1968, p. 3).

The legacy of programmed instruction originated in the behavioral (stimulus-response) school, rather than the analytical school. Like Freud, the behaviorists find the origination of behavior as a response to primary psysiological needs, but their explanation of the dynamics of behavior is different, namely, that the organism's random interaction with environmental stimuli in response to primitive drives is reinforced, contingent upon instrumental behavior, by gratification of the primary drives. After reinforcement,

probability of the same instrumental behavior is increased in the presence of the environmental stimuli when the primary drive regains its strength. Selective use of primary reinforcers can be used to make predictable the behavior of the organism when the primary drives are present. Social behavior not directly associated with primary drives is explained through the concept of secondary reinforcers. When primary drives are being reduced contingent upon appropriate instrumental behavior, secondary reinforcing stimuli such as praise, money, and other symbolic rewards are paired with the primary reinforcers (food, water, sex). The secondary reinforcers take on the effect of primary drives, so that people behave in certain ways in order to receive praise and the other social reinforcers.

Hull (1943), Miller and Dollard (1941), and others have erected elaborate theories accounting for anticipatory responses, drive states, contiguity of chaining, and so forth to derive a theoretical explanation of what is occurring within the "black box" called a human being. Their basic premise assumed that observed behavior was in response to the interaction effect of stimuli with primary and secondary drives, and thus is called a respondent theory of conditioning.

However, programmed instruction is more an outgrowth of operant conditioning, as stated by Skinner (1953), and has a slightly different theoretical premise. Skinner rejected the "black box" hypothesis in terms of theoretical

constructs as to what is occurring within it. He held that it is only necessary to observe input (stimuli) and output (behavior) in order to determine cause-effect relationships on a probability basis. Theories of intervening variables are unnecessary and irrelevant.

Both respondent and operant conditioning conceive of habit as the logical outcome of successful contingencies of reinforcement leading to drive reduction or increased probability of response. Thus, regardless of whether one refers to the black box theories of hypothetical constructs involving intervening variables (Hull) or probability statements of outcome behavior based upon contingencies of reinforcement (Skinner), all behavioristic theories have in common their premise that the "trigger" of motivating factors lies in stimuli which are essentially external to the organism and which relate directly or indirectly to primary physiological needs relating to oxygen, food, water, and sex. Thus, one should control extrinsic rewards in order to control behavior of human beings. Predispositions to respond are the outcomes of a history of reinforcement contingencies and existing drive states.

Consistent with the above premise, behaviorists (who have fostered the development of programmed instruction) analyze entry behaviors of students exclusively in terms of the outcome behaviors to be reinforced through interaction with the program. For example, entry behaviors into a programmed structure of basic textile information are examined

with respect to outcome behaviors and resulting extrinsic rewards (e.g., mastery yielding high grades, good jobs, one less requirement to beat the system, etc.). Intrinsic factors relating to information-processing considerations have heretofore played a minor role.

Critique of the Drive Hypothesis

In contrast to the drive theories, the cybernetic model of behavior does not assign any special importance to traditional drive concepts. "Drive" is assumed to be present within any living organism as a definition of "life." The emphasis in the cybernetic model is upon the internal integration, differentiation, and evaluation of perceptual phenomena such that observable behavior is logical and consistent. The importance of external loci of stimuli as the source of "push-pull" is de-emphasized. Hunt (1971, p. 92) cited some evidence which illustrates certain deficiencies in current drive theories:

1. Monkeys, well fed and watered, will work for hours to learn to disassemble a puzzle just for the privilege of disassembling it (Harlow, 1950).
2. Rats will explore new areas, given only the opportunity, and this tendency increases in proportion to the novelty of the situation (Berlyne, 1960).
3. Variations in innocuous receptor inputs will instigate and sustain looking or listening; and novelty, incongruity, and complexity will

reinforce behavior in human beings (Berlyne, 1957a,b,c; 1958a,b).

4. Rats running a T-maze will consistently favor the less-familiar alternative (Montgomery, 1952).
5. Rats will learn merely to earn an opportunity to explore unfamiliar territory (Montgomery and Segall, 1955).
6. Monkeys will learn to discriminate merely to obtain the privilege of peeking through a window in the opaque walls of their cages (Butler, 1953).
7. Human beings (their primary needs kept satisfied) have been found to be unable to tolerate homogeneity of input (lack of stimuli) for more than three days (Bexton, Heron, and Scott, 1954; Heron, Doane, and Scott, 1956).

More recently, Houston and Mednick (1963) demonstrated that creative individuals need greater novelty in the environment than do noncreatives. Although Skinner (1957) constructed an elaborate defense of the development of language according to the behavioristic model, Chomsky (1965) and others raised plausible questions about how young children can construct novel speech which could not possibly have been the result of conditioning (e.g., by using syntactical differences of word arrangement they could not have heard before). Studies of stimulus deprivation of human beings during infancy have demonstrated that such infants, although otherwise well fed and cared for, show marked impairment of

psychological and physiological adjustment and development, even to the point of unrecoverable damage (Ribble, 1943; Spitz, 1946). In an elaborate series of experiments with primates, Hebb (1946) showed how fear that could not possibly have been explained by conditioning could be elicited in primates. Koestler (1967) devoted an entire book to constructing arguments against traditional behavioristic theories. Hunt (1971) concluded:

> These modes of theoretical recognition fail, then, to explain the evidence. Further, since organisms do not become quiescent in the absence of painful stimulation, homeostatic need, and sex, or in the absence of acquired drives based upon these, a mechanism of motivation must inhere within the informational interaction of organisms with their environments. There must be a system of motivation inherent in information reception through the ears and eyes, information processing and action. These systems of motivation, one in information processing per se, and another in action, may be termed "intrinsic motivation." (p. 94)

Human Sensory Processing of External Structure

Recall that a human being can be conceived of as an information-processing device. The internal neural map and the external structure are in continual interaction. The amount of information that can be processed, however, has finite limits (Miller, 1956). Therefore, the flux of incoming information (i.e., uncertainty) must be selectively received and selectively processed. However, due to the regularity of both internal and external structure, the capacity of the neural structure to process information can be increased by "chunking" the information to increase the

effective number of bits and at the same time increase redundancy in order to overcome noise (Shannon and Weaver, 1949; Miller, 1956; Katzman, 1971). The neural structure is alert to changes in the external structure, which, when perceived, is compared with the internal map and cast into the short-term memory (Broadbent, 1958). If the incongruence is validated while in the short-term memory, it is transferred in to and modifies the permanent map in the long-term memory. If the incongruence is of no consequence, it is expunged (forgotten).

The construction of a neural map or cognitive structure of the external environment can be conceptualized as a schemata (Bartlett, 1932; Piaget, 1936; Woodsworth, 1938; Hebb, 1949; Attneave, 1954, 1959).

The schemata arises in the neurological structure as a result of the regularity or constraints existing in the external environment. The dynamics of interaction can be conceptualized through a feedback model (TOTE) proposed by Miller, Galanter, and Pribram (1960). The organism:

TESTS the environment and compares it with its existing schemata,

OPERATES to reduce any irregularities or modifies the internal schemata,

TESTS the environment again and either recycles to the operate phase if the incongruity remains, or if incongruity is no longer present, then it will

EXIT

The TOTE model of human information processing depends heavily upon the concept of feedback or, in effect, knowledge of results (KR) of the organism's OPERATE phase. The concept of reward (the KR) or extrinsic motivation does not share the central emphasis in the cybernetic TOTE model that it does in the respondent- or operant-conditioning models. Annett (1969) said:

> It is suggested that we describe an organism as being "motivated" when we see it pursuing some plan of action. Since plans involve hierarchies of feedback loops, feedback is essential to motivation, but motivation is not an additional energizing factor; it is simply descriptive of feedback in action. (p. 169)

In the TOTE model, it is the resolving of schemata-environmental structure incongruencies which is rewarding. Only a portion of the incongruencies occurring in the TOTE model for a given organism are concerned with primary "drives." Life itself means change, and a primary need is for stimulation from the external environment so that the organism can exercise its TOTE mechanisms (von Forester, 1968; Mackworth, 1969, 1970). So important is this need for TOTE (intrinsic motivation) that in an excessively static environment an organism must seek variety within the constraints (Berlyne, 1960).

Information processing is inherent in the organism and is basic for survival. Each human being has a capacity for information processing, but the capability for processing information is not fixed, and considerable variability exists among different persons. Hoepfner, et al. (1970)

demonstrated that what is called "learning" amounts to a continual process of redefining and interpreting known information, regardless of level of ability. Such findings are highly congruent with the TOTE-process notion in regard to the concept of internal schemata, and with the concept of intrinsic motivation discussed below.

Intrinsic Motivation and Human Information Processing

Recent concepts of intrinsic motivation were thoroughly reviewed by Hunt (Schroder and Suedfeld, 1971), and relate to the preceding discussion of an internal schemata, which is a map of the structure external to the person.

Of interest in human information processing is the phenomenon of how different persons process various amounts of incongruity between the internal schemata and the environment. Figure 3 illustrates the conceptualization of how differing amounts of incongruity have been demonstrated to affect the processing agent. In Figure 3, the relationship between affect and incongruity is demonstrated. The figure illustrates that there is an optimum amount of discrepancy, regardless of whether or not it is positive or negative, which is received with positive affect. This amount of discrepancy was discussed by Berlyne (1957, 1958, 1960) in terms of curiosity or amusement. When the discrepancy proceeds beyond the optimal point, first denial occurs, then fight or flight (Lorenz, 1963).

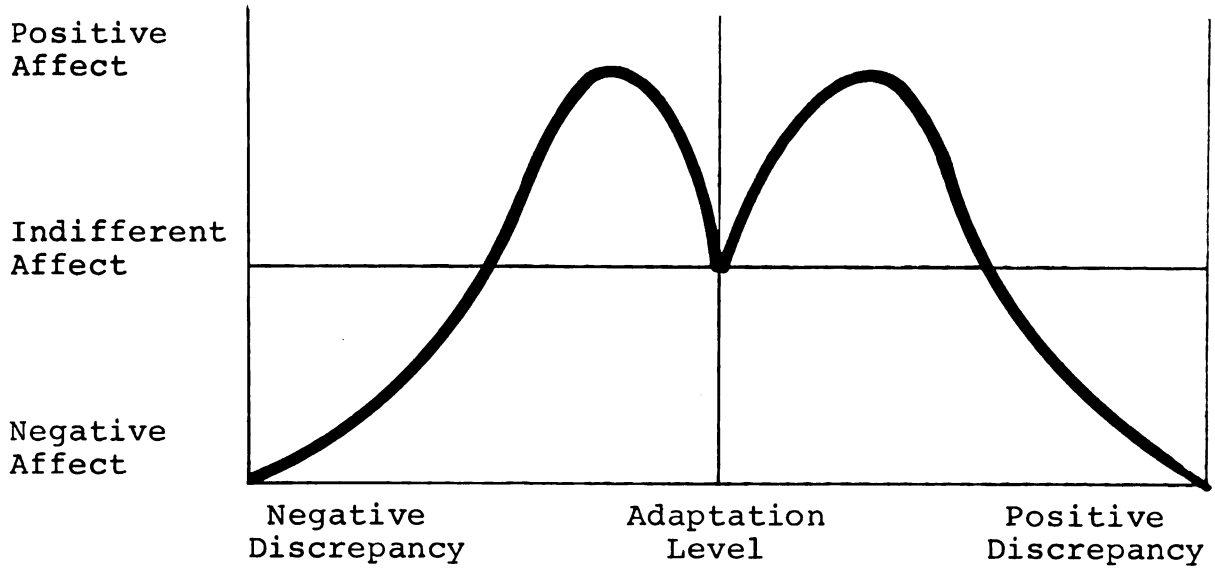


Figure 3.--Affect compared to amount of discrepancy.

Source: Schroder and Suedfeld, 1971, p. 111.

Hunt (in Schroder and Suedfeld, 1971) cited a variety of experimental data which give support to the model. Figure 4 illustrates the relationship between level of cue function or efficiency and the level of arousal. Figure 5 illustrates the relationship between arousal level and effect of "drive reduction." Intrinsic motivation can be defined as the TOTE operation of the human being as he operates in the environment, which provides a variety of incongruencies and constraints. Hunt discussed how seven major behavioral issues are handled in terms of intrinsic motivation.

1. Instigation -- Behavior is instigated when there is perceived incongruity between external constraints and the schemata.

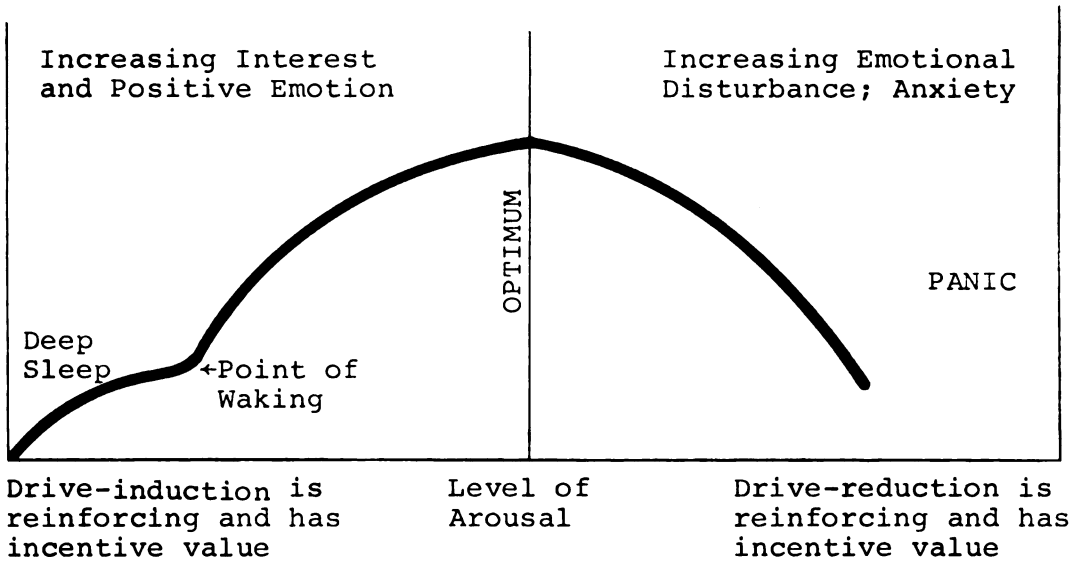


Figure 4.--Level of "cue function" compared with level of arousal.

Source: Schroder and Suedfeld, 1971, p. 114.

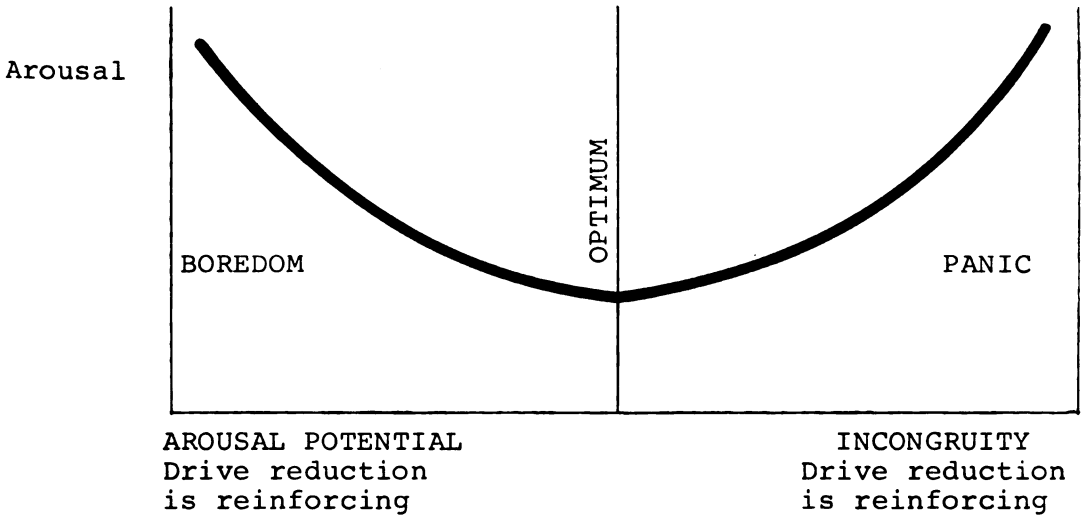


Figure 5.--Arousal as a function of incongruity.

Source: Schroder and Suedfeld, 1971, p. 116.

2. Energization -- Energization is the arousal level, due to the incongruity, which can range from curiosity behavior and exploration to panic behavior.
3. Direction -- Behavior derives its direction based upon the schemata. In young children, behavior tends to be more random and the TOTE process serves to construct the schemata. In adults, behavior is less random or more constrained due to the fully developed schemata, except during extremely high incongruency (panic).
4. Cathexis -- The presentation of positive affect toward a person or object moves from simple imprinting to affection and trust in complex neural processing. Cathexis can be traced to fundamental consistencies in the environmental constraints. A characteristic of all love objects is their perceived stability.
5. Choice -- The concept of choice relates to the structure of the schemata, in which there is a hierarchy of "prepotency" to respond, ranging from high priority incongruencies (e.g., pain producing, which is most directly linked to the neural structure) to discrepancies of low priority (e.g., subtle cues relating to cultural norms embedded in the schemata).

6. Change -- Behavioral change relates to maintenance of an optimal incongruity level. Change can be gradual, the result of efforts to defeat boredom, or at the other extreme, rapid to extrinsic input which forces a rapid change in the schemata.
7. Persistence -- Persistence is the logical outcome of mixed experience of success and failure (in S-R psychology the phenomenon is variable ratio reinforcement). Behavior is more persistent when the schemata is constructed in an emotional state characterized by high affect (Schroder and Suedfeld, 1971):

> Frenkel-Brunswik (1949) attributed such evidence of affective rigidity to children's inability to express their emotional ambivalence toward parents, but perhaps the basic factor is the level of arousal at the time the beliefs, attitudes and plans were laid down. If the level of arousal has been high, the central processes upon which such standards are based may become highly stable, so that it takes a higher degree of incongruity to effect a modification of the system in the storage, and unadaptive rigidity may be the consequence. (p. 129)

The genetic legacy and prenatal development bring tremendous variety within the human species with respect to perceptual fidelity, psychomotor skill, and neural processing potential with which the environment then interacts with incredible variety. In comparison to the variety of constraints which the environment can exercise and in which the human processing system can find itself, the variety which exists in terms of the neural processing structure is, by comparison, trivial. Is there a pattern which gives rise to

a consistent pattern of constructs (Kelly, 1955) or ways of viewing the world?

Suppose (call the following System 1) that the characteristics of environmental constraints during the construction of the schemata are extremely rigid. The child is required always to conform to the training agent's demands. Compliance or rebellion is dealt with by the training agent in terms of rewards or punishments. Thus, the child learns to conform to highly specific and unvarying behavioral criteria. For the child, the constrained environment reflects high certainty and minimum variety.

Suppose, however (call the following System 2), that the training agent is capricious in exercising constraints. Although rigid and unyielding in his demands, the training agent's standards vary widely. Sometimes the child is rewarded for conforming, sometimes not. Sometimes there is reward for an act, but on other occasions there is punishment for the same act. The criteria for rewards and punishments are never clear. For the child, the environment is in a constant state of high uncertainty.

Suppose (call the following System 3) the environment exercises negligible human-imposed constraints. The child has a high level of degrees of freedom to operate in the environment, subject only to natural environmental constraints, with even the training agent being subject to easy manipulation by the child. The child is allowed to want for nothing. All demands are acceded to when humanly possible,

so that the child is infused with an enormous sense of power over the environment. What might be the behavioral differences of such a child's processing style when compared to the previous systems?

Finally, suppose (call the following System 4) the child is raised with considerable degrees of freedom to operate in the environment, but the training agent is not manipulatable. Suppose that the child finds his own rewards in exploration and experimentation, with the training agent neither punishing nor rewarding for any particular behavior, but rather serving as a source of information to the child to save him from punishment by extreme but natural environmental constraints (e.g., getting burned by fire), to provide shortcuts to information acquisition, and to assist the development of the child's level of skill. Such a child is encouraged to be independent, but constrained in behavior only to conform to standards such that respect for the rights of others is a part of the natural environmental constraints.

Given these four arbitrarily defined systems or "worlds of constraints" into which a child might be placed, what patterns of information processing or other behavioral consistencies in the schemata might be discovered? Harvey (1966) reported an intensive series of studies into various measures of personality and found fairly discrete consistencies within each of the four systems. Some of the variables investigated include: cognitive complexity (Kelly, 1955; Campbell, 1960), authoritarianism (measured by the F scale),

dogmatism (Rokeach, 1960); left and right opinionation (Rokeach, 1960); rigidity (Gough and Sanford, 1952); autonomy, affiliation, change, and aggressiveness (Edwards Personal Preference Schedule; self-causality (Srole Scale of Anomie, 1956); identification of the American motif (Nettler Scale of Anomie, 1957); self-concept (Dymond's Self-Concept Scale, 1953; Deck 13 of Hilden's Self-Concept Statements, 1954); self-control, honesty, creativity, kindness, loyalty, independence, religiousness, and status (Scott's Scale of Values); and need for affiliation (French, 1956).

Harvey (1966, p. 44) summarized the correlation of the preceding measures with persons who are products of the four different systems:

System 1 Persons (low information processing)

Highest on religious beliefs (i.e., most closed-minded)
authoritarianism
dogmatism
right opinionation
rigidity
deference
honesty
kindness
loyalty
status seeking
identification with the American motif
self-control

Lowest on cognitive complexity (i.e., information processing)
autonomy
anomie
creativity

2nd highest on need for affiliation
change (with System 3)

3rd highest on self-causality
self-esteem
independence (with System 3)

System 2 Persons (moderately low information processing)

Highest on change (with System 4)
aggressiveness
creativity
independence
Machiavellianism
left opinionation

Lowest on religiousness
self-causality
self-esteem
need for affiliation
identification with American motif
self-control
honesty
kindness
loyalty

2nd highest on dogmatism
rigidity
deference
status seeking (with Systems 3 and 4)

3rd highest on authoritarianism
right opinionation
cognitive complexity (information processing)

System 3 Persons (moderately high information processing)

Highest on need for affiliation
kindness

Lowest on none of the measures

2nd highest on cognitive complexity (information
religiousness (with System 4) processing)
authoritarianism
opinionation
change (with System 3)
self-causality
self-esteem
identification with American motif
self-control (with System 4)
honesty (with System 4)
creativity (with System 4)
loyalty (with System 4)
status seeking (with Systems 2 and 4)

3rd highest on anomie
dogmatism
rigidity
independence (with System 1)

System 4 Persons (high level of information processing)

Highest on change (with System 2)
cognitive complexity (information processing)
self-causality

Lowest on authoritarianism
dogmatism
opinionation
rigidity

2nd highest on self-control (with System 3)
honesty (with System 3)
creativity (with System 3)
independence
status seeking (with Systems 2 and 3)
anomie

3rd highest on need for affiliation
identification with American motif

The above information provides criteria for evaluating the schemata and for predicting the kinds of constraints that representative persons are likely to project into the environmental structure. One of the most pervasive and significant predictors of cognitive interaction with the environment is the construct of cognitive complexity.

The Assessment of Cognitive Complexity

A human being can be categorized according to the number of bits of information that he can perceive in the environmental structure. A System 1 type person perceives fewer bits (less uncertainty) in the external structure than does a System 4 type. Hence the world is simpler for a System 1 type, who processes information along fewer dimensions than does the System 4 person. The range of processing competence ranges from concrete (System 1) to abstract

(System 4), with differing levels lying along the continuum (Hunt, 1961).

Schroder, et al. (1967) reported a substantial body of research dealing with aspects of processing abilities. The authors described the four systems as follows:

A. Low integration index (System 1) -- characterized by:
   1. Categorical thinking (i.e., black-white)
   2. Minimization of conflict (i.e., either fit or exclude)
   3. Anchoring of behavior in external conditions
   4. Change, when it occurs, is abrupt and categorical (i.e., 180-degree changes)

B. Moderately low integration index (System 2) -- characterized by:
   1. Generation of simple dimensions to a category (more or less of something)
   2. Elements of the schemata only primitively related
   3. Ambivalence and inconsistency
   4. A preponderance of negativism and defensiveness since possibilities of alternative schemata are threatening

C. Moderately high integration index (System 3) -- characterized by:
   1. Alternate combinations of perspective, more complex rules for categorizing
   2. Less deterministic
   3. Multiple tracking of environmental structure

4. Use of internal processes due to the presence of choice. "Self" becomes a viable agent in the total schemata.
5. A more empirical outlook with some data-based decision making

D. High integration index (System 4) -- Characterized by
1. Multiple combinations of dimensional scale values, flexible rules for comparison, and a structure for generalizing complex relationships
2. Elaborate theoretical conceptualization beyond simple empiricism
3. The generation and accommodation of multiple possibilities of schemata
4. Simplification of complexity in a variety of creative and flexible ways
5. High diversity permitted and sought after
6. Absence of "checking" behavior, many perceived degrees of freedom to operate within the environmental constraints

Schroder, et al. (1967) cited a body of research which suggests that if any two of the three variables shown in the abscissa in Figure 6 (complexity, noxity, eucity) are held constant, the third variable can be manipulated from low to high levels, and the characteristic curves will emerge as illustrated. The two curves illustrate the information-processing rate for concrete and abstract persons. Notice that the curve for information processing is lowest for

concrete persons, and peaks earlier when complexity, noxity, or eucity is increased. Harvey's (1966) summary, reviewed above, shows some of the behavior correlates associated with a person's information-processing level.

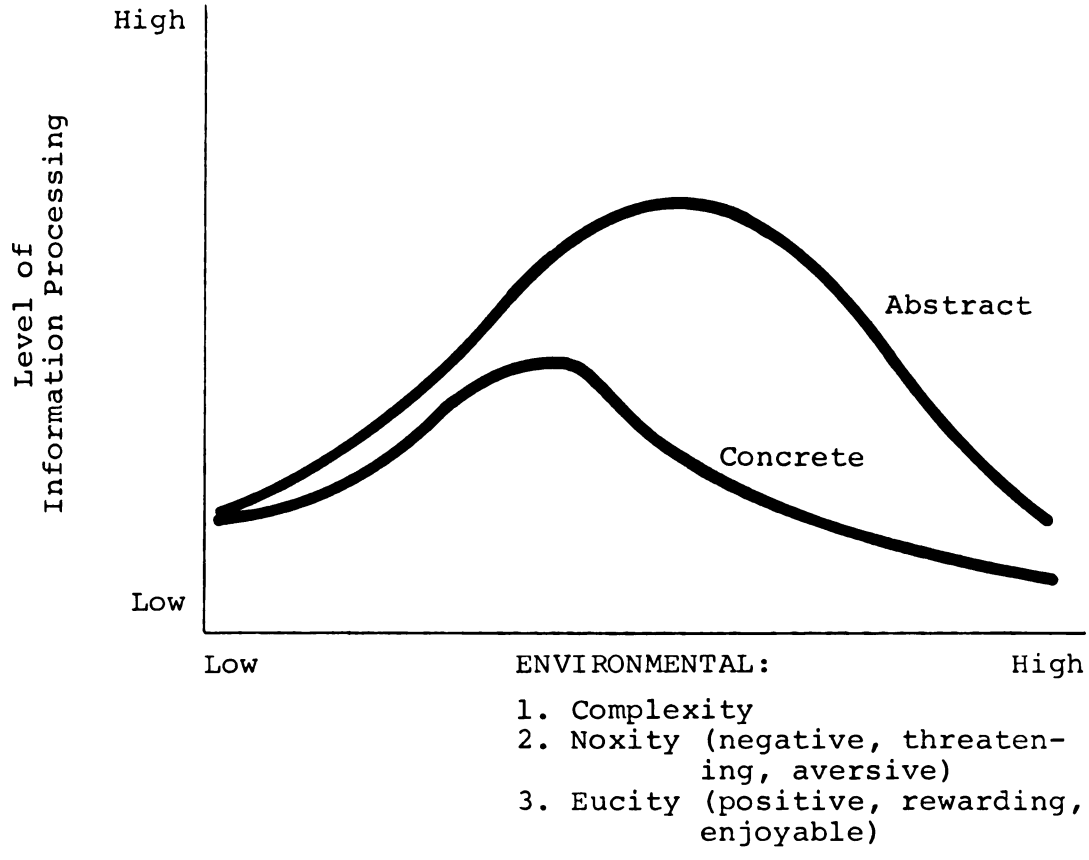


Figure 6.--Processing level compared to environmental factors.

Source: Schroder, et al., 1967; Figure 6, p. 40 (modified).

In addition, a major element that emerges from the information-processing model just described is the extent to which the locus of perceived control is perceived to be external to the person (with few degrees of freedom) or internal

to the person (with many degrees of freedom). The dimension of control is an important variable in this study.

The Locus of Perceived Control

A person can be described according to where he perceives the locus of power to reside insofar as environmental constraints are effected. The locus of control can reside either:

A. Internally -- with the person as the basic controlling agent. Environmental constraint is perceived as being indeterminant, temporary, and an artifact of perception to be overcome (even though perhaps with difficulty), if convenient.

B. Externally -- with the person powerless as a controlling agent. Environmental constraint is inviolable, with the person's degrees of freedom limited to operate within the given structure.

Schroder, et al. (1967) held that, for persons of low integrative complexity (System 1 types):

> . . . behavior is maximally controlled by external stimulus conditions. With increasing conceptual levels, alternative perspectives and interrelationships can be generated from the same dimensional value of information. This represents an increase in the concept of "self" as agent, a going beyond any single or externally given interpretation, in an increase in the conception of internal causation. (p. 17)

To what extent is interaction with a programmed cognitive structure dependent upon information-processing level and the locus of control perceived by the student? Following is background information on the locus of control question.

The concept of "self" as agent in regard to control originally appeared outside of information-processing literature, in the area of clinical psychology (Allport, 1943; Lecky, 1945; Rogers, 1942, 1951; Murphy, 1947; Hilgard, 1943). Bugental and Zelen (1950), who explored the phenomenon through systematic use of the W-A-Y technique (Who Are You?), attempted to move beyond nondirective, therapeutic applications to define basic parameters concerning self-concept. The concept of self (as related to control) which is discussed here is analogous to the analytical concept of ego competence (White, 1960).

A variety of early studies have been conducted exploring self-concept as it affects different parameters. Taylor and Coombs (1952) found that children who were "better adjusted" than others, as measured by external criteria, were better able to cope with criticism. Bills (1954) found a significant correlation between what a person says about himself in an interview and his self-ratings on an index of adjustment and values, findings which were supported by Hanlon, et al. (1954). Diller (1954) looked at conscious and unconscious attitudes toward self after experiencing success and failure, and found that both conscious and unconscious attitudes fluctuated directly with success and failure.

Janis (1954) looked at the persons who were susceptible to persuasion as a function of personality. He found that persons with low self-esteem tend to be more readily influenced by others, and that persons with acute symptoms

of neurotic anxiety (i.e., high levels of perceived environmental uncertainty) tend to be more resistant to persuasion than others.

Lepine and Chodorkoff (1955) and Steiner (1957) found that the more an individual tends to express feelings of adequacy, the less dependent he is upon environmental (external) evaluation of past performance in setting goals.

More recent investigations continue to find support for the relationship of locus of perceived control and performance, and for the construct validity of the internal-external control variable as a generalized personality dimension (Rotter, 1960; Battle, 1963). Harvey (1964) found persons of high cognitive complexity (more internally controlled) were less influenced during tests of discrimination when cues were falsely manipulated.

Sherwood (1965) conducted a detailed analysis of the "self's" relationship to peer group factors in the environment, and found that self-concept was directly related to public identity in regard to the importance of peers to the person, the extent of peer group communication of peer values, and the extent of the person's investment (involvement) in the group.

A major review of the literature bearing upon the locus of control construct was conducted by Lefcourt (1965). He concluded that while there was a demonstrated relationship between internal locus of control with intelligence (citing Bailer, 1961; Crandall, et al., 1962; Cromwell, 1963), he

observed that these studies used extreme ends of the intelligence scale. He cited Battle and Rotter's (1963) study, which demonstrated that there is generally little correlation between intelligence and locus of perceived control. Therefore, Lefcourt argued that the concept of locus of perceived control is more than a simple phenomenological response to one's own intelligence.

Related to the problem of correlating control with intelligence is the question of the relationship of control to academic performance. While evidence supports the lack of a relationship between intelligence and control, a relationship between control and performance has been demonstrated.

Crandall, et al. (1965) found that young children (undeveloped schematas) tended to show greater initiative in seeking rewards and showed greater persistence in the face of difficulty as a function of the extent to which they felt responsible for their own success in academic situations.

A social learning approach (Bandura and Walters, 1963) was employed by Ringness (1970) to identify why some children are more highly motivated to achieve in school than are others. He concluded that there is an effect due to the presence of "significant others" with whom the child identifies. However, the findings of the study can be related to the differential perception of perceived locus of control in relation to the nature and personality of "significant others": ". . . not only identification with various figures,

but the values attributed to these figures do relate to differences in achievement commensurate with ability." (p. 184)

Humphreys (1968) demonstrated the inconsistency of predicting a student's college success using the traditional academic criteria, but Flook and Saggar (1968) looked at academic performance as a function of both knowledge of results (KR) and personality. The KR group performed significantly better than the no-KR group, a difference which the authors attributed to ". . . improved self-evaluation through social comparison, with the KR being the catalytic agent." (p. 395) This conceptualization of KR places its function in a different context than the function of KR, according to the behaviorist (stimulus-response) model.

Keefer (1971) reported that accurate predictors of college success tended to differ in academic classification, academic achievement, and self-concept. Accurate predictors were:

> . . . more "self-acceptant" as inferred from Bills Index of adjustment, and values, and from their self-reports of feelings of academic success and predictive accuracy, operationally more successful in achieving their stated goals and operationally more accurate in predicting their achievement. (p. 404)

The data generally point to locus of perceived control as an important predictor of student performance in an academic environment. However, a study by Egeland, Hunt, and Hardt (1970) provides an interesting exception. In this study, interpersonal flexibility (Hunt, 1964) was found to be a predictor ($p<.05$) of college-bound students, but internal

control (Rotter, 1966) failed to discriminate between the college and noncollege groups. This finding is inconsistent with the findings of Coleman (1966), who reported that internal control is correlated with academic achievement. Egeland, et al. assumed that since both college enrollment and control are correlated with academic success, there should be a correlation between control and college enrollment. One possible reason for the apparent discrepancy is that while control may be correlated with performance, the values which lead to college enrollment may just as easily be in response to perceived external control as to internal control, hence the lack of correlation.

Rotter (1971) summarized the research to date on the question of control, which illustrates the wide range of applicability of the concept. The following generalizations were made:

A. Lower-class children tend to be more external than middle-class children.

B. Young children tend to be more external and become more internal as they mature, but there is considerable variability due to cultural factors (Harvey, 1966).

C. Black prisoners in a reformatory were more external than were white prisoners.

D. Among disadvantaged children, high scores on achievement were more correlated with internal control than external control.

E. In a hospital and in a reformatory, patients and inmates who were internal knew much more about their state and about conditions in the institution than did externals.

F. There is negligible correlation between intelligence and control.

G. Persons who are internal are more successful at persuasion than are external persons.

H. Nonsmokers are significantly more internal than are smokers.

I. Externals are more susceptible to subtle persuasion than are internals, but externals express more unfounded suspicion than do internals.

J. Internals actively resist being "conditioned."

K. Internals may be willing to "play the game" in submitting to subtle pressures under certain social constraints (e.g., the schoolroom).

L. Internals forget failures more readily than do externals.

Studies of college students in 1960 showed that the norm was more toward an internal locus of control, but recent studies by Rotter showed that college students have become significantly more external. (The measure was Rotter's and is the same measure used in this thesis.)

Summary: The Relationship Among Motivation, Control, and Information Processing

A person is born with a neural structure which is an internal information-processing structure. This structure is the product of his genetic and prenatal legacy. At birth the internal structure begins its life history of interaction with the organization in the external environment. The organization or external structure is perceived to be made up of permutations and combinations of forms of variety and constraint.

The environmental structure (at one point on a continuum) can represent a degree of constraint which is extreme in its rigidity. In such a case the emerging schemata or internal representation will reflect behavior patterns indicative of few degrees of freedom. The schemata will become efficient in responding only within the narrow parameters of the constraints set by the restricted environment. On the other hand, the environmental structure can contain considerable variety, in which there are many degrees of freedom for the human processor to exercise in the construction of his schemata.

In addition to amount and type of variety and constraint existing in the environment, the structure will represent a range of stability, from low uncertainty (i.e., high stability and consistency of structure) to high uncertainty (i.e., randomness, capricious interaction, and erratic and inconsistent reinforcement of constraints).

Depending on the accident of birth, a given child can find himself in an environment which is consistently representative of some particular combination of: (1) a point on the continuum of structural constraints, and (2) a point on the continuum of structural stability (certainty-uncertainty).

As the child develops into adulthood, the organization of the schemata (internal map of the external environment) develops through the TOTE interaction with the environment. Depending upon whether or not the person is evolving into a predominantly System 1, 2, 3, or 4 type, the domination of behavioral orientation will become more or less intrinsically or extrinsically motivated, and the person will perceive the locus of the agent controlling his life to be more or less internal or external to himself.

The visible behavior of the adult, which is the outcome of his schemata's interaction with existing perceived external structure, can be measured by a number of dimensions (e.g., rigidity, creativity, authoritarianism, kindness, etc.).

Of interest to this thesis are the dimensions of cognitive complexity (level of information processing), motivation (intrinsic-extrinsic), and locus of perceived control (internal-external).

There can be a range of information processing from concrete (characterized by rigidity, few dimensions, categorical thinking, and decision making) to abstract (characterized

by flexibility, multiple dimensions, qualified thinking, and decision making).

There can be a range of motivation from intrinsic (anchored in curiosity and exploration for the purpose of matching environment with schemata) to extrinsic (anchored in gratification of external rewards). In extrinsic motivation, the cognitive incongruency between structure and schemata which leads naturally to exploratory behaviors may be suppressed in order to invest behaviors in the acquisition of the external reward. Facilitation or suppression of intrinsic motivation can be a function of the structure of the training environment.

There can be a range of locus of perceived control from internal (the person is the controlling agent) to external (the person is subject and helpless to controls other than himself).

The research interest of this thesis lies in how a person with varying "amounts" of the above variables will interact with a fixed cognitive structure in the form of a sequence of programmed instruction, as measured by performance and attitude. To what extent, it can be asked, can persons representing commonalities of the above variables be predicted to cluster together as representatives of the above variables, in relation to their performance on criterion tests of the cognative structure, and their oreintation or attitude toward a particular cognitive structure? The answer to such questions will have implications for the design of

instructional systems, not only for the purpose of developing content competencies, but most especially in developing efficient and personally rewarding styles of interaction with environmental organization, and in interacting with other human beings.

Statement of the Hypotheses

Hypothesis I

> There will be a positive attitude shift (as measured by the group mean) in favor of the highly structured sequence of programmed instruction when the attitude toward HED 171* is compared with attitude toward college-level instruction in general on several dimensions.

The reason for this shift lies in the human being's penchant for order or congruity in input structure. The input (programmed cognitive structure) was intentionally designed to reflect an optimum of incongruity, to defeat the boring tradition of the program, and, when combined with the use of salient referents, defeat the "boring" tradition associated with linear programs. (Development of the program is discussed in Chapter III.)

The majority of college courses are instructor oriented, rather than student oriented. The information organization is designed to reflect the schemata of the instructor rather than of the student. The student is on his own to reorganize the content information to meet two criteria:

A. It must be compatible with his own existing schemata, and

B. It must be compatible with the instructor's schemata.

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*HED 171--Human Environment and Design.

The second criterion serves to introduce anxiety, because while the content structure can be analyzed in the context of the student's schemata, the cues to the instructor's schemata may not be readily apparent. In fact, the instructor's schemata may itself be in a state of flux, or the student may misinterpret cues to the instructor's schemata which, while salient for the student, are not salient for the instructor.

The problem is compounded if the student is taking the course for reasons of extrinsic motivation. Extrinsic rewards may exist at the conclusion of a chain of delayed gratifications, e.g.:

A. Attractive mate and other status symbols (ultimate reward) or independence
B. A well-paying job (makes possible "A")
C. A college degree (makes possible "B")
D. Passing the course with a high grade (makes possible "C")

Under the present state of art of college instruction, students enrolled for basically extrinsic reasons find the experience aversive. For such a student, the low uncertainty of the programmed cognitive structure is fully appreciated, since the second criterion is fully accounted for and the student need only apply energy in assimilating the content information. Such students will, in general, find more approval for the structured course rather than for courses which reflect the college norm.

Some students enroll in college for reasons of intrinsic motivation. Since the program was designed for these students, intrinsically motivated students should also, in general, approve of the structure since it will not hinder them while appealing to their intrinsic needs. Since both intrinsically and extrinsically motivated students should, in general, approve of the program, Hypothesis 1 should find support when an attitude survey toward college level instruction in general is compared with an attitude survey which is specifically about the course experience.

Hypothesis 2a

> Students who are extrinsically motivated will report greater satisfaction with HED 171 than will students who are intrinsically motivated.

Hypothesis 2b

> Students who perceive the locus of control to be external will report greater satisfaction with HED 171 than will students who are internally controlled.

While the general attitude toward the course should receive support as per Hypothesis 1, there will be individual differences among specific students. Extrinsically motivated and externally controlled students have more to gain from the programmed structure. Intrinsically motivated students may have to take the textile course as a university requirement, but they may not be interested in textiles. Thus, the programmed instruction will do them no favors, and in fact will reduce their degrees of freedom to conduct the exploratory activities so important to them. Harvey (1966)

and Schroder and Suedfeld (1971) reported that there is a correlation between intrinsic motivation and complexity of thinking (i.e., abstract information processing). The same argument can be advanced for externally controlled students preferring the low uncertainty of the program as being consistent with the normal state of affairs. Therefore, a third hypothesis can be stated, which is directly related to the second.

Hypothesis 3

> Students who are more cognitively simple (concrete information processing) will report greater satisfaction with HED 171 than will cognitively complex (abstract information processing) students.

Houston and Mednick (1963) reported that the greater the creativity of the person, with creativity being associated with cognitive complexity (J. M. Hunt, 1960), the greater his need for novelty. Such individuals would not find any programmed structure to be equal to the degrees of freedom permitted by free exploration.

Suedfeld and Streufert (1966) found that cognitively simple subjects require more feedback, a feature provided by programmed instruction.

Karlins and Lamm (1967) found that high complex students tend to ask more questions, an alternative denied them in programmed instruction. Likewise, Wicker (1969) found cognitively complex students become more involved through asking questions, an alternative denied in working through programmed instruction.

The latent anxiety to which cognitively simple persons are subject when confronted with uncertainty is also a factor supporting Hypotheses 2 and 3. Krohne and Schroder (1971), building upon earlier research by Driver (1962), Bryne (1964), and Epstein (1967), found that cognitively simple persons yield a regression of information from the environment and differing interaction styles:

A. Repression -- amounting to denial of existing information

B. Sensitization -- amounting to over-preoccupation with anxiety-producing stimuli

Either style is dysfunctional in information acquisition. Once again, the low uncertainty of the programmed structure would permit a less-hampered interaction with the course information and yield a more positive attitude toward the course than should be expected from complex cognitive persons, to whom high uncertainty levels are less disturbing.

Additional support is provided by Mouw (1969), who found that closed-minded persons (cognitively simple) tend to rely on authority for direction, a feature inherently provided by programmed instruction.

Hypothesis 4

> As a person's information processing progresses toward abstraction, he will hold less-polarized attitudes toward college-level instruction.

Complex thinkers can perceive more dimensions in a situation than can cognitively simple persons. Thus, their

attitudes toward college would be less anchored in success-failure experiences than would concrete person's attitudes. Waterman (1970) showed that stress produced by identity crisis in college (Who am I? Why am I here?) will produce a significantly more negative attitude toward college than that held by people who have passed or do not experience such a crisis. Since concrete persons are more subject to anxiety, the effect will be greater for them than for abstract types.

Hypothesis 5

> As a person's information processing progresses toward abstraction, there will be fewer differences when attitudes toward the course are compared to attitudes toward college-level instruction in general.

Scott (1962) and Suedfeld (1964) found that concrete thinkers tend to change opinions in a more categorical way. Schroder, et al. (1967) wrote: "When highly salient (but discrepant) information is presented to concrete persons, there is a strong tendency to adopt the new attitude in a categorical manner." (p. 139) Since concrete thinkers process information on fewer dimensions, any association with success or failure in the course will be associated with the programmed instruction, which is the most salient feature of the course. Complex persons will attribute success or failure to multiple causes; however, concrete persons will attribute success or failure to the program and will "vote" accordingly, showing more extreme positive or negative attitudes than will complex students.

Hypothesis 6

There will be a relationship between increasing cumulative grade-point hours and increasing levels of internal control.

Hypothesis 7

There will be a relationship between increasing cumulative grade-point hours and increasing levels of intrinsic motivation.

Hypothesis 8

There will be no relationship between performance on the course criterion test and locus of perceived control.

Hypothesis 9

There will be no relationship between performance on the course criterion test and intrinsic or extrinsic motivation.

Several factors relating to information processing could work to support the above hypotheses. Streufert, et al. (1965) showed that as information load increases, information search decreases with narrowing of categories, and this effect is more pronounced for concrete thinkers than for complex thinkers. Marx (1970) supported that finding with data which showed that incidental concept formation decreases with increasing information complexity and the effect is greater for concrete persons.

The high-information environment of college-level courses should tend to produce divergence in grade-point hours between individuals who are concrete and those who are abstract, because of the compounding effect of increasing

anxiety with extrinsic motivation and external locus of control. The grade-point hours of concrete persons should be more variable.

However, the high structure (low uncertainty) of this particular programmed course should reduce anxiety and provide the necessary organization required for such persons to concentrate on the material, so that there will be no correlation between performance and locus of control or type of motivation for this course.

Hypothesis 10

> Persons who are intrinsically motivated, internally controlled, and complex in cognitive structure will be highly intercorrelated.

Support for this hypothesis is general in nature and is found outlined in the preceding review of the literature, most especially in Harvey (1961, 1966), and in Schroder, Driver, and Streufert (1967), Schroder and Suedfeld (1971), and Schroder, Karlins, and Phares (1972).

CHAPTER III

METHODOLOGY

In this chapter the following aspects of the study are described: the sample of HED 171 students, the procedures of a preliminary study testing the effectiveness of the programmed cognitive structure in increasing student performance, the measuring instruments used in the main study, the statistical tests applied to the theoretical hypotheses, and a secondary analysis of three of the questionnaires, for the purpose of possibly assisting in the analysis of the study.

The study was conducted in two parts: a preliminary study, completed in 1970, in which the programmed cognitive structure was developed and tested; and the main study, conducted winter quarter, 1972, in which the programmed cognitive structure was used to investigate the research variables discussed in Chapter II.

The Sample

In both the preliminary and the main studies, students enrolled in Consumer Textiles (HED 171)* were used

*During development of the programmed cognitive structure, HED 171 was called Textiles and Related Arts (TRA) 270.

as the sample. After design and development, the completed sequence of programmed instruction was tested on the entire enrollment of students during summer of 1969 (N = 38), fall of 1969 (N = 175), and spring of 1970 (N = 141).

The main study was conducted during winter quarter, 1972, using a random sample of 50 students selected from the class of 142. Costs of analyzing the information-processing classification instrument precluded using the entire class. Selection of students was achieved through matching with a table of random numbers.

In the secondary study, all 142 students enrolled in HED 171 during spring quarter, 1972, were used for the factor analysis of the three questionnaires.

Detailed demographic data on the sample are found in N. Harries (1972).

The Preliminary Study: Design of the Programmed Cognitive Structure

N. Harries, in cooperation with this writer, worked during the 1967-69 academic years to design a consumer approach to basic textiles (Harries and Harries, 1969). See Appendix A for the statement of behavioral objectives for each of the seven sections of the program. The program progresses in complexity, beginning with basic facts and concepts related to the dimensions of durability, comfort, care, and aesthetic appearance. These foundation concepts are then applied to increasingly complex alternatives introduced by fibers, yarns, structures, finishing treatments, and color

and design applications. The student's cognitive structure is intended to be developed to facilitate complex decision making in the selection of textile alternatives on the variety of dimensions described above, through the correct application of a substantial amount of factual material.

The basic outline of the seven sections of the program was written and modified as a result of the authors interacting with six students of varying ability as they worked with the program. The program was then tested on a class of 38 students during the summer of 1969. A printed version, prepared by the University Printing Office, has been used since the fall of 1969. In anticipation of testing the programmed structure, the writers identified 46 test questions that had been used at least five times (most had been used at least ten times) during the period of conventional instruction. These particular questions were selected for several reasons:

1. Because of their history of regular use, the questions could be assumed to be fair tests of the objectives used by the department faculty prior to the new sequence of instruction.
2. The faculty committee agreed that the 46 test items were fair and representative tests of student performance, as defined by the new program's stated objectives.

3. Each of the questions met the classical* accepted standards for discrimination and difficulty.

Items similar to the 46 test questions are found in Appendix B.

All of the courses were under the direction of Nancy Harries, both during the quarters representing conventional instruction, and those analyzed during use of the experimental program. The course structure consisted of twice-weekly multimedia, large-group lectures, each taught by Nancy Harries, and once-weekly small-group recitations, some of which were taught by Nancy Harries and the rest of which were taught by department faculty who had varying degrees of experience and ability. The only significant difference in format between the conventional (control) and the experimental groups was the use of the 700-page programmed text, instead of the conventional textbooks, during the experimental quarters. There was change in certain content emphases of the course, due to the new consumer orientation; however, as was described above, the preliminary

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*Note: The author rejects the classical criterion for selecting test items based upon discrimination and difficulty. The author holds that a "difficult" item that "discriminates" does so because the sequence of instruction fails to account for individual differences of the students. Students should not be punished for deficient instruction. Ideally, an item should be a fair test of the instructional sequence's objectives, and show zero difficulty and discrimination, indicating that individual differences have been overcome, and that all students in the sequence have been able to meet the learning criteria reflected in the test question. The writer advocates what is sometimes referred to as a "mastery model."

study tested only those content areas that had been carried over to the new programmed course.

The purpose of the preliminary study was to ascertain the probability that increased performance of students in meeting the course objectives could be attributed to the sequence of programmed instruction.

Using the 46 test items that had been carried over from the preceding conventionally taught courses, an analysis of covariance was performed, comparing the students' ability to master the test questions under the programmed conditions with their ability under the conventional conditions. Other than the instructional system, the only variable thought to influence performance systematically was student ability. To control for the possibility that the experimental groups might be of above-average ability, the students' cumulative grade-point averages at the time of enrollment in the course were used as the covariate. The study was conducted, comparing students who had been taught by the programmed sequence of instruction during fall term of 1969 with students who had been taught by conventional methods during spring term of 1968. The study was replicated, comparing programmed students during fall of 1969 with conventionally taught students during the spring of 1969, and replicated again, comparing programmed students during spring of 1970 with conventionally taught students during spring of 1969. The results are discussed in Chapter IV.

The Main Study: Analysis of the Measuring Instruments

Five measures were taken during the main study: level of information processing, internal-external perceived control, intrinsic-extrinsic motivation, attitude toward college-level instruction, attitude toward HED 171, and performance on the final exam. Each of these measures is discussed below. In addition, the student's cumulative grade-point average was recorded at the beginning of the quarter.

Performance on the Final Exam

Each of the participants was given the textile instruction in HED 171, following the identical format used in all preceding quarters. There were no significant exceptions or interruptions in the course format and modes of presentation from those of previous quarters. The final exam was representative of all previous quarters, in that it contained many of the same questions that had been used in previous quarters; all test items were judged to be fair tests of the course objectives. Finally, all test items, taken together, reflected a comprehensive examination over the entire instructional sequence. The total scores on the several parts of the exam were combined into a total score, which was used in the study.

Level of Information Processing

The means of classification used was a Paragraph Completion Test, developed by Harold Schroder (1967, pp. 185-204). The 50 subjects used in the main sample completed the test at the beginning of the sequence of instruction. Each subject was asked to complete paragraphs beginning with the stems:

1. Rules.....
2. When I am criticized.....
3. When I am in doubt.....
4. Parents.....

Student responses were sent to Harold Schroder at the University of Southern Illinois (Edwardsville campus), where they were analyzed by coders who had been trained and supervised by Dr. Schroder. Students were classified on a seven-point scale ranging from simple (or concrete) information processing (Scale of 1) to complex (or abstract) information processing (Scale of 7). The minimum acceptable level of intercoder reliability is reported by Schroder (1967, p. 190) to be from .80 to .95. Coders are specifically trained to ignore content referents and look only at the structural complexity generating the response. Two examples are given below, showing typical student responses reflecting a score of 1 (concrete) and typical student responses reflecting a score of 7 (complex) in response to the stem "Rules....."

Score 1 (a) "are made to be followed. They give direction to a project or life or anything. They should not be broken except in extreme circumstances."

(b) "are made to govern society and to keep society from living in chaos. We also have enforcement agencies to make sure people follow rules. If they don't, punishment follows."

Score 7 (a) "serve mankind and should be interpreted in terms of their ends, not their letter. They have a purpose both for the governed (keeping order) and for those who govern (order, maintaining status quo, etc.), which purpose can and perhaps should, change from time and place and, hopefully, lead to a better, broader basis of understanding humans and making rules."

(b) "are made for everyone but are interpreted in many ways. It depends on the point of view of the interpreter. It is in this very process of interpretation that a society stays dynamic and changes and grows."

Internal consistencies of the paragraph completion test are relatively high, as reported by Schroder (1967):

> . . . correlations between individual stem scores and total scores (over six stems) vary between .57 and .75. These figures remain substantially the same whether the mean of six scores or the mean of the top two scores are used. These correlations support the procedure of using mean scores. A correlation of .70 . . . exists between approximately equal split halves of the test (scores on stems "doubt," "rules," and "when criticized" versus

> scores on "confusion," "parents," and "criticism means"). A third measure of internal consistency is provided by the intercorrelations among similar pairs of stems. The correlations between scores based on ambiguity stems, external imposition stems, and the interpersonal conflict stems are .46, .38, and .56, respectively. While this may suggest that different classes of stems (stimuli) produce somewhat different levels of conceptual functioning, the correlations are sufficient to warrant the summation of scores across these stimuli to arrive at a general score. (p. 196)

See Appendix C for details of how the test was administered.

Internal-External Perceived Controls

A 23-item questionnaire developed by Rotter (1960, 1966) is used to provide a measure of locus of perceived control. See Appendix D for a copy of the questionnaire and instructions for administrators. Analysis of the test was reported by Robinson and Shaver (1969). Robinson said:

> For the student group just mentioned (200 male and 200 female Ohio State University elementary psychology students) an internal consistency analysis (Kuder-Richardson) yielded r = .70 for males, and the same for females. For two subgroups of this population test-retest reliability coefficients were computed. After one month: males, r = .60 (N = 30); females, r = .83 (N = 30); combined, r = .72 (N = 60). After two months: males, r = .49 (N = 63); females, r = .61 (N = 54); combined r = .55 (N = 117). Rotter suggests that part of the decrease after the two-month period is due to differences in administration (group vs. individual). Correlations with the Marlowe-Crowne Social Desirability Scale (1964) range from -.07 to -.35. Several factor analyses reported by Rotter support the assumption of unidimensionality of the I-E Scale, and numerous laboratory and survey studies give evidence for its construct validity . . . . (p. 143)

Rotter (1966) reported extensively on the history of the instrument. He cited an intercorrelation table (p. 11) which, he asserted, gives evidence of the measure's internal consistency, and which gives support to his assertion that

the concept of control represents a general measure of behavior. Rotter cautioned against using the test to discriminate among college students within the middle 50 per cent of the distribution. Inasmuch as this study is looking at the total continuum, the application of the Rotter measure to this study is believed to be valid.

Although Rotter's factor analysis does not reveal that there are significant subfactors within the test, a study by Gurin, et al. (1969) showed that discrete factors could be discerned (although weakly). One of these factors, dealing with race ideology, is a result of her having introduced a series of questions of her own dealing with black student perceptions of control. The other three factors do bear upon the Rotter instrument. These factors include: (1) control ideology, (2) personal control, and (3) system modifiability.

The Rotter test, as applied to this study, assumes that "control" is a general factor.

Intrinsic-Extrinsic Motivation Questionnaire

No instrument which was designed to get at the constructs of intrinsic-extrinsic motivation, as described in Chapter II, could be found in the literature. Therefore, the writer designed a 21-item questionnaire, intended to differentiate between intrinsic and extrinsic motivational appeals. Following are three examples of questions. (See Appendix E for the complete questionnaire and instructions for use.)

1. I would most likely climb Mount Everest because...

   ...it is there. (intrinsic stem)*

   ...I would, frankly, somewhat enjoy the publicity, or the task would be useful in my work. (extrinsic stem)

2. The major reason I would invest extensive money and time in flying lessons is because...

   ...of the fun and challenge of flying. (intrinsic stem)

   ...an airplane is a useful transportation tool. (extrinsic stem)

3. When you get right down to it, I might work overtime earning an income...

   ...even though having to earn money gets in the way of things that are important. (intrinsic stem)

   ...because money makes possible the things that are important. (extrinsic stem)

For each question, the student can select one stem from the choice of two stems. The choice calls for a value judgment, in which the alternative at issue could be contemplated for reasons relating mostly to interest or satisfaction from the act itself (defined as intrinsic motivation). The alternate stem, if chosen, implies values which relate mostly to activities which are the means to some other end, such as money, travel, degrees of freedom, social approbation, and so forth (defined as extrinsic motivation). The

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*The identifier does not appear on the questionnaire used by students.

student is asked to select which of the two stems mostly applies to him; after making the selection, the student evaluates the extent to which the chosen stem applies (e.g., much or little). A total score can then be computed, indicating the level of intrinsic-extrinsic motivation.*

Attitude Toward College-Level Instruction in General

A 37-item questionnaire was prepared, which inquired about college-level instruction in general. See Appendix F for the complete questionnaire. An effort was made to write three specific types of questions into the questionnaire. The first type dealt with the concept of control in the fashion of the Rotter test (Items 1 through 6, inclusive); the second type dealt with the concept of motivation (intrinsic or extrinsic); and the third type was general attitude questions. Not all of the questions were appropriate for the objectives of the main study, but were included for possible application subsequent to the study. Only Items 1 through 30, inclusive, were used; within that group, items 7, 8, 9, and 12 were dropped since they were not applicable to the objectives of the main study.

The weightings of all questions are indicated. To conform with the attitude format, the questions pertaining to control were weighted positively (value of 5) to the

*Note: This questionnaire was to prove unsatisfactory for methodological reasons described later, but the discussion is retained because of the theoretical importance of the concept.

extent that they indicated internal control. The questions on motivation were weighted positively (value of 5) when the response implied intrinsic motivation. The weightings are indicated to the right of the item in Appendix F. (For the control and motivation questions, the weightings in parentheses indicate 1 = internal control or intrinsic motivation and 5 = external control or extrinsic motivation, depending upon the item. These valuations were not used in the main study.)

For the purposes of the main study, all questions were evaluated as dealing with attitude. The questions weighted according to the control or motivation (in parentheses) were entered when applied to a secondary analysis, described below.

Attitude Toward HED 171

This questionnaire is identical to the general attitude questionnaire, with the exception that the referent for each item was changed to HED 171. Thus, each item in the HED 171 questionnaire asks the same question as the item in the general questionnaire, but with reference exclusively to the programmed course. In the HED 171 questionnaire, the same considerations apply for the special control and motivation questions. As in the general questionnaire, the main study weightings are with respect to attitude, and the same items have been eliminated from application to the main study. The complete questionnaire is found in Appendix G.

The Main Study: Procedure

The sample of students was given a series of tests designed to measure entry behaviors on the three independent variables: level of information processing, intrinsic-extrinsic motivation, and internal-external control. These tests were given at T_1, as illustrated in Table 1. Also given at T_1 was an attitude survey designed to measure student attitude toward college-level courses in general. The cumulative grade-point average (GPA) was also recorded at T_1.

TABLE 1.--Timetable for collection of data.

T_1 (Beginning of 1st Week)	T_2	T_3 (End of 9th Week)
Attitude Toward College-Level Inst.	HED 171	Attitude Toward HED 171
Motivation Test		Criterion (Final) Test--150 Items
Locus of Control Test		
Level of Information-Processing Test		
Cumulative GPA Recorded		

At T_3, the conclusion of the course, the students were given the criterion test (final exam) on the course objectives, followed immediately by an attitude survey designed to measure attitude toward the specific instructional experience--HED 171.

The cumulative grade-point average (GPA) was that at the time the student enrolled in the course (T_1).

Main Study: Statistical Analysis

The following statistical procedures were performed as tests of the ten hypotheses (Wright and Finn, 1970).

Hypothesis 1: There will be a positive attitude shift (as measured by the group mean) in favor of the highly structured sequence of programmed instruction when the attitude toward HED 171 is compared with attitude toward college-level instruction in general on several dimensions.

Treatment: A one-cell analysis of variance, testing difference from 0 with the dependent variable being the discrepancy score between the attitude toward college-level instruction in general and the attitude toward HED 171.

Hypothesis 2a: Students who are extrinsically motivated will report greater satisfaction with HED 171 than will students who are intrinsically motivated.

Treatment: An analysis of covariance, with the independent variable being the dichotomized score on the motivation test, the dependent variable being the score on the attitude toward HED 171, and the covariate being the performance level on the course final exam.

Hypothesis 2b: Students who perceive the locus of control to be external will report greater satisfaction with HED 171 than will students who are internally controlled.

Treatment: An analysis of covariance, with the independent variable being the dichotomized score on the control test, the dependent variable being the score on the attitude toward HED 171, and the covariate being the performance score on the course final exam.

Hypothesis 3: Students who are more cognitively simple (concrete information processing) will report greater satisfaction with HED 171 than will cognitively complex (abstract information processing) students.

Treatment: An analysis of covariance, with the independent variable being the dichotomized score on the information-processing measure, the dependent variable being the score on the attitude toward HED 171, and the covariate being the performance score on the course final exam.

Hypothesis 4: As a person's information processing progresses toward abstraction, he will hold less-polarized attitudes toward college-level instruction.

Treatment: A regression analysis, with the independent variable being information-processing level and the dependent variable being attitude toward HED 171. The hypothesis was tested for a curvilinear relationship.

Hypothesis 5: As a person's information processing progresses toward abstraction, there will be fewer differences when attitudes toward the course are compared to attitudes toward college-level instruction in general.

Treatment: A regression analysis, with the independent variable being information-processing level and the dependent variable being the difference score between attitude toward college-level instruction in general and attitude toward HED 171.

Hypothesis 6: There will be a relationship between increasing cumulative grade-point hours and increasing levels of internal control.

Treatment: A regression analysis, with the independent variable being the dichotomized score on the control questionnaire and the dependent variable being the cumulative grade-point average.

Hypothesis 7: There will be a relationship between increasing cumulative grade-point hours and increasing levels of intrinsic motivation.

Treatment: A regression analysis, with the independent variable being the dichotomized score on the motivation questionnaire and the dependent variable being the cumulative grade-point average.

Hypothesis 8: There will be no relationship between performance on the course criterion test and locus of perceived control.

Treatment: A regression analysis, with the independent variable being the score on the control questionnaire, and the dependent variable being the score on the final course examination.

Hypothesis 9: There will be no relationship between performance on the course criterion test and intrinsic or extrinsic motivation.

Treatment: A regression analysis, with the independent variable being the score on the motivation test and the dependent variable being the score on the final course examination.

Hypothesis 10: Persons who are intrinsically motivated, internally controlled, and complex in cognitive structure will be highly intercorrelated.

Treatment: A Pearson product-moment correlation matrix between the following variables:

1. Score on the motivation questionnaire.
2. Score on the control questionnaire.
3. Score on the information-processing continuum.

Secondary Study

As an aid in analyzing results, and to learn more about the basic test instruments, a factor analysis was conducted using the Factor A program of the Michigan State University Computer Institute for Social Science Research (Williams, 1967). The program was run with the following instructions: Communalities are unities, principal axes solution followed by varimax (orthoganal) rotation with Kiel-Wrigley criterion set at 3, and eigen-value threshold set at -0.000. The factor analysis was applied separately to each of the following questionnaires: the control questionnaire, the motivation questionnaire, and the general attitude questionnaire. The analysis was applied using responses from the entire class of 142 students* who had completed all of the questionnaires.

Assumptions of the Study

1. No abnormalities or irregularities occurred during winter quarter of 1972 to cause the HED 171 class to represent other than a normative class of HED 171 students.

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*Note: By the end of the quarter, five students had dropped the class, reducing the final N to 137.

2. No abnormalities or irregularities were present in the answers to questionnaires or other data submitted by students and accepted for the study.
3. There was no special or unusual treatment of the course content and method of presentation of HED 171 during winter quarter or 1972 to cause the course experience to be other than the normative experience of previous quarters using the programmed text.
4. The acquisition of test data from students did not significantly affect student interaction with or perception of HED 171 content and structure, nor did it affect their responses to measuring instruments.

Limitations

1. HED 171 reflects a specific content orientation for a special-interest audience, predominantly female, and the findings of the study may or may not be generalizable to other audiences.
2. The programmed text (Harries and Harries, 1969) represents a particular design of programmed instruction and the findings based upon this particular program may or may not be generalizable to experiences based upon classical linear programs or branching-type programs.

Summary

The samples of students used in the preliminary study, the main study, and a secondary analysis were described.

The preliminary study applied an analysis of covariance technique to test student performance on questions that were used in the course as conventionally taught, comparing student performance after conventional instruction with student performance after the programmed instruction. The procedures and various measures used in the main study were described. A secondary study, done for the purpose of assisting in the analysis of the questionnaires, was also described. The results of the procedures follow in Chapter IV.

CHAPTER IV

ANALYSIS OF RESULTS

In this chapter, the analysis of the preliminary study comparing the effectiveness of the programmed sequence with conventional instruction is summarized. The analysis of the 11 hypotheses set forth at the conclusion of Chapter II is summarized. Finally, a secondary study, factor analyzing three of the questionnaires, is summarized. Where statistical significance is at issue, alpha is set at 0.01.

Findings of the Preliminary Study

The purpose of the preliminary study was to compare HED 171 as conventionally taught with HED 171 as taught using programmed instruction, and to attribute the increased effectiveness to the programmed instruction. Such a step is necessary in order to insure that the programmed instructional sequence used in the main study is significantly different from, and an improvement over, general college-level courses in terms of performance, and that the performance is stable and consistent from quarter to quarter. Analysis of the data suggests that in HED 171, student performance using programmed instruction is significantly improved over conventional instruction, that the performance

is stable from quarter to quarter, and that the difference in performance can be attributed to the programmed instruction.

The final examination grade distributions are shown in Table 1. Nancy Harries was the instructor for all quarters included in the table. Fall 1968 and spring 1969 are the two quarters which were taught using the conventional (textbook) method of instruction, and the distributions shown are normative for the conventionally taught course, even when different instructors were in charge of the course. Summer 1969 was the first quarter using the new programmed text. Winter 1972 was the quarter during which data were collected for the main study.

The results described in Table 1 are accepted as being indicative of a relatively consistent or stable base of performance using the sequence of programmed instruction. The stability is maintained in spite of two anomalies believed to have adversely affected spring 1970 student performance. The grade distributions on the final exam have been relatively consistent each quarter of use, with the exception of spring of 1970, when an unusually low performance level was reflected.

The first anomaly during spring of 1970 occurred when the university was disrupted by student protests relating to the Vietnam War, causing exceptionally high emotional levels and excessive and widespread absenteeism. Second, the instructors, who were still under the influence of

Table 1.--Distribution of final examination grades by number of students and per cent of class.

	Conventional						Experimental							
	Fall '69		Spring '69		Summer '69		Fall '69		Spring '70		Spring '71		Winter '72	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
4.0	5	4.3	4	4.5	14	36.8	10	5.9	8	5.0	22	13.1	32	23.4
3.0-3.9	23	19.6	16	18.3	17	44.7	79	45.2	46	30.0	59	35.0	54	39.4
2.0-2.9	44	37.6	32	36.7	5	15.7	66	38.1	50	32.5*	59	35.0	32	23.4
-2.0	45	38.5	35	40.2	2	5.2	20	11.8	47	32.5	28	16.9	19	13.8
N =	117		86		38		175		141		168		137	

*See page 94 for circumstances influencing per cent which is below the norm.

traditions which hold that no test item should be easy," beginning in fall 1969 had removed a number of test items (which they had agreed were fair tests of the program's objectives) because they were now "too easy." Thus, the test had inadvertently become an unfair test of course objectives, because the fall 1969 through spring 1970 exams concentrated on questions measuring those concepts in which the instructional sequence was less effective, rather than on a balanced measurement of all important concepts set forth in the objectives. The eliminated test items have subsequently been returned to the exam. In spite of the introduction of the above-described disparities, performance in HED 171 was maintained at a significantly high level. Further, performance is internally consistent within a class, in which recitation sections are taught by instructors of varying ability and experience.

Table 2 presents the results of the analysis of covariance that was done comparing fall 1969 with fall 1968, and replicated comparing fall 1969 with spring 1969, and replicated again comparing spring 1970 with spring 1969. The replications were necessary to answer concerns that students enrolled during spring quarter were a different type of student, in that they were enrolled for different reasons, had different social pressures, were tired from a year's work, were looking forward to summer, and so forth. Spring quarter 1970 was the quarter in which the students were under the most severe social disruption during the Vietnam protests,

TABLE 2.--Analysis of covariance comparing student performance on the final exam with GPA as the covariate.

	Test 1			Test 2			Test 3		
	Term	Test Score $\bar{X}$	Cum. GPA $\bar{X}$	Term	Test Score $\bar{X}$	Cum. GPA $\bar{X}$	Term	Test Score $\bar{X}$	Cum. GPA $\bar{X}$
Experimental	Fall '69	43.13	2.61	Fall '69	43.13	2.61	Spr. '70	38.41	2.64
N =	175			175			141		
Control	Fall '68	28.97	2.56	Spr. '69	39.07	2.53	Spr. '69	36.49*	2.64
N =	117			54			86		
Significance Between Treatments	p<0.0001			p<0.0041			p<0.0198		
Significance of GPA (covariate)	p<0.0001			p<0.0001			p<0.0001		

*NOTE: Spring '69 N=54 (in Test 2) was increased to N=86 for Test 3, representing a more complete sample. The cumulative grade-point hours of the 31 students added were not available at the time Test 2 was run.

and represented the lowest performance level since the programmed instruction was instituted. Nevertheless, the performance during that quarter is significantly above traditional norms and can be attributed to the programmed instruction at an alpha level below .05. The analysis indicates that the cumulative grade-point average accounts for a significant portion of the effect.

The Findings of the Main Study

The purpose of the main study was to evaluate three student entry-behavior variables in interaction with the programmed cognitive structure. These independent variables were: information-processing level, locus of perceived control, and intrinsic-extrinsic motivation. The dependent variables were: attitude toward college-level instruction in general, attitude toward HED 171, performance on the course final exam, and difference score between attitude toward college-level instruction in general and attitude toward HED 171. Student grade-point average was also used as a variable for certain of the hypotheses. Group means and standard deviations for the variables are shown in Table 3. An intercorrelation matrix showing relationships between all variables contributing to the study is presented in Table 4.

Following are the experimental hypotheses and the findings of the main study:

TABLE 3.--Group measures of central tendency for variables used in the study.

Variable		Possible Range	$\bar{X}$	Variance	Standard Deviation
Locus of Control	1 (CONTRL)	23-46	34.30	15.11	3.89
Attitude Toward College-Level Courses in General	2 (AGEN)	26-130	74.78	74.01	8.60
Motivation	3 (MOTIVA)	21-84	49.28	65.06	8.07
Attitude Toward HED 171	4 (AHED)	26-130	97.00	217.26	14.74
Cumulative Grade-Point Average	5 (GPA)	0-4	2.89	0.26	0.51
Information-Processing Level	6 (INFOPR)	1-7	4.10	1.89	1.37
HED 171 Final Exam	7 (FINAL)	0-150	121.48	339.15	18.42
Difference Score Between AGEN and AHED	8 (DIFF)	0-130	22.22	298.62	17.28

df = 49

TABLE 4.--Correlation matrix for variables used in the study.

		1 CONTRL	2 AGEN	3 MOTIVA	4 AHED	5 GPA	6 INFOPR	7 FINAL	8 DIFF
1	CONTRL	1.00	...	...	...	...	...	...	...
2	AGEN	-0.39	1.00	...	...	...	...	...	...
3	MOTIVA	-0.09	0.13	1.00	...	...	...	...	...
4	AHED	-0.11	-0.03	0.09	1.00	...	...	...	...
5	GPA	0.12	0.08	-0.15	0.40	1.00	...	...	...
6	INFOPR	-0.24	-0.08	-0.07	0.01	-0.18	1.00	...	...
7	FINAL	0.12	0.08	0.04	0.63	0.67	-0.12	1.00	...
8	DIFF	0.10	-0.52	0.01	0.87	0.30	0.05	0.50	1.00

$r_{\alpha} = .05 = .2353$

$r_{\alpha} = .01 = .3281$

df = 49

Hypothesis 1

There will be a positive attitude shift (as measured by the group mean) in favor of the highly structured sequence of programmed instruction when the attitude toward HED 171 is compared with attitude toward college-level instruction in general on several dimensions.

TABLE 5.--Attitude toward college-level courses in general compared to attitude toward HED 171.

	$\bar{X}$	Standard Deviation
General Attitude	74.78	8.60
HED 171 Attitude	97.00	14.74
Difference	22.20	17.28
Univariate F = 82.67	df = 49	p .0001

Hypothesis 1: Univariate Analysis of Variance

Finding: There was a significant difference in attitude when attitude toward college-level instruction in general was compared to attitude toward HED 171 in particular. Students preferred HED 171 over other college-level courses in general. The experimental hypothesis was supported.

Hypothesis 2a

Students who are extrinsically motivated will report greater satisfaction with HED 171 than will students who are intrinsically motivated.

TABLE 6.--Attitude toward HED 171 compared with intrinsic-extrinsic motivation with final exam grade as covariate.

	Attitude Toward HED 171		Final Grade	
	$\bar{X}$	Standard Deviation	$\bar{X}$	Standard Deviation
Extrinsic Motivation	99.17	15.13	123.08	19.12
Intrinsic Motivation	95.00	14.40	120.00	18.10
	$p<0.43$		$p<0.0001$	(of covar.)

F = 31.13 df (hypothesis) = 1 df (error) = 47

Hypothesis 2a: Analysis of Covariance

Finding: The greater preference for HED 171 of extrinsically motivated students over intrinsically motivated students was not significant with the effect of performance removed. The experimental hypothesis was not supported.

Hypothesis 2b

> Students who perceive the locus of control to be external will report greater satisfaction with HED 171 than will students who are internally controlled.

TABLE 7.--Attitude toward HED 171 compared with locus of control with final exam grade as covariate.

	Attitude Toward HED 171		Final Grade	
	$\bar{X}$	Standard Deviation	$\bar{X}$	Standard Deviation
External Control	94.96	16.68	123.70	17.27
Internal Control	99.39	12.01	118.87	19.74
	$p<0.03$		$p<0.0001$	(of covar.)

F = 37.89 df (hypothesis) = 1 df (error) = 47

Hypothesis 2b: Analysis of Covariance

Finding: The greater preference for HED 171 of internally controlled students over externally controlled students was not significant. The experimental hypothesis was not supported.

Hypothesis 3

> Students who are more cognitively simple (concrete information processing) will report greater satisfaction with HED 171 than will cognitively complex (abstract information processing) students.

TABLE 8.--Attitude toward HED 171 compared with level of information processing with final exam grade as covariate.

	Attitude Toward HED 171		Final Grade	
	$\bar{X}$	Standard Deviation	$\bar{X}$	Standard Deviation
Concrete	97.16	15.96	122.75	19.30
Abstract	96.75	13.09	120.63	17.47
	$p<0.65$		$p<0.0001$ (of covar.)	
$F = 32.00$	df (hypothesis) = 1		df (error) = 47	

Hypothesis 3: Analysis of Covariance

Finding: There was no difference between the attitude toward HED 171 of concrete compared with abstract students with the effects of increased performance removed. The experimental hypothesis was not supported.

Hypothesis 4

> As a person's information processing progresses toward abstraction, he will hold less-polarized attitudes toward college-level instruction.

TABLE 9.--Test for curvilinear relationship between information processing and polarized attitudes toward college-level instruction in general.

F = 1.15	df (hypothesis) = 2
p<0.32	df (error) = 47

Adding Dependent Variable "Information Processing" to the Regression Equation: Chi-square = 0.27 df = 1 p<0.60

Adding Dependent Variable "Information Processing" Squared to the Regression Equation: Chi-square = 1.95 df = 1 p<0.16

Hypothesis 4: Regression Analysis of 2nd Degree Equation With Two Covariates

Finding: There is not a significant relationship between level of information processing and polarity of attitude in regard to college-level instruction in general. The experimental hypothesis was not supported.

Hypothesis 5

> As a person's information processing progresses toward abstraction, there will be fewer differences in attitudes toward the course when compared to college-level instruction in general.

TABLE 10.--Information processing in relationship to the difference in attitude between college-level instruction in general and HED 171.

F = 0.1071	p<0.74
df (hypothesis) = 1	
df (error) = 48	

Hypothesis 5: Regression Analysis With One Dependent Variable

Finding: There is no relationship between a student's level of information processing and the difference between attitudes toward college-level instruction in general and HED 171. The experimental hypothesis was not supported.

Hypothesis 6

> There will be a relationship between increasing cumulative grade-point hours and increasing levels of internal control.

TABLE 11.--Locus of control in relationship to cumulative grade-point average.

F = 0.72	p<0.40
df (hypothesis) = 1	
df (error) = 48	

Hypothesis 6: Regression Analysis With One Dependent Variable

Finding: There is no relationship between a student's locus of perceived control and his cumulative grade-point average. The experimental hypothesis was not supported.

Hypothesis 7

> There will be a relationship between increasing cumulative grade-point hours and increasing levels of intrinsic motivation.

TABLE 12.--Intrinsic-extrinsic motivation in relationship to cumulative grade-point average.

F = 1.11	p<0.30
df (hypothesis) = 1	
df (error) = 48	

Hypothesis 7: Regression Analysis With One Dependent Variable

Finding: There is no relationship between a student's level of intrinsic-extrinsic motivation and his cumulative grade-point average. The experimental hypothesis was not supported.

Hypothesis 8

> There will be no relationship between performance on the course criterion test and locus of perceived control.

TABLE 13.--Locus of control in relationship to final exam grade.

F = 0.68	p<0.41
df (hypothesis) = 1	
df (error) = 48	

Hypothesis 8: Regression Analysis With One Dependent Variable

Finding: There is no relationship between a student's locus of perceived control and his performance on the course final exam. The hypothesis was supported.

Hypothesis 9

There will be no relationship between performance on the course criterion test and intrinsic or extrinsic motivation.

TABLE 14.--Motivation in relationship to final exam grade.

F = 0.06	p<0.80
df (hypothesis) = 1	
df (error) = 48	

Hypothesis 9: Regression Analysis With One Dependent Variable

Finding: There is no relationship between a student's level of intrinsic-extrinsic motivation and his performance on the course final exam. The hypothesis was supported.

Hypothesis 10

Persons who are intrinsically motivated, internally controlled, and complex in cognitive structure will be highly intercorrelated.

TABLE 15.--Relationship of control, motivation, and information processing with each other.

	Control	Motivation	Information Processing
Control	1	...	...
Motivation	-0.09247	1	...
Information Processing	-0.24268	-0.074395	1

$r^{\alpha} = .05 = .2353$ df = 49
$r^{\alpha} = .01 = .3281$

Hypothesis 10: Pearson Product-Moment Correlation

Finding: There is no significant relationship between perception of locus of control and concreteness of information processing. Neither is there a relationship between motivation and information processing, nor between intrinsic-extrinsic motivation and locus of perceived control. The hypothesis was not supported.

Secondary Study

Recalling that a factor analysis was performed by Rotter and Gurin (Rotter, 1966; Gurin, 1969) on the Rotter scale of internal-external control, the writer decided also to run a factor analysis on the scale and separately on the other three "before" questionnaires. It was thought that the factor analysis might assist in the interpretation of the main study. Following are the results of this secondary study. Table 16 summarizes the results of the factor analysis.

The items corresponding to the useable factors are found in the respective intercorrelation table (see Appendix H). Following Table 16 are the definitions of the factor names as related to the topics of the items that clustered together.

TABLE 16.--Summary of factor analyses.

	Control	Motivation	General Attitude
Number of Factors to Emerge	7	7	5
Variance Accounted For	0.5569	0.5242	0.3655
Number of Usable Factors	2	2	3
Variance Accounted For	0.2603	0.2047	0.1949
Table of Intercorrelations	Table 17*	Table 18*	Table 19*
Names of Usable Factors	1. System Modifiability	1. Personal (Signif. Other)	1. Control
	2. Personal Ideology	2. Practical	2. Motivation
			3. Challenge

*See Appendix H.

Control Questionnaire

A. System Modifiability--Perceived ability or power to change or influence the institutions of society, especially government.

B. Personal Ideology--An abstract orientation toward "self" as an agent of influence in the environment.

Motivation Questionnaire

A. Personal (Significant Other)--Relating to actions of the self as judged by another.

B. Practical--Tendency of the item to be related to decisions outside of the "self."

General Attitude Questionnaire

A. Control--Relating to factors similar to the Rotter measure, as the perception of alternatives relating to the self's ability to control or to function.

B. Motivation--Relating to questions of intrinsic or extrinsic motivations as measured by the motivation questionnaire.

C. Challenge--Relating almost exclusively to an element of challenge or mastery.

Summary

The findings of data gathered and the analysis of those data have been reported for a preliminary study of the programmed cognitive structure; for the main study, which was the programmed cognitive structure, to investigate the theoretical variables of interest; and for a secondary factor

analysis of three of the questionnaires. Discussion and implications are considered in the following chapter.

CHAPTER V

DISCUSSION AND CONCLUSIONS

In this chapter, the results of the preliminary study are discussed in terms of its effect on student performance and in terms of its use as a stable base for the conduct of the main study. Second, the implications of the intercorrelation matrix of the main study variables are discussed. Some conclusions are drawn, based upon the matrix and the tests of the specific hypotheses as related to the entry behavior variables of information-processing level, intrinsic-extrinsic motivation, and internal-external locus of perceived control. Then the implications of the findings are briefly related to certain of the literature. Third, the findings of the study are discussed in regard to their implications for instructional development. Finally, the thesis concludes with a summary of implications for future research.

Implications of the Preliminary Study

The preliminary study clearly demonstrated an increase in performance in the basic textiles course, which could be attributed to the programmed cognitive structure. Analysis of the performance of students for each quarter since the implementation of the programmed text, beginning in summer

of 1969, indicates that the level of performance is stable. Use of the structure as a predictable vehicle for examining student personality variables applied in the main study in interaction with the programmed structure appears to be justified.

Implications of the Intercorrelation Matrix and Tests of the Hypotheses

Because of the large number of correlations in the study, the writer concluded that a more proper test of significance would be to set the alpha level at 0.01 rather than at 0.05, as was originally planned. Based upon a significance level of 0.01, the conclusions which can be drawn from the matrix are as follows:

1. There is a general factor called "Locus of Perceived Control" which interacts with a student's general attitude toward college-level instruction (-0.39) in that the more internal the control, the more positively the student will view the college instructional experiences; the more external the control, the more negatively the student will view the experience.

2. Regardless of a student's locus of perceived control, the effect of the HED 171 instructional experience effectively removes the relationship of control to attitude in that there is no apparent relationship between control and attitude toward HED 171 (-0.11).

3. The concept of intrinsic-extrinsic motivation did not show any significant relationship to the variables of

control (-0.09) or information processing (-0.24); therefore, there will be no discussion of this variable in terms of application.

4. The concept of information-processing level did not show a significant relationship to the variables of control (-0.24) or motivation (-0.07).

5. The most significant correlation is between GPA and final grade (0.67). Students who typically tend to perform above the norm still perform above the norm in HED 171, but when the performance level is examined, the effect of HED 171 is to raise the lowest common denominator of performance level significantly above the norms established during application of conventional instructional techniques.

6. The difference score (DIFF) between the general attitude questionnaire and the HED 171 attitude questionnaire correlates most with attitude toward HED 171 (.87) and second with attitude toward college-level instruction in general (-.52), but not significantly with GPA (.30). In other words, the more negative the attitude toward college instruction, the more striking was the difference in student attitude toward HED 171, with the difference being in the positive direction. Students who typically disliked college-level instruction, typically approved of HED 171. This relationship, however, has its exceptions, in that these relationships are based upon group means, and analysis of the attitude questionnaire weightings found in Appendix F shows that there were still some students (less than 10 percent) who viewed

HED 171 negatively. The study sheds no direct light on the nature of these individual differences.

7. GPA correlated significantly with attitude toward HED 171 (0.40), but there was no correlation with attitude toward college-level instruction in general (0.08). Whatever is the nature of student individual differences as measured by this AGEN (general attitude) questionnaire, those individual differences were apparently significantly overcome. This was demonstrated in the fact that increasing levels of performance in college-level instruction tends to be associated with increasing positive attitude toward HED 171, but not toward college-level instruction in general.

8. Student performance on the final exam was most significantly correlated with GPS (0.67), attitude toward HED 171 (0.63), and the difference score (DIFF) between attitude toward HED 171 and college-level instruction in general. Performance on the final exam was not related to attitude toward college instruction in general (.08). In the tests of the specific hypotheses to follow, performance was found to be the most significant relationship with attitude toward HED 171. This relationship becomes even more significant since performance does not seem to be related to attitude toward college instruction in general (i.e., GPA with AGEN = 0.08), and that the measure of HED 171 was taken immediately after the HED 171 final but before knowledge of the outcome. The students had to place their feelings about the previous course experience in the context of their

feelings toward their performance on the exam when reflecting their attitudes in the AHED questionnaire.

The difference score (DIFF) between attitude toward college instruction in general and attitude toward HED 171 correlated with AGEN -0.52. This relationship suggests that the greater the DIFF, the lower the AHED. This is of interest because, since there was no correlation between AHED (attitude toward HED 171) and AGEN (-0.03), the greatest difference in attitude was demonstrated by students with a history of poor attitude toward college instruction in general; or the group with the least probability of showing positive affect toward a college-level course showed the most significant change in a positive direction.

In view of the relationships suggested by the correlation matrix, there were findings based upon some specific tests of the hypotheses. One of the first conclusions reached as a result of specific tests of the hypotheses and interpretation of the correlation matrix was to discount the findings based upon the intrinsic-extrinsic motivation questionnaire. The matrix shown in Table 4 indicates that no significant relationships with the questionnaire emerged on any of the variables in the study. Further, a check of the range of scores found in Table 3 shows that out of a possible range from 21 to 84, the actual range was only from 36 to 61, with a standard deviation of 8.06. The concept of intrinsic-extrinsic motivation is assumed not to have been measured by the questionnaire; hence no conclusions can be drawn

with respect to that variable. In consequence, no further consideration will be given to that variable in this discussion. However, the theoretical concept of intrinsic-extrinsic motivation is still believed to be a tenable concept and is discussed further below, under the heading of "Implications for Further Research."

The construct of information processing also failed to produce significant relationships. In light of the history of research, and extensive successful use of the Schroder measure, the only possible methodological factor that could account for the problem would be excessive variability of the coding of the information-processing test. Since the coding of the information-processing levels was supervised by Schroder himself, this possibility has been discounted. The reasons for the failure of the information-processing measure to emerge in significant relationship to the other variables relates to theoretical reasons and constitutes an important finding of the study.

Hypothesis 3, which states that there will be discrimination by information-processing level in relation to attitude toward HED 171 and AGEN, was predicated upon the assumption that certain salient features of the experience, such as the nature of the structure in regard to degrees of freedom and level of perceived uncertainty, would be such as to generalize to the overall attitudes of the students who were concrete processors and would reveal itself in discrimination on the general attitude questionnaire. This was not

the case, however, and given the generalized nature of this questionnaire, the outcome of the study is still consistent with the theory of Schroder, who wrote (Schroder and Suedfeld, 1971):

> One of the most common and simplistic assumptions in psychology, however, is that persons typically use single combinatory rules in judging, evaluating and thinking. Much of the work in personality, in attitudes and needs assumes a single "position," an "own stand." However, it is obvious that persons can generate different perspectives about the same scale of values of information by varying the weightings of dimensions. This variation of weightings, the generation of alternate combinatory rules, is common when the situational context changes. (p. 251)

In order to check on the apparent support for Schroder's assertion, as revealed by the findings, a post study was done, in which extreme scores (information-processing level scores of 1 and 2, concrete; and information-processing level scores of 6 and 7, abstract) were subjected to a multivariate analysis of variance. The results are tabulated in Table 20 of Appendix I. Even at the extreme ends of the scale, the hypothesized relationships are not significant. Thus Hypothesis 3, Hypothesis 4, and Hypothesis 5 are rejected on the assumption that there is no unidimensional attribute related to "attitude" that is sufficiently salient to discriminate even at the concrete end of the information-processing continuum. This finding is of interest because of the almost universal use of generalized measures of attitude used in support of the analysis of student attitudes toward instructional alternatives. The implications of this finding are discussed below under the

heading "Implications for Future Research." Although a generally positive attitude toward the course is shown, no conclusion can be reached about student individual differences relative to information processing.

A second conclusion that can be reached is the support for Rotter's assertion that the construct of locus of perceived control is a generalized construct, in that there was a significant correlation between control and the general attitude toward college-level instruction in general (-0.39). The specific assumption in Hypothesis 2b, to the extent that the control variable will discriminate toward HED 171 in particular, was not supported, however. Further, a post study multivariate analysis of variance was also run on the extreme ends of the internal-external continuum in order to ascertain whether variability in the middle range was exerting a confounding effect, since Rotter cautioned against using the middle range for college students. The results of this study are found in Table 21 in Appendix I. Although a trend emerged, there was no statistical significance in support of the hypothesis at the extreme ends of the range. Given the emergence of a relationship to control in terms of a general attitude toward college-level instruction in general, the failure of the same relationship to emerge in regard to student attitude toward HED 171 is attributed to the effects of HED 171. The study, however, sheds no direct light on the dimensions accounting for the finding. The significant conclusion emerging from this

portion of the study is the apparent possibility of generating external cognitive information structures which, because of their low uncertainty, override the negative associations of externally perceived control with instructional systems, in order to increase performance level, regardless of the history of performance, and with associated high positive affect. The structure provides external cues that outcomes are really based upon skills rather than chance.

Hypothesis 8, which predicted that there would be no relationship of control to performance in HED 171, was supported. Hypothesis 6, however, which predicted that there would be a relationship of internal control to high GPA, was not supported by this sample of students. The hypothesis was predicated upon the structural nature of most college courses as compared to HED 171, in which there is a substantially lower level of uncertainty than in college courses in general. It was thought that, in addition to the existence of some direct support for the hypothesis in the literature (Seeman, 1962; Seeman and Evans, 1965; Rotter, 1966), the less dependence of internally controlled students upon visible structure would lead to the hypothesized relationship between GPA and control. However, apparently Lefcourt's (1966) assessment is more applicable:

> . . . in investigations concerned with learning and achievement related variables, the control construct allows some prediction when the materials are relevant to the subjects' goal strivings. (p. 214)

In addition, Lefcourt reported that there can be failure to

discriminate among goal-directed learning and achievement activities where female subjects are involved (Crandall, et al., 1962, 1965). Since the sample used in this study happened to be 98 percent female, there could be a sex bias operating in terms of the control construct as applied to the GPA, since GPA is a goal-related variable. Nevertheless, the control construct did clearly relate to general attitude. In relation to the phenomenon of goal striving, the failure of the intrinsic-extrinsic motivation variable to function for the methodological reasons described above is especially disappointing in this instance, since there remains the possibility of relating variability, on the motivation construct of this particular finding, to control. Stated another way, it is possible that control is a unidimensional construct when applied to attitude, but multidimensional when applied to goal-directed behaviors, and there may be a relationship to intrinsic-extrinsic motivation.

A Complementary Study by Nancy Harries (1972)

Using the same winter quarter, 1972, students, Nancy Harries investigated the effect of the programmed cognitive structure on decision rule, information processing, and time orientation. Significant gain scores were revealed on both information processing and future time orientation in the area of textile decision making covered by the course content. Further, there was evidence of a small but statistically significant generalization of information-processing

ability beyond the textile area, as measured by a posttest using the Schroder instrument on a second sample of 25 students. This evidence suggests that it is possible for the structure of cognitive information, regardless of content orientation, to influence information-processing ability and to modify a person's time orientation in the future direction.

Summary of Implications

1. The "control" construct seems to be a generalized unidimensional construct where attitude is concerned, but possibly a multidimensional construct where goal-directed performance is concerned.

2. The "information-processing" construct is a multidimensional construct, and does not lend itself to applications or measures which assume unidimensional constructs, such as attitude surveys or goal-directed performance.

3. The function of the intrinsic-extrinsic motivation construct is indeterminate for methodological reasons applicable only to this particular study.

4. The nature of the programmed cognitive structure, for this particular sample, is such as to increase significantly the performance, as tested by rigorous criterion measures. (See Appendix B.)

5. The nature of this particular programmed cognitive structure is such as to generate high positive affect for a substantial majority of the sample studied.

5. When combined with the N. Harries study, it was found that the nature of this particular structure of cognitive information can be used to increase significantly the processing level of the cognitive information covered, and to change the time orientation from present to future. Further, the evidence suggests that there is some generalization of information processing beyond the content area to other stimulus dimensions.

Application of the Findings and Implications to Instructional Development

Three general areas might find some application of the findings of this study: application to the writing of programmed instruction, application of the concept of locus of perceived control to Instructional Development, and application to heuristics in the designing of instructional system prototypes.

One of the common heuristics of writing programmed instruction is the Skinnerian injunction that no more than 10 percent errors should be allowed throughout the length of the program. The Holland-Skinner (1961) program is a classic example. However, one of the characteristic phenomena that has come to be associated with such programs is "pall effect," or extreme fatigue and boredom reported by students when working such programs. Roth (1963) reported on this effect in detail in analyzing student reaction to working through the Skinner-Holland program. Twenty-one out of 26 students increasingly reported frustration and boredom as

they progressed through the sequence even though they continued to do well in performance. Although there were some students who agreed that the HED 171 sequence of instruction was "boring," the majority disagreed with that statement. (See Appendix F.) It is felt that the 10 percent error rate was adhered to only during the initial stages of the program. The increasing level of complexity soon made it extremely difficult to maintain the minimum 10 percent error rate since closure on a complex concept might require several frames. Throughout the program, however, all deliberate effort was made to cast the structure in terms of familiar referents with which the students could identify. These techniques included references to fashion, human factor anecdotes, and references to industry-related conditions and implications. Although the authors were not entirely familiar with information-processing theory and concepts of intrinsic-extrinsic motivation at the time the text was written, it seems that the net effect of the different techniques used in the program was such as to strike near the optimum information-stimulation level illustrated in Figure 5, p. 44.

The theory explains a second area of possible application relating to the Rotter measure as it might be applied to Instructional Development. Rotter (1966) said:

> Research in human learning should be understood in the light of a position on a continuum of internal to external control that the tasks and procedures would be perceived by the subjects. (p. 25)

Some different interpretations of the results of Instructional Development efforts might result if student interaction with information structures were to be examined from the perspective of the student. Perhaps it should be considered that when an instructional system is designed for 25 students, not to mention 225 student, not one instructional system is designed, but rather "N" instructional systems are designed. For example, on the control dimension alone:

> If a person sees reinforcement as being outside his own control or not contingent, that is, depending upon chance, fate, powerful others, or unpredictable, then the preceding behavior is less likely to be strengthened or weakened. . . learning under skill conditions [internal control] is different from learning under chance conditions [i.e., external control]. (Rotter, 1966, p. 5)

Applications of the Rotter measure to instructional development are discussed further under "Implications for Future Research." Thus the data suggest that extremely controlled students will respond more positively when information is contained in an uncertainty-reducing structure.

The third area of application of the findings relates to the design and development for instructional prototypes. Abedor (1971) proposed an Instructional Development heuristic for analysis and further development of existing instructional prototypes. Based upon the demonstrated effectiveness and satisfactory student reception of the HED 171 instructional system, following are some heuristics which can be applied during design of the prototype stage, and which lend themselves to further analysis within the Abedor model. All

of the following are inherent aspects of the HED 171 sequence of programmed instruction. There is nothing in the study which points conclusively to or relates these heuristics causally to the outcomes reported in this study, but clearly, taken together with perhaps some other intangibles, they seemed to work for the intended HED 171 student audience. All page numbers refer to Harries and Harries (1969).

1. Define responsibility of the student. Part of the introductory material of the program clearly explicated for the students their expected role in the instructional sequence (pp. 1-6).

2. Identify salient audience referents. Prior to deciding upon the nature of the information structure in which the content information would be embedded, pains were taken to identify topics, items, areas, trends, applications, and personalities which were of importance to students, which were known to "turn them on," which would not be so transient as to be illogical within the lifetime of the text prior to revisions, and which lent themselves to use as a suitable vehicle for the content data.

3. Control complexity development. The details of the developmental sequence are described in the preface to the text (pp. v-vii). One student was selected who was above average in ability, and who had completed the course. Such a person gives the advantage of relative newness, yet can combine the advantage of perspective with existing course material and experience with a still relatively simple

construct in regard to the course content. This student worked through the first draft which the authors by her side. A detailed explanation was given for each ambiguity the program presented to the student. (This student involvement occurred after the authors thought all communications problems had been solved, but they obviously had not.) Then the program was tested at that stage by a selected sample of six students of varying ability; the program was revised again, prior to large-scale tests of the mimeographed version. In this way, the complexity of content development was carefully controlled to retain the optimum level indicated by student performance in relationship to group norms.

4. Reduce uncertainty. Deliberate efforts were made to reduce student uncertainty while working through the program. The estimated time objectives were established for each unit, and written so that the student could see and understand them. Estimated time frames were given so that the students could know in advance approximately how long they would commit themselves to in beginning a section of the program. There was immediate knowledge of results. Sample test items were included at the conclusion of every unit. The student was told, in advance, the nature of the test format, and was given practice in working in that format. Where possible, the content under discussion was related to the "real world" so that the student had cues to the place of the materials within the textiles field. The authors made every effort to

anticipate and answer the question at the time it would logically be asked by the student: "Why am I being asked to learn this?"

5. Construct an information-linking structure which is compatible with the content structure. The purpose of the linking structure is to relate content items with each other. What is said at Time 1 is said with respect to Time 2. What is said at Time 2 is designed to link Time 1 with Time 3, and so on. The students were encouraged to review as often as needed. The linking structure has far greater potential than was exploited in the HED 171 program. Given present understandings of process variables, the linking structure can be used to develop student processing ability more fully in handling the course content. In order to assist students in linking content, special memory matrixes were designed, which contained the skeleton or outline or logic flow of the system, and students could fill it in according to the detail which was suitable for them.

6. Establish discrete and short breaking points. Every effort was made to introduce logical stopping points such that the student seldom had to work longer than 30 minutes without an opportunity to stop.

7. Provide devices for student internalization of behaviors. The student interaction with the memory matrixes served this purpose. Fabric samples were provided at appropriate points for students actually to work with the textile materials they were studying about in the program. Students

were put in role-playing positions in working through the program. Future development of the course will involve the design and development of visualized sequences to be used in conjunction with an instructional game to further facilitate internalization of key concepts.

Scientific procedures can be used in the analysis of student interaction with such instructional systems, but until much more is learned about the process of student interaction based upon student individual differences in regard to personality and ability, the design of such systems must remain as much an art form as a scientific application. The author is convinced that a fruitful path toward increasing the predictable results of such "art forms" is through the route of cybernetic psychology and information-processing concepts within the overall concept of general systems theory.

At the practical level, for example, a study of a training program involving the complex behaviors of radar controllers revealed a construct called "visibility" (Alexander, et al., 1962). In information-processing terms, it was learned that when an external structure is to be internalized, or in other words becomes a part of the person's operational "map" of the external environment, knowledge of results has little effect when the person-environmental interaction is direct. This effect can be interpreted as the result of the structures being in direct interaction so that feedback was redundant, hence irrelevant. However, when

the radar controllers had to interact with structure which was remote, they had to resort to devices such as telephones, printouts, etc., which, in effect, extended their senses beyond immediate direct interaction. Under these conditions, the behavior of external and remote structures with which they had to interact had to be codified by means of a common symbol structure. Under these conditions, feedback in the form of knowledge of results (i.e., the making "visible" of remote structure) became the critical factor in increasing accurate operational performance of the radar controllers.

At the theoretical level, the concept of "visibility" and the effect of structural interactions is more fully developed through the related concept of "adaptive self-organization" (Ashby, 1968a,b). Interaction with the cognitive symbol structure of HED 171 leads to a form of adaptive self-organization. By means of interaction with the programmed cognitive structure, the student constructs an internal map of the remote external world called "Consumer Textiles." As a result of this interaction, the internal schemata becomes altered in such a manner that a more functional interaction is possible when confronted with the real structure in the external world of consumer textiles.

Concepts of information processing can also be found to be compatible at the philosophical level relating to systems theory concepts, for example in terms of the "invariant Gestalten" of Lazlo (1969). Lazlo provided a cybernetic model capable of dealing not only with the tangible evidence

of physical structure, but also the intangibles of visual syntax, poetry, and art.

There seems to be a variety of possible applications to which the implications of this study might be relevant, not only in existing patterns of instruction, but also in more radical innovative approaches, such as cognitive mapping (Hill and Nunney, 1971). In any case, the utility of this study can be related to future research.

Implications for Future Research

The potential of the findings of this study for future research may be found in three areas: (1) in terms of the experimental variables used in the study; that is, information processing, locus of perceived control, and intrinsic-extrinsic motivation; (2) in the application of the variables to instructional systems; and (3) in suggesting a different approach to research using treatment by individuals rather than treatments using the normative group means of the variable under consideration.

Research Relating to the Experimental Variables

A factor analysis of the three questionnaires is of interest in terms of the findings related to the attitude questionnaire. (See Appendix H.) Recall that the writer deliberately attempted to structure control-oriented and motivation-oriented questionnaires. Although the correlations are weak, both of the constructs of motivation and

control emerged as the principal factors, along with a third factor called "challenge." In addition to some of the items deliberately intended to reflect control or motivation, some other items clustered with the factor. While these items were not intended to represent the factor, upon examination they can be seen to be related to the factor with which they clustered. The concept of motivation should be looked at more closely. Perhaps a more basic level of examination using words, instead of sentences (with their additional syntactical confusion), in association with the intrinsic-extrinsic motivation variable, could be achieved through the application of the semantic differential (Osgood, et al., 1957).

Information-processing concepts relative to the "bit" also might be pursued. This would involve codifying the programmed structure in terms of information "bits" and then developing or modifying test instruments into the "bit" format.

Research Relating to Other Instructional Systems

Only the control instrument combined with the attitude survey would seem to have immediate application to other instructional systems. Comparative analyses could be made as to the effect of such systems on the control and attitude variables and their relationships, as measured by this study. Would engineering courses (with primarily male students)

reveal a different dynamic? Would human ecology students (primarily female) reveal a different dynamic in other human ecology courses?

While all of these explorations might be useful endeavors, and would certainly be interesting, such approaches essentially replicate what the author believes to be one of the major difficulties encountered in this study--namely, the attempt to generate useful findings based upon group means, in order to measure variables which are essentially based upon individual differences rather than upon group means.

Treatments to Individual Differences

A possible area of research lies in applying the information processing and locus of control variables to studies concerned with individual differences. Such an approach to individual differences would be possible using Q-techniques (Stephenson, 1953) and the reportory grid of Kelly (1955).

The findings of this study support Schroder's contention that, in the case of information-processing constructs, a multidimensional variable is at issue; hence it is subject to considerable individual differences effects. Likewise, the findings also support Lefcourt's (1966) assertion that use of the locus of control variables depends upon the nature of relationships with goal-directed behavior. In such an application, control is another variable which is subject to wide individual differences. In order to maximize the

acquisition of individual variables, several lines of investigation seem feasible.

In Figure 7, groups are classified as being high or low as the variables of information processing or locus of perceived control.

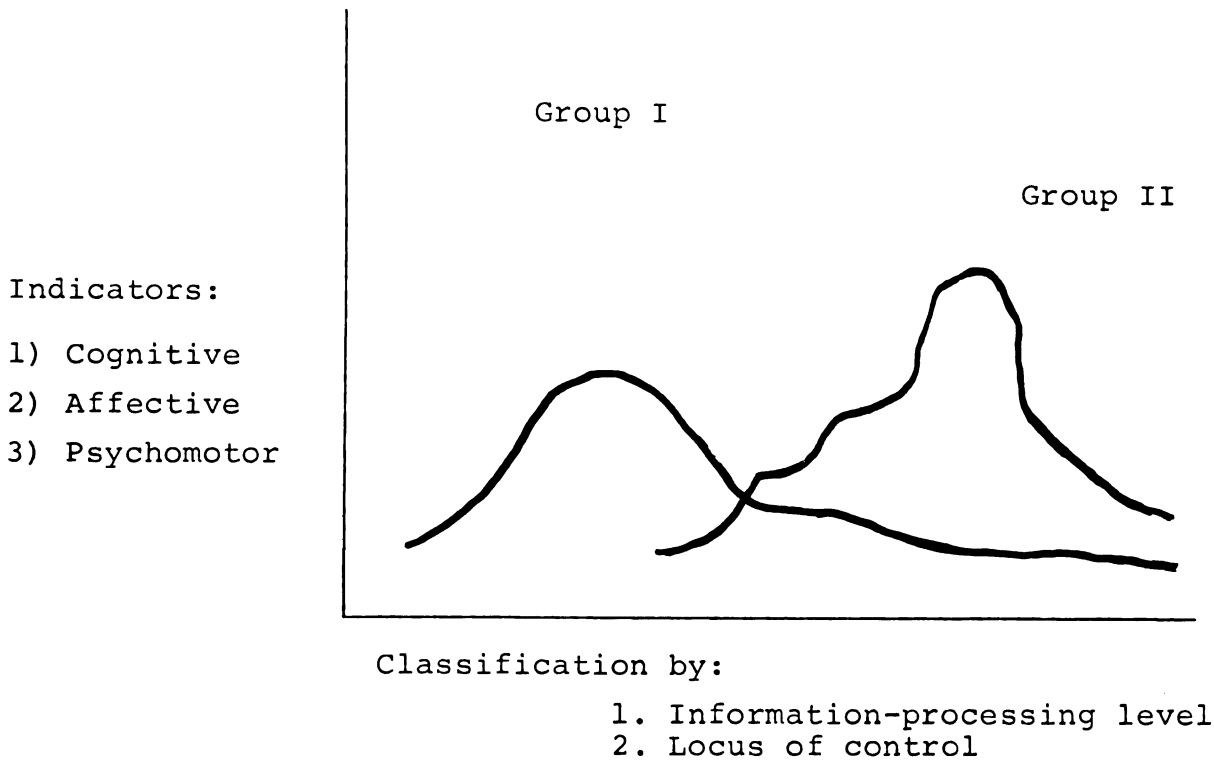

Figure 7.--Dimensions of potential research.

Given the Groups representing a high or low point on a given classification; of interest would be the height and shape of their respective curves as measured by the indicators.

The following research treatments can be applied based upon:

A. Personality typologies emerging from reportory grid analysis.

1. Using the reportory grid, the students generate their own constructs with respect to attitudes toward instructional experiences.
2. Using a large N (+200), a number of dimensions which seem to cluster together are identified as representing major attitudinal dimensions.
3. Students are then asked to rank order the instructional attitude dimensions relating to their preferences. Students' responses are then analyzed to see if these measures cause certain students to cluster together.
4. Students found clustering on a given attitudinal dimension can be evaluated on the information-processing level, locus of perceived control, and nature of their motivation. Demographic and other personality variables might also be correlated.
5. The attitudinal dimensions can then be applied to other instructional experiences, and/or predictions made as to the effect of a particular instructional system on a given student typology.

This same technique can also be applied to the structural dimensions of a particular instructional system, in order to determine if there are not dimensions of individual differences which suggest an optimum instructional treatment. Hill, Hunney, and others (1971) appear to have made a

significant start in this direction at Oakland Community College, with respect to their use of cognitive mapping based upon student individual differences as clustered around behavioral typologies. Based upon the nature of the typology, the student is assigned a particular instructional alternative, such as lecture, small group, auto-tutorial, and so forth. The above-suggested research approach seems to propose a related research alternative.

B. Relationship to modes of presentation, such as:
    1. Visual-aural channel combinations
    2. Group vs. individualized treatments
    3. Student-controlled structuring compared to instructor-controlled structuring
C. Relationship to manipulations of noise within the communications channels.
D. Interactions with manipulations of message redundancy.
E. Responsiveness to process methods of instruction (Berman, 1968) compared with content methods of instruction as defined by Schroder, et al. (1972).

In addition to Schroder and Berman, other workers are suggesting that traditional group mean dependent measures of evaluation such as the Scholastic Aptitude Tests be de-emphasized in favor of more complex and more individualized measures (e.g., Meese, 1972).

Finally, there is the potential of the concepts of intrinsic motivation compared to the traditional extrinsic sources of motivation that have been much studied. Intrinsic

motivation can potentially be channeled to maintain the creative energies of very young children throughout their educational experiences. A major task for future research is to explicate satisfactorily, in a measurable form, the construct of intrinsic motivation as developed by Berlyne, Hunt and others.

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APPENDICES

APPENDIX A

STATEMENT OF OBJECTIVES FOR THE PROGRAM

STATEMENT OF OBJECTIVES FOR THE PROGRAM

Following are the objectives for each of the seven Units of HED 171. The student progresses from the general use of specific terms to a more and more specific use of the terms as appropriate for each of the areas. The objectives stated for Unit VII are the terminal objectives for the course. All of the preceding statements of objectives are considered enabling objectives.

OBJECTIVES FOR UNIT I: Textile and Serviceability Concepts and Terminology

(1) You will be asked to list the four subconcepts which underlie the basic concept of serviceability. These are: durability, comfort, care, and aesthetic appearance.

(2) You will be asked to list and give definitions for the specific properties which define each of the four serviceability subconcepts.

OBJECTIVES FOR UNIT II: Fibers

(1) You will be asked to describe the serviceability characteristics of each of the following fiber categories:

(A) Natural cellulosic
(B) Protein
(C) Man-made cellulosic
(D) Synthetic
(E) Mineral

(2) You will be asked to recall at least three specific fiber examples from each fiber category.

(3) You will be asked to discuss the implications of each fiber category in terms of potential serviceability.

(4) You will be asked to prescribe the appropriate care procedures for each of the fiber categories.

(5) You will be asked to list and defend potential end uses for which a fiber category is best suited, and you must be able to account for the major advantages and disadvantages a category offers for a particular end use.

(6) In all of your discussions, you should be able to use the properties discussed under the serviceability concepts presented in Unit I.

OBJECTIVES FOR UNIT III: Yarns

(1) You will be asked to identify and describe the manufacturing process which differentiates the following yarn types:

(A) Singles
(B) Ply
(C) Novelty

(a) Slub
(b) Crepe
(c) Bouclé
(d) Tweed
(e) Core

(2) You will be asked to identify your fabric samples from the above listing.

(3) Given any one of the above yarn types, you will be expected to define its serviceability implications using the terminology of Unit I, and the variations introduced by different fiber choices.

OBJECTIVES FOR UNIT IV: Fabric Structures

(1) Given a package of fabric samples, you will be able to identify the structures listed below:

(A) Knit

(a) Warp
(b) Filling

(B) Woven

(a) Plain
(b) Twill
(c) Satin
(d) Pile
(e) Dobby
(f) Jacquard

(C) Net, lace, braid

(D) Multi-component

(a) Double woven
(b) Double knit
(c) Laminate
(d) Knit-sew (Malimo)

(E) Nonwoven

(a) Felt
(b) Bonded web
(c) Needle felt
(d) Film

(2) You will be able to identify and explain the function of the parts of a loom:

(A) Warp beam
(B) Heddle
(C) Harness
(D) Reed
(E) Shuttle
(F) Cloth beam

(3) You will be expected to describe the serviceability characteristics of the fabric structures studied.

(4) You will be expected to describe the particular care procedures necessary for preservation of a particular fabric structure.

(5) You will be expected to make "end use" judgments in regard to the serviceability concepts of the various structures.

OBJECTIVES FOR UNIT V: Fabric Finishes

(1) You will be asked to describe the following finishing processes:

(A) General Mill Finishes

(a) Cleaning
(b) Bleaching
(c) Singeing
(d) Calendering
(e) Tentering

(B) Finishes which contribute to durability

(a) Abrasion-resistant
(b) Antislip
(c) Shrinkage control
(d) Mercerization

(C) Finishes which contribute to comfort

(a) Absorbent
(b) Antistatic
(c) Thermal
(d) Slack-mercerization

(D) Finishes which contribute to ease of care

(a) Softeners
(b) Soil- and stain-resistant
(c) Mothproof
(d) Antiseptic
(e) Waterproof
(f) Water-repellent
(g) Flameproof
(h) Flame-retardant

(E) Finishes for aesthetic appearance

(a) Singeing--Shearing
(b) Sizing
(c) Weighting
(d) Brushing
(e) Napping
(f) Fulling
(g) Beetling
(h) Embossing
(i) Pleating
(j) Glazing
(k) Ciréing
(l) Moiréing
(m) Schreinerizing
(n) Flocking
(o) Fume-fading resistant
(p) Parchmentizing
(q) Chemical crepeing

(@) Given a particular finish, you should be able to explain how the finish contributes to:

(A) Durability
(B) Comfort
(C) Care
(D) Aesthetic appearance

(3) Given an end use, you should be able to determine the most suitable finish.

OBJECTIVES FOR UNIT VI: Color and Design of Textile Products

(1) Given any of the following coloring methods, you will be asked to describe the techniques involved:

(A) Solution dyeing
(B) Fiber (stock) dyeing
(C) Yarn dyeing
(D) Piece dyeing

(a) Union
(b) Cross

(2) Given any of the following design applications, you will be asked to describe the differences among them and their implications for serviceability:

(A) Roller (surface) printing
(B) Warp printing
(C) Stencil printing
(D) Screen printing
(E) Discharge printing
(F) Resist printing

(a) Batik
(b) Tie-and-dye

(3) Given a packet of fabric samples, you will be expected to identify their:

(A) Coloring methods
(B) Design applications (where applicable)

(4) Given a particular end use or a method of coloring and/or design application, you will be able to list the applicable criteria relative to the serviceability concepts of:

(A) Durability
(B) Comfort
(C) Care procedures
(D) Aesthetic judgments regarding choice of color and design

OBJECTIVES FOR UNIT VII: Decision Making from Textile Alternatives: Summary

(1) You will be asked to recall the specific properties of fibers, yarns, structures, finishes, and various color and design alternatives as they relate to the four serviceability concepts.

(2) You will be asked to apply the above properties to specific hypothetical situations, and select appropriate textile alternatives in each case.

(3) You should be able to select the appropriate serviceability alternative in 90% of the simulated situations.

APPENDIX B

SAMPLE TEST QUESTIONS

SAMPLE TEST QUESTIONS

Final Examination Type Questions

The actual final examination can not be used because of the reuse of some of the questions in course examinations. The examination is typically divided into three parts. The first part consists of multiple-choice items to test knowledge of facts, concepts, and relationships. A second part of the examination consists of students identifying actual fabric samples by fiber (when possible), yarn, structure, finishes (when possible), color and design treatment (when possible), and then recommending types of applications for which the sample would be most appropriate. This part of the examination is not included in the sample questions which follow. The third portion of the examination is situational-type questions, in which the student is placed in the role of textile consumer or professional, and is asked to make decisions regarding textile alternatives within the context of the situation.

Part I--Multiple-Choice Type Questions

A fiber with high tenacity will be able to

a. absorb a large amount of moisture.
b. conduct a high amount of electricity.
c. withstand a heavy pulling force.
d. retain its shape after elongation.

If a fabric is dimensionally stable, it will

a. lose its shape through stretching.
b. have a low amount of elasticity.
c. retain its shape over time.
d. have a high amount of elongation.

"Built" detergents have a higher _____ content than "unbuilt" detergents.

a. acidic
b. alkaline
c. salt
d. soap

_____ yarns produce fabrics of rough texture.

a. Wollen and worsted
b. Worsted and combed
c. Carded and woolen
d. Carded and combed

What is the correct order of steps for forming a cord yarn?

a. singles--ply--roving--cord
b. roving--singles--ply--cord
c. roving--ply--singles--cord
d. ply--singles--roving--cord

Which yarn would be least affected by agitation in laundering?

a. core
b. bouclé
c. slub
d. tweed

A 50/50 blend of rayon and polyester in a fabric ompared to a 100 per cent rayon fabric would have

a. half the properties of each of the fibers.
b. greater loss of strength when wet.
c. increased wrinkle resistance.
d. higher heat resistance.
e. greater resistance to oily stains.

Why are twill weaves generally stronger than basket weaves? Twill weaves

a. are more loosely woven.
b. have a plain weave pattern of interlacing.
c. are woven with yarns of low twist.
d. have shorter yarn floats.

The major advantage to the consumer of knit-sew fabrics is their

a. increased durability.
b. wide range of uses.
c. increased absorbency.
d. lower cost.

Which fabric structure would be the least absorbent and consequently uncomfortable to wear?

a. unsupported film
b. supported film
c. fabric-foam-fabric laminate
d. fabric-fabric laminate

Match the most desirable structure to the appropriate consumer need:

1. needle felt	a. reversible blanket with contrasting colors.
2. double cloth	b. durable blanket for camping
3. double-faced	c. lowest cost blanket
4. twill	d. blanket with highest thermal retention

Answer: 1--c; 2--d; 3--a; 4--b

Match the most appropriate carpet description to the consumer need:

_____ 1. wool woven pile	a. den carpeting that successfully imitates natural fiber competitor
_____ 2. acrylic tufted pile	b. low-cost porch carpeting
_____ 3. olefin needle felt	c. durable, abrasion-resistant carpet for hallway
_____ 4. nylon tufted pile	d. nonabsorbent and durable kitchen carpeting
_____ 5. olefin tufted pile	e. cost is no object for living room carpet of high workmanship

Answer: 1--3; 2--a; 3--b; 4--c; 5--d

As an interior designer, for which purpose would you recommend thermoplastic fabrics with an embossed finish?

a. to achieve a true crepe
b. to increase durability
c. to achieve a dimensional effect
d. to increase luster

Match the appropriate finish to the consumer need it would fulfill:

_____ (1) parchmentizing	(a) plissé fabric
_____ (2) sanforization	(b) soft, lustrous cotton fabric
_____ (3) shearing	(c) sculptured carpet
_____ (4) mercerization	(d) garment with comfort stretch
_____ (5) chemical crepeing	(e) shrinkage guaranteed to be less than one percent
_____ (6) slack mercerization	(f) etched effect
_____ (7) antiseptic	(g) shrinkage guaranteed to be less than two percent
Answer: 1--f; 2--e; 3--c; 4--b; 5--a; 6--d; 7--i	(h) action stretch
	(i) shower curtain

What advantages do woven-in fabric designs have over those that are printed on? Woven-in designs

a. are less expensive to produce.
b. are often reversible.
c. have the design structured with the grain.
d. have more thorough dye penetration.
e. all of the above
f. b, c, and d above

Which of the following fabric finishes are used solely for design effect?

a. schreinerizing and flocking
b. moiréing and embossing
c. parchmentizing and mercerizing
d. fulling and beetling

Match the design application to its description:

_____ a. batik	1. printing on a flat surface
_____ b. discharge	2. printing with bleach
_____ c. screen	3. resist dyeing with waxed thread
_____ d. tie-and-dye	4. resist dyeing with wax
_____ e. surface	5. printing with etched copper rollers

Answer: a--4; b--2; c--1; d--3; e--5

If a department store buyer ordered the most economical tweed-effect carpet, the order would have been for carpet colored by

a. fiber dyeing.
b. solution dyeing (filament tow).
c. roller printing.
d. cross dyeing.
e. union dyeing.

Match the coloring or design method which would be most feasible and serviceable for each of the end uses indicated. You may use the choices (1. through 9.) more than once or not at all.

_____ a. floral glass drapery
_____ b. olefin needle-felt
_____ c. boy's polyester/ cotton school slacks
_____ d. man's wool tweed sports coat
_____ e. lady's linen dress
_____ f. cotton plaid bedspread
_____ g. flowered, cotton kitchen curtains
_____ h. birdseye huck toweling
_____ i. brocade evening jacket
_____ j. black and white silk dress print

1. fiber dyed
2. yarn dyed
3. piece dyed
4. solution dyed
5. cross dyed
6. union dyed
7. pigment colored
8. roller printed
9. discharge printed

Answer: a--7; b--4; c--6; d--1; e--3; f--2; g--8; h--3; i--2; j--9

Part II--Omitted

Part III--Situational Questions

SUPPOSE YOU ARE A DESIGNER-CONSULTANT

You are assigned as a designer-consultant to assist in meeting low-income housing needs. From the alternatives listed below, suggest the floor covering, wall covering, and drapery fabric that would be most economical, durable, and yet attractive for furnishing a mobile home. Remember to justify all choices.

Check the best floor covering:

1. Polyester; sculptured, tufted pile; piece dyed; soil resistant.
2. Nylon; sculptured, tufted pile; solution dyed; soil resistant
3. Olefin; uncut tufted pile; solution dyed; soil resistant
4. Acrylic; cut tufted pile; fiber dyed; soil resistant

*Justification: The olefin carpeting (3) would be the most economical and durable choice due to the fiber content and uncut pile, which does not require the extra expense of cutting or shearing to give a sculptured appearance.

Check the best wall covering:

1. Conventional wallpaper
2. Flocked wallpaper
3. Embossed vinyl wall covering
4. Smooth vinyl wall covering

Justification: A smooth vinyl wall covering (4) is inexpensive, durable, and easy to clean.

Choose the best glass drapery fabric:

1. Glass fibers; plain weave; pigment printed; antislip
2. Glass fibers; plain weave; solution dyed; abrasion resistant
3. Glass fibers; leno structure; solution dyed; abrasion resistant

Justification: The plain weave structure (2) would put less stress than the leno structure on the low flex life of glass fibers; and the solution-dyed coloring would be more suitable for draperies than a pigment application, which could crock off.

SUPPOSE YOU ARE A MANUFACTURER'S REPRESENTATIVE

You are a shipping officer for a textile manufacturing concern. As you are checking the invoices on four truckloads of cotton fabric which are to go to a tablecloth manufacturer, you notice that the fabric is incorrectly billed. Each truckload has the same yardage of comparable weight fabric suitable for table linens.

Match the appropriate price with each tablecloth fabric:

_____ 1. Jacquard	a. $250	
_____ 2. Plain	b. $150	Answer: 1--a; 2--c;
_____ 3. Malimo	c. $100	3--b; 4--d
_____ 4. Dobby	d. $50	

*Student's justification should be similar to the most appropriate one given as an answer in the example. The "sample answer" is most appropriate in view of course content and structure.

Since you are concerned that there may be additional errors, you look through a consignment of dobby structures which have been woven with a different fiber content. Which price should be on each comparably woven dobby fabric?

_____ 1. Cotton	a. $300	
_____ 2. Acetate	b. $175	
_____ 3. Wool	c. $150	Answer: 1--c; 2--d; 3--b; 4--a
_____ 4. Silk	d. $100	

SUPPOSE YOU ARE A BUYER FOR A RETAIL DEPARTMENT STORE

You want to select a versatile suiting fabric suitable for customers who travel in variable climates. Indicate the combination you would order and justify your selection.

___cotton	___double knit	___antistatic
___polyester	___plain weave	___mercerized
___olefin	___plain filling knit	___durable press
___flax	___rib weave	___sanforized
___rayon	___pile weave	___schreinerized

Justification:

Polyester would be the most versatile fiber to use in travel fabric, since polyester is very resilient.

The double knit structure would contribute to stability and wrinkle recovery; it would make the nonabsorbent polyester fibers more comfortable. (The plain filling knit would not be as stable and suitable for traveling as the double knit.)

An antistatic finish would be most desirable to prevent fabric clinging.

Note: The other combination which would be a possibility for travel would be a cotton, plain weave, with a durable press finish. However, in traveling you would not have a washer and dryer, which give the best results when laundering durable press fabrics. A polyester double knit launders very well by hand and is serviceable in more kinds of weather than a cotton or polyester plain weave.

A large order of shirts has just arrived and your assignment is to send them to their appropriate departments. Match the shirts with their most likely sales department. More than one shirt may go to the same department.

_____ 1. Silk; slub yarn; plain weave

_____ 2. Combed cotton/polyester blend; high yarn count; plain weave; permanent press

_____ 3. Combed cotton; high yarn count; basket weave (oxford); permanent press

_____ 4. Cotton; low yarn count; sizing; permanent press

_____ 5. Worsted wool; twill weave; light napping

a. men's specialty

b. main floor men's department

c. budget basement

Answer: 1--a; 2--b; 3--b; 4--c; 5--a

You are ordering suits and tuxedoes for the rental shop. Match the fiber content you would order for the following end uses:

_____ 1. summer wedding

_____ 2. winter black

_____ 3. modern dance

_____ 4. concert pianist

_____ 5. nightlub entertainer

a. 75 percent wool/25 percent polyester

b. 65 percent acetate/35 percent silk

c. 75 percent flax/25 percent cotton

d. 40 percent nylon/30 percent cotton/30 percent spandex

e. 50 percent cotton/30 percent silk/20 percent metallic

Answer: 1--c; 2--a; 3--d; 4--b; 5--e

You are ordering blankets for a variety of purposes. Indicate the most appropriate blanket structure you would order for each use listed below:

_____ 1. light-wieght spring blanket

_____ 2. heavy-weight, durable, winter blanket

_____ 3. inexpensive blanket for college students

_____ 4. average-weight durable blanket

a. rayon needle felt

b. cotton plain weave, napped (flannelette)

c. laminated nylon twill, napped

d. wool twill weave, napped

e. wool double cloth, napped

Answer: 1--b; 2--e; 3--a; 4--d

SUPPOSE YOU ARE A TEACHER

A student approaches and asks that you differentiate among the terms hydrophilic, hydrophobic, hygroscopic, and wicking. Your explanation should include fiber examples of each.

Answer: All terms describe absorbency relationships.

Hydrophilic literally means "water loving"; therefore, a hydrophilic fiber absorbs moisture readily into its structures. Cotton, flax, rayon, and wool are hydrophilic, as well as most of the natural cellulosic and protein fibers.

Hydrophobic fibers are those which will not accept moisture internally, such as the synthetic and mineral fibers.

Hygroscopic fibers can absorb moisture vapor without feeling wet to the touch because the moisture is trapped under scales; wool and other animal hair fibers are hygroscopic.

Wicking describes the property of a fiber to transmit moisture along the fiber length or around its width. Thus, hydrophobic fibers, such as certain synthetics, can wick along the outside of the fiber, thereby increasing comfort.

A student does not understand how a fiber can absorb moisture and not feel wet. Explain!

Answer: The hygroscopic property is possible in fibers with scales. The water molecules are held under the scales such that the surface of the fiber feels dry until the product is saturated with water.

You are explaining to your textiles class the implications and importance of the EFPIA. Discuss the major significance of the act, and give the three items which the law requires on a fabric label.

Answer: The major significance of the act is that it established the generic classifications of fibers and forced common fiber groupings on a market filled with trade names.

The Textile Fiber Products Identification Act requires that the manufacturer accurately label the following:

1. Generic classification of all fibers present in amounts over 5 percent
2. Fiber percentage
3. Manufacturer's name

(Note: The label does not have to be sewn in.)

Explain the implications of the WPL for the consumer.

Answer: The consumer can evaluate the serviceability of a wool garment based on the percentage by weight and type of wool. For example, a consumer should think twice before purchasing a product of reused wool, which would be less durable than one of reprocessed or virgin wool.

SUPPOSE YOU ARE A CONSUMER

You are interested in purchasing some shirts for school or work, and you want them to require NO ironing. Indicate which purchase you would make from the alternatives listed below and tell why.

_____ 1. 100 percent cotton; durable press

_____ 2. 80 percent polyester/20 percent cotton; durable press

_____ 3. 100 percent polyester; antistatic

_____ 4. 65 percent cotton/35 percent polyester; durable press

Answer: The durable press blend with the most polyester (2) would contribute to the highest wrinkle resistance and recovery after laundering.

(Note: The 100 percent polyester (3) is not a durable press product.)

You want to select some pajamas for a friend in the hospital. Comfort is the most important consideration. Indicate the selection you would make and tell why.

_____ 1. 100 percent cotton; plain weave; durable press

_____ 2. 50 percent cotton/50 percent polyester; twill weave; easy-care finish

_____ 3. 100 percent cotton; plain weave; chemical crepe; (plissé)

_____ 4. 100 percent flax; plain weave; easy-care finish

Answer: The 100 percent cotton plissé fabric (3) would be most comfortable and would require little ironing due to the crinkled effect.

(Note: The 100 percent cotton durable press fabric would have a somewhat stiff hand, which would not be desirable in pajamas.)

APPENDIX C

ADMINISTRATION OF THE SCHRODER TEST

_____
Student Number

INSTRUCTIONS TO PARTICIPANTS

I. Part One: Paragraph Completion

On the following pages you will be asked to complete certain sentences and write a short paragraph.

On each page you will find the beginning of a sentence, and your task is to complete it.

For example: I like....

When you are given the signal turn to Page 1. Complete the sentence given and write at least three additional sentences. You will be given 120 seconds. After 100 seconds I will say "Finish your sentence," and at 120 seconds I will ask you to turn to the next page. Make sure you complete your last sentences. There are 6 sentence completions in all.

Write your sentences as quickly but as clearly as possible.

Do not turn this page until you are given the signal.

APPENDIX D

ROTTER QUESTIONNAIRE

ROTTER QUESTIONNAIRE

Instructions:

Following are some pairs of statements about life experiences. Will you please read each pair of these statements and mark an "X" beside the statement which best fits your feelings about the topic. It may be hard for you to decide which statement of the pair to mark; but please mark only one statement in each pair, selecting the one you most nearly agree with. There are no "right" or "wrong" statements, and all statements will be selected by university students.

Comments:

Following are the questions and response weights for the Rotter questionnaire. A "I" to the left of the item indicates the question loaded on Factor I, called System Modifiability; a "II" indicates the question loaded on Factor II, called Personal Ideology. See Table 17, Appendix H. Two points are assigned to "external" responses and one point is assigned to "internal" responses. The factors, code, and weights do not appear on the actual questionnaire.

ROTTER LOCUS OF PERCEIVED CONTROL QUESTIONNAIRE

Factor	Item	Code	Weighting
	1.a. Children get into trouble because their parents punish them too much.	1. filler	
	b. The trouble with most children nowadays is that their parents are too easy with them.	2. filler	
I I	2.a. Many of the unhappy things in people's lives are partly due to bad luck.	1. external	2
	b. People's misfortunes result from the mistakes they make.	2. internal	1
	3.a. One of the major reasons why we have wars is because people don't take enough interest in politics	1. internal	1
	b. There will always be wars, no matter how hard people try to prevent them.	2. external	2
	4.a. In the long run people get the respect they deserve in this world.	1. internal	1
	b. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.	2. external	2
	5.a. The idea that teachers are unfair to students is nonsense.	1. internal	1
	b. Most students don't realize the extent to which their grades are influenced by accidental happenings.	2. external	2
I I	6.a. Without the right breaks one cannot be an effective leader.	1. external	2
	b. Capable people who fail to become leaders have not taken advantage of their opportunities.	2. internal	1
I I	7.a. No matter how hard you try some people just don't like you.	1. external	2
	b. People who can't get others to like them don't understand how to get along with others.	2. internal	1
	8.a. Heredity plays the major role in determining one's personality.	1. filler	
	b. It is one's experiences in life which determine what they're like.	2. filler	
	9.a. I have often found that what is going to happen will happen.	1. external	2
	b. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.	2. internal	1
	10.a. In the case of the well-prepared student there is rarely, if ever, such a thing as an unfair test.	1. internal	1
	b. Many times exam questions tend to be so unrelated to course work that studying is really useless.	2. external	2
	11.a. Becoming a success is a matter of hard work, luck has little or nothing to do with it.	1. internal	1
	b. Getting a good job depends mainly on being in the right place at the right time.	2. external	2
I	12.a. The average citizen can have an influence in government decisions.	1. internal	1
	b. This world is run by the few people in power, and there is not much the little guy can do about it.	2. external	2
I	13.a. When I make plans, I am almost certain that I can make them work.	1. internal	1
	b. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.	2. external	2
	14.a. There are certain people who are just no good.	1. filler	
	b. There is some good in everybody.	2. filler	
	15.a. In my case getting what I want has little or nothing to do with luck.	1. internal	1
	b. Many times we might just as well decide what to do by flipping a coin.	2. external	2

Factor	Item	Code	Weighting
	16.a. Who gets to be the boss often depends on who was lucky enough to be in the right place first.	1. external	2
	b. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.	2. internal	1
I	17.a. As far as world affairs are concerned, most of us are the victims of forces we can neither understand, nor control.	1. external	2
	b. By taking an active part in political and social affairs the people can control world events.	2. internal	1
	18.a. Most people don't realize the extent to which their lives are controlled by accidental happenings.	1. external	2
	b. There really is no such thing as "luck."	2. internal	1
	19.a. One should always be willing to admit mistakes.	1. filler	
	b. It is usually best to cover up one's mistakes.	2. filler	
	20.a. It is hard to know whether or not a person really likes you.	1. external	2
	b. How many friends you have depends on how nice a person you are.	2. internal	1
	21.a. In the long run the bad things that happen to us are balanced by the good ones.	1. external	2
	b. Most misfortunes are the result of lack of ability, ignorance, laziness, or all three.	2. internal	1
I	22.a. With enough effort we can wipe out political corruption.	1. internal	1
	b. It is difficult for people to have much control over the things politicians do in office.	2. external	2
	23.a. Sometimes I can't understand how teachers arrive at the grades they give.	1. external	2
	b. There is a direct connection between how hard I study and the grades I get.	2. internal	1
	24.a. A good leader expects people to decide for themselves what they should do.	1. filler	
	b. A good leader makes it clear to everybody what their jobs are.	2. filler	
	25.a. Many times I feel that I have little influence over the things that happen to me.	1. external	2
	b. It is impossible for me to believe that chance or luck plays an important role in my life.	2. internal	1
	26.a. People are lonely because they don't try to be friendly.	1. internal	1
	b. There's not much use in trying too hard to please people, if they like you, they like you.	2. external	2
	27.a. There is too much emphasis on athletics in high school.	1. filler	
	b. Team sports are an excellent way to build character.	2. filler	
	28.a. What happens to me is my own doing.	1. internal	1
	b. Sometimes I feel that I don't have enough control over the direction my life is taking.	2. external	2
I	29.a. Most of the time I can't understand why politicians behave the way they do.	1. external	2
	b. In the long run the people are responsible for bad government on a national as well as on a local level.	2. internal	1

APPENDIX E

MOTIVATION QUESTIONNAIRE

MOTIVATION QUESTIONNAIRE

Instructions:

Below is a sentence completion questionnaire, and each of the sentences has two possible endings. Will you please read each sentence carefully and select the one conclusion that mostly applies to you, or the one that you most agree with. In some cases both alternatives may apply, but select the one that you believe applies more often than the other. In some cases, neither alternative will apply very much; nevertheless, select the one alternative that applies more than the other.

Now notice that to the right of each alternative are the words "much" and "little." If you feel that the alternative you have chosen applies a great deal, or you agree with it very much, mark on the answer sheet the number that corresponds with "much" [e.g. (1) much, mark 1 on the answer sheet]. If you feel that the alternative only applies a little, or you agree with it only a little, then select the alternative "little" beside your selected conclusion, and mark on the answer sheet the number which corresponds with "little" [e.g. (4) little, fill in "4" on the answer sheet].

Be sure to complete each sentence by choosing only the one alternative which applies more than the other, and by indicating whether the chosen alternative applies "much" or "little." Thus, you should have marked only one of the four choices for each of the 21 questions. There are no correct answers, and many students will select each of the alternatives.

Comments:

Following are the questions and weights for the Motivation questionnaire. A "4" indicates a highly extrinsic orientation; a "1" indicates a highly intrinsic orientation. A "I" indicates that the question loaded on Factor I, called Personal (Significant Other); a "II" indicates the question loaded on Factor II, called Practical. See Table 18, Appendix H. The factor numbers, codes, and weightings do not appear on the actual questionnaire.

MOTIVATION QUESTIONNAIRE

Factor	Item	Code	Weighting
	1. I feel that I would most likely enjoy using tools... ...on a do-it-yourself project for fun. ...to repair or paint something that needs attention.	intrinsic to extrinsic	1234
	2. When I read a book (other than an assigned reading) I would more likely be reading a topic because... ...it is just plain interesting. ...it somehow contributes to my effectiveness or growth.	intrinsic to extrinsic	1234
	3. Whenever I find a moment in which I have nothing to do, most of the time I feel... ...empty and seek out something to stimulate me. ...relaxed and relieved for the brief respite before going on to the next task.	intrinsic to extrinsic	1234
II	4. People who watch my activities and know me, would be most likely to say that I... ...have many non-practical but fun and challenging hobbies. ...pursue hobbies that serve a utilitarian or useful function.	intrinsic to extrinsic	1234
	5. I would most likely attend some kind of public concert because... ...the intricacies of music excite me. ...the experience relaxes and refreshes me so that I can better attend to more important tasks.	intrinsic to extrinsic	1234
I	6. I would most likely climb Mount Everest because... ...it is there. ...I would, frankly, somewhat enjoy the publicity, or the task would be useful in my work.	intrinsic to extrinsic	1234
	7. I would most likely be found taking a long hike by myself... ...for complex reasons that are difficult to explain. ...because it contributes to a healthy mind and body.	intrinsic to extrinsic	1234
I	8. The reason that most often explains why I complete a difficult and challenging assignment is because... ...I get my "kicks" out of doing it. ...it is a responsibility that has to be met.	intrinsic to extrinsic	1234
II	9. The major reason I would invest extensive money and time in flying lessons is because... ...of the fun and challenge of flying. ...an airplane is a useful transportation tool.	intrinsic to extrinsic	1234
	10. I would travel the length of the Amazon River mostly because... ...I would enjoy the exploration. ...it would be a part of some income-producing responsibility	intrinsic to extrinsic	1234
	11. I would spend considerable time weaving a complicated fabric mostly because... ...the weaving would be fun. ...the fabric would make a useful, attractive product.	intrinsic to extrinsic	1234
II	12. I more often would find myself... ...tinkering with intriguing objects to see what can result. ...putting objects together to create or repair a useful item.	intrinsic to extrinsic	1234
	13. I believe that many people pursue the friendships of others because... ...such relationships can be mutually beneficial. ...people are just plain interesting	extrinsic or intrinsic	4321

Factor	Item	Code	Weighting
I	14. I would spend time and energy planting and taking care of a lawn and plantings surrounding a home I might own, mostly because... ...it's kind of fun to observe the outcome. ...it enhances the beauty and attractiveness of the home.	intrinsic to extrinsic	1234
I	15. I generally select the clothes I wear mostly according to the criteria of... ...what I would be expected to wear for an occasion. ...whatever "turns me on."	extrinsic to intrinsic	4321
I	16. I spend time caring for my wearing apparel... ...in order to have it look right for the occasion. ...because I enjoy experimenting with it.	extrinsic to intrinsic	4321
II	17. I generally spend my leisure time... ...satisfying my curiosity about non-practical things I normally don't have time for. ...improving awareness and my competence to make things happen in the world and to deal with practical needs.	intrinsic to extrinsic	1234
II	18. When I day dream it most often concerns... ...the planning and analysis of practical matters. ...mulling over abstract relationships regardless of practical considerations.	extrinsic to intrinsic	4321
	19. In having to choose between one of two college courses, I would tend to select the course that... ...arouses my curiosity and relates to something that interests me. ...contributes more directly to a goal to which I aspire.	intrinsic to extrinsic	1234
	20. If there is a driving force that influences me more than the other, it would be... ...identification of practical goals and choosing alternatives (even if unpleasant) that enable me to reach them. ...exploration of the unknown, and choosing alternatives that answer my questions (regardless of practical concerns).	extrinsic to intrinsic	4321
I	21. When you get right down to it, I might work overtime earning an income... ...even though having to earn money gets in the way of things that are important. ...because money makes possible the things that are important.	intrinsic to extrinsic	1234

APPENDIX F

GENERAL ATTITUDE QUESTIONNAIRE

GENERAL ATTITUDE QUESTIONNAIRE

Instructions:

Unless otherwise specified, please answer the following questions according to the format:

Very much agree	Somewhat agree	Not Sure	Somewhat disagree	Very much disagree
1	2	3	4	5

Please work thoughtfully and quickly.

Comments:

Following are the questions and weights for the Attitude Toward College-Level Instruction in General questionnaire and the Attitude Toward HED 171 questionnaire. A "5" in the weightings to the right of each pair of questions indicates a very positive weighting; a "1" indicates a very negative weighting on the Likert scale. The weightings in parentheses for items 1-6 inclusive (i.e., questions having implications of control) indicate internal (1) to external (5) perceived control; for items 7-12 inclusive (i.e., questions having implications of motivation) the weightings indicate intrinsic motivation (1) to extrinsic motivation (5).

Immediately following the question is a row of percentages. This indicates the student response to the question on the Likert scale from: "Very Much Agree" at the extreme left, to "Agree" next to extreme left, to "Uncommitted" in the

middle, to "Disagree" next to extreme right, to "Very Much Disagree" at the extreme right.

Note that the first question is numbered "1.G." The "G" is for "General Attitude Questionnaire." Immediately following the row of percentages indicating student response to that question on the Likert scale, is a second question numbered "1.H." This question is the comparable question which is found on the Specific attitude questionnaire regarding student attitudes toward the HED 171 experience. The "H" stands for HED 171. The weightings of the "H" item are the same as the corresponding "G" item. Immediately below the question is another row of percentages. These indicate student responses on the same Likert scale to the "H" questions, as described above for the "G" question.

By reading the "G" question and noting the student response pattern, and then looking at the corresponding "H" question and noting its response pattern, you can easily compare the change in student responses from their feeling about the question in regard to college-level instruction in general, as compared with their attitudes toward HED 171 in particular.

A "I" to the left of a question indicates that the "G" question loaded highly on Factor I, Control; a "II" indicates that the question loaded highly on Factor II, Motivation; and a "III" indicates that the question loaded highly on Factor III, Challenge. See Table 19 in Appendix H.

An "omit" means that the item was not included in the attitude analysis.

The factors, codes, and weights do not appear on the actual questionnaire. The "G" numbered questions were on the questionnaire dealing with attitude toward college-level instruction in general. The "H" numbered questions were on the attitude toward HED 171 questionnaire. The instructions were identical.

Omit	Factor	Item	Very Much Agree	Agree	Uncommitted	Disagree	Very Much Disagree	Code	Weighting
		1.G. Most of the courses I have taken provide me with methods to cope with difficulties, and to score well on exams.	4.1	45.6	14.3	26.5	9.5	(Control)	54321 (12345)
		1.H. HED 171 has provided me with methods to cope with difficulties, and to score well on exams.	29.4	37.1	16.1	16.1	1.4		
		2.G. In many of the courses I have taken, factors other than my own efforts are most likely to influence my final grade.	7.5	31.3	11.6	36.1	12.9	(Control)	12345 (54321)
		2.H. In HED 171, factors other than my own efforts have influenced by grades.	8.4	25.2	10.5	23.8	31.5		
	I	3.G. I often find that the structure of a course is such as to make it difficult for me to do the best I can.	9.5	30.6	19.7	33.3	5.4	(Control)	12345 (54321)
		3.H. I often found that the structure of HED 171 was such as to make it difficult for me to do the best I can.	4.2	6.3	7.0	22.4	58.7		
		4.G. In most of my courses, I know exactly what is expected of me.	21.1	44.2	6.1	23.8	4.8	(Control)	54321 (12345)
		4.H. In HED 171, I knew exactly what was expected of me.	65.7	21.0	9.1	3.5	...		
	I	5.G. I often find it helpful to check with a classmate concerning what I am supposed to be doing in a course.	25.9	45.6	4.1	19.7	4.8	(Control)	12345 (54321)
		5.H. I often found it helpful to check with a classmate concerning what I was supposed to be doing in HED 171.	4.2	11.2	8.4	31.5	44.8		
		6.G. As far as most courses are concerned, I really feel that I am in the "driver's seat" in getting the grades I receive.	18.4	51.0	12.2	17.0	1.4	(Control)	54321 (12345)
		6.H. As far as HED 171 is concerned, I really feel that I have been in the "driver's seat" in getting the grades I receive.	58.0	29.4	5.6	2.8	3.5		
Omit	II	7.G. In many of the courses that I take, even though they are a requirement, I find myself deeply involved in the substance of the course.	10.2	42.2	9.5	29.9	8.2	(Motivation)	54321 (12345)
Omit		7.H. Even though HED 171 is a requirement, I find myself deeply involved in the substance of the course. (Not answered unless course is a requirement.)	39.2	28.7	6.3	4.9	2.8		
Omit	II	8.G. As a result of being involved in a required course, I generally find myself relating to many of the other students in the course through a commonality of interest.	13.6	32.0	20.4	25.2	8.8	(Motivation)	54321 (12345)
Omit		8.H. As a result of being involved in this required course, I generally find myself relating to many of the other students in the course through a commonality of interest. (Not answered unless course is a requirement.)	10.5	27.3	17.5	21.0	2.8		

Omit	Factor	Item	Very Much Agree	Agree	Uncommitted	Disagree	Very Much Disagree	Code	Weighting
Omit	II	9.G. At the completion of most of the required courses I have taken, I invariably look back and decide that the experience would have been worthwhile, even if the course were not required.	17.7	36.1	15.0	21.8	9.5	(Motivation)	54321 (12345)
Omit		9.H. At the completion of this required course, I can now look back and feel that the experience would have been worthwhile, even if the course were not required. (Not answered unless course is a requirement.)	52.4	14.7	2.8	4.9	2.1		
		10.G. The real satisfaction I get from most of my courses is just being involved.	8.8	41.5	19.7	25.9	3.4	(Motivation)	54321 (12345)
		10.H. The real satisfaction I got from HED 171 was just being involved.	7.7	42.7	28.7	16.1	4.9		
Omit		11.G. I find that a major attraction of most courses I enjoy, lies in their relevance to practical applications.	53.1	29.3	4.8	11.6	1.4	(Motivation)	12345 (54321)
Omit		11.H. I find that a major attraction of HED 171, lies in its relevance to practical applications.	73.4	20.3	2.8	3.5	...		
Omit	I	12.G. Many of the courses I take are required (rather than due to initial interest on my own part).	26.5	34.0	4.1	29.9	4.8	(Motivation)	12345 (54321)
Omit		12.H. Many of the courses I take are required (rather than due to initial interest on my own part).	28.0	35.0	5.6	21.7	9.8		
	II	13.G. Instructors generally hold my interest and attention during their lectures.	6.1	56.5	12.9	22.4	2.0		54321
		13.H. Mrs. Harries generally held my interest and attention during her lectures.	41.3	41.3	8.4	7.7	1.4		
	I	14.G. I often have difficulty knowing what I am expected to remember when I study a textbook.	25.2	40.1	6.1	21.1	7.5		12345
		14.H. I often had difficulty knowing what I was expected to remember when I studied the textile programmed textbook.	4.2	14.0	3.5	38.5	39.9		
	II	15.G. In courses oriented toward a professional preparation, I almost always feel that I am being as thoroughly prepared as intended by the course's objectives.	12.9	36.7	22.4	23.8	4.1		54321
		15.H. In HED 171, I almost always felt that I was being thoroughly prepared as intended by the course's objectives.	41.3	39.2	11.2	5.6	2.1		
		16.G. Questions asked by others in many of my classes generally have little relevance to what I expect to get from the course.	4.1	12.9	27.9	47.6	7.5		12345
		16.H. Questions asked by others in HED 171 generally had little relevance to what I expect to get from the course.	2.1	7.7	10.5	42.7	37.1		

Omit	Factor	Item	Very Much Agree	Agree	Uncommitted	Disagree	Very Much Disagree	Code	Weighting
		17.G. Textbooks used in many courses could definitely be improved to make them more relevant or compatible with the course's stated objectives.	38.1	36.7	12.9	8.8	3.4		12345
		17.H. The HED 171 textbook could definitely be improved to make it more relevant or compatible with the course's stated objectives.	2.1	7.7	10.5	42.7	37.1		
		18.G. I have noticed that course instructors often spend considerable time repeating what has already been stated in assigned readings.	25.9	46.3	8.2	17.7	2.0		12345
		18.H. I noticed that Mrs. Harries often spent considerable time repeating what had already been stated in the assigned readings.	11.2	45.5	14.7	23.1	5.6		
	II	19.G. A typical result of most professionally oriented courses is that I feel more comfortable in using the thought processes and jargon of the profession as a result of experiencing the course.	33.3	47.6	13.6	4.8	0.7		54321
		19.H. A typical result of HED 171 is that I feel more comfortable in using the thought processes and jargon of the profession as a result of experiencing the course.	57.3	34.3	5.6	2.1	0.7		
		20.G. I have noticed that the effort I have spent in studying assigned readings often has not paid off in terms of tangible results.	26.5	37.4	2.7	25.9	7.5		12345
		20.H. I noticed that the effort I spent in studying HED 171 assignments often did not pay off in terms of tangible results.	5.6	9.1	6.3	37.8	41.3		
		21.G. I have noticed that I invariably do better on examinations where there is not a specific textbook, but simply a variety of assigned readings.	6.1	9.5	38.8	24.5	21.1		12345
		21.H. I would have invariably done better on examinations if we had not used the specific textbook, but simply a variety of assigned readings.	1.4	5.6	4.2	16.1	72.7		
		22.G. In most classes, how classroom topics relate to the textbook materials is made explicitly clear.	8.8	32.7	17.0	38.1	3.4		54321
		22.H. In HED 171, how classroom topics relate to the textbook materials was made explicitly clear.	41.3	40.6	10.5	5.6	1.4		
		23.G. I often find that I run out of time as an exam draws near, and I have to "cram" in order to prepare for the exam.	15.6	39.5	6.8	32.0	5.4		12345
		23.H. I often found that I ran out of time as an exam drew near, and I had to "cram" in order to prepare for the exam.	13.3	30.8	4.9	28.7	22.4		
		24.G. I often find that textbooks make a course more dull and boring than it has to be.	13.6	38.8	15.0	31.3	1.4		12345

Omit	Factor	Item	Very Much Agree	Agree	Uncommitted	Disagree	Very Much Disagree	Code	Weighting
		24.H. I often found that the HED 171 textbook made the course more dull and boring than it had to be.	5.6	7.7	9.1	30.8	46.9		
		25.G. There is no special teaching method that I would prefer to be used in all courses.	18.4	36.7	20.4	13.4	6.1		54321
		25.H. I wish that the methods used in this course were used in all courses.	28.0	30.1	21.0	11.9	9.1		
		26.G. When I think about the kinds of questions that students ask in class, they generally do not relate to my interests in the course as much as I would like.	2.0	22.4	28.6	39.5	7.5	(Motivation)	12345 (54321)
		26.H. When I think about the kinds of questions that students usually asked in HED 171 classes, they generally did not relate to my interests in the course as much as I would have liked.	0.7	6.3	35.0	45.5	12.6		
		27.G. I often find at the end of a quarter, that students feel they did not really get their "money's worth" in a course.	15.0	38.1	23.1	19.7	3.4		12345
		27.H. I often found that students felt they did not really get their "money's worth" in HED 171.	2.1	3.5	18.2	38.5	37.8		
		28.G. I often find myself taking short cuts in a course in order to "beat the system."	4.8	28.6	8.8	40.8	17.0		12345
		28.H. I often found myself taking short cuts in HED 171 in order to "beat the system."	2.8	14.7	8.4	32.2	42.0		
		29.G. Programmed instruction does not substitute for a good textbook.	3.4	6.8	39.5	26.5	23.1		12345
		29.H. Programmed instruction does not substitute for a good textbook.	6.3	2.8	8.4	24.5	58.0		
	I	30.G. Too much is expected of students in most courses, if the objectives of the course are to be really met.	10.2	32.0	16.3	36.1	4.8		12345
		30.H. Too much is expected of students in HED 171 in order that the objectives of the course be met.	4.9	21.7	9.1	34.3	30.1		
Omit		31.G. I would expect a programmed text to be boring and frustrating.	2.7	18.4	28.6	35.4	15.0		12345
Omit		31.H. I would expect a programmed text to be boring and frustrating.	3.5	25.2	23.1	32.2	16.1		
Omit	III	32.G. One characteristic of a "worthless" course is that I only apply what I learn in a practical way.	2.0	10.9	24.5	37.4	25.2	(Motivation)	12345 (54321)
Omit		32.H. One characteristic of a "worthless" course is that I only apply what I learn in a practical way.	5.6	13.3	18.2	28.7	33.6		

Omit	Factor	Item	Very Much Agree	Agree	Uncommitted	Disagree	Very Much Disagree	Code	Weighting
Omit	III	33.G. One criterion of a "good" course is that it challenges my mind, regardless of practical application.	21.8	54.4	11.6	10.9	1.4	(Motivation)	54321 (12345)
Omit		33.H. One criterion of a "good" course is that it challenges my mind, regardless of practical application.	25.9	44.1	9.8	16.8	3.5		
Omit	III	34.G. I will enroll in a challenging course over a "practical" one any time, if I can't enroll in both.	6.8	21.8	30.6	29.3	10.9	(Motivation)	54321 (12345)
Omit		34.H. I will enroll in a challenging course over a "practical" one any time, if I can't enroll in both.	7.7	7.7	39.2	32.2	13.3		
Omit		35.G. I generally expect to make (____) of a perfect score on most of my finals. 1. (100-95*) 2. (94-90*) 3. (89-80*) 4. (79-70*) 5. (-60*)	3.4	27.2	52.4	15.0	...		54321
Omit		35.H. I generally expect to make (____) of a perfect score on most of my finals. 1. (100-95*) 2. (94-90*) 3. 89-80*) 4. 79-70*) 5. (-60*)	2.1	21.7	75.2	18.9	0.7		
Omit		36.G. Based upon my past performance on final exams, I expect to make (____) on the final exam in this course. 1. (100-95*) 2. (94-90*) 3. (89-80*) 4. (79-70*) 5. (-60*)	3.4	27.2	52.4	15.0	...		54321
Omit		36.H. Based upon my past performance on ETS 171 exams, I expect to make (____) on the final exam in this course. 1. (100-95*) 2. (94-90*) 3. (89-80*) 4. (79-70*) 5. (-60*)	4.2	32.5	44.6	14.7	2.8		

APPENDIX G

HED 171 ATTITUDE QUESTIONNAIRE

(See "H" numbered questions and comments in Appendix F.)

APPENDIX H

TABLES: FACTOR ANALYSIS OF THREE QUESTIONNAIRES

TABLE 17.--Intercorrelations of items on Intrinsic-Extrinsic Motivation Questionnaire.

			I							II				
		Item → ↓	15	8	19	6	14	21	16	17	18	9	12	4
I	PERSONAL (SIGNIF. OTHER)	15	..	24	22	07	15	25	27	-00	-09	08	08	-03
		8	24	..	27	05	18	02	06	-02	06	-19	02	08
		19	22	29	..	10	13	10	04	14	03	08	13	04
		6	07	05	10	..	13	17	17	-07	-01	-06	-05	-05
		14	15	18	13	13	..	13	02	07	-01	-11	03	-09
		21	25	02	10	17	13	..	09	03	-01	10	06	06
		16	27	06	04	17	02	09	..	02	-18	08	-04	01
II	PRACTICAL	17	-00	-02	14	07	07	03	02	..	06	16	17	21
		18	-08	06	03	-01	-00	-01	-18	06	..	10	11	07
		9	08	-19	07	-06	-11	10	-01	16	10	..	09	08
		12	07	06	13	-04	02	06	-04	17	11	04	..	10
		4	-03	-02	04	05	-09	06	01	21	07	08	10	..

TABLE 18.--Intercorrelation of items on Rotter Intrinsic-Extrinsic Control Questionnaire.

			I						II		
		Item → ↓	22	17	12	13	29	3	6	2	7
I	SYSTEM. MODIF.	22	..	47	51	23	36	24	-00	03	10
		17	47	..	41	29	35	19	-07	05	07
		12	51	41	..	18	33	11	-00	06	00
		13	23	29	18	..	16	18	07	-04	-00
		29	36	35	33	16	..	06	00	15	03
		3	24	19	11	18	06	..	-01	-13	-07
II	PERSONAL IDEOLOGY	6	00	-07	-00	07	00	-01	..	21	19
		2	03	05	06	-04	15	-13	21	..	21
		7	10	07	00	-00	03	-07	19	21	..

TABLE 19.--Intercorrelations of items on General Attitude Questionnaire.

			I							II						III			
		Item →	14	30	27	12	3	5	2	15	7	8	9	19	13	34	33	32	31
		↓																	
	C	14	..	35	18	-23	-16	-30	-15	-02	-01	01	-13	03	-09	-16	-04	-19	-00
	O	30	35	..	18	-22	-21	-18	-12	-13	-00	02	-04	-10	03	-05	-08	-11	10
	N	27	18	18	..	-04	-21	-19	-12	18	18	09	-31	01	-05	-09	-02	-00	03
I	T	12	-23	-22	-04	..	14	19	01	10	06	-11	04	-06	16	10	10	-06	11
	R	3	-16	-21	-21	11	..	21	22	-04	17	02	07	-03	-15	-08	-02	-15	01
	O	5	-30	-18	-19	19	21	..	23	08	12	-20	04	07	03	-09	-06	08	03
	L	2	-15	-12	-12	01	22	23	..	-00	17	09	21	-11	16	-09	-06	00	-10
	M	15	-02	-13	18	10	-04	08	-00	..	-23	-20	-26	28	28	08	07	08	04
	O	7	-01	00	18	06	17	12	17	-23	..	25	17	-21	-32	-08	-02	00	-08
	T	8	01	02	09	-11	02	20	09	-20	25	..	23	-29	-25	09	04	11	-14
II	I	9	-13	-04	-31	09	07	04	21	-26	17	23	..	21	-11	04	-01	11	-04
	V	19	03	-10	01	-06	-03	07	-11	28	-21	-29	-21	..	08	00	06	01	09
	.	13	-09	03	-05	16	-15	03	16	28	-32	-25	-11	08	..	16	09	04	-00
	C																		
	H	34	-16	-05	-09	10	08	-09	-09	08	-08	09	04	00	16	..	44	-27	11
	A	33	-04	-08	-02	10	-02	-06	-06	07	-02	04	-01	06	09	44	..	-16	15
III	L	32	-19	-11	-00	-06	-15	08	00	08	00	11	11	01	04	27	27	..	-18
	L	31	-00	10	03	11	01	03	-10	04	-08	-14	-04	09	-00	11	11	15	..
	.																		

APPENDIX I

TABLES: POST STUDY

TABLES: POST STUDY

TABLE 20.--Information processing: Test for effect of extremes of range.

	Scores	N
Concrete	1 & 2	6
Abstract	6 & 7	6

Cell Means

	Att. Gen.	Att. HED	GPA	Final	Diff.
Concrete	28.83	103.16	3.32	131.83	24.33
Abstract	75.50	100.16	2.77	125.00	24.66

Test: Equality of Mean Vectors

Overall: f = 0.68 p<0.62 df = 4 and 7

Variables:	Univariate F	
Att. Gen	1.05	p<0.32
Att. HED	0.41	p<0.53
GPA	3.36	p<0.09
Final	0.79	p<0.39

df (hypothesis) = 1
df (error) = 10

TABLE 21.--Locus of control: Test for effect of extremes of range.

	Scores	N
External Control	39+	6
Internal Control	30-	8

Cell Means

	Att. Gen.	Att. HED	GPA	Final	Diff.
External	72.16	89.00	2.78	118.16	16.83
Internal	80.75	94.50	2.74	112.37	13.75

Test: Equality of Mean Vectors

Overall: f = 2.87 p<0.08 df = 4 and 9

Variables:	Univariate F	
Att. Gen	5.35	p<0.04
Att. HED	0.33	p<0.57
GPA	0.02	p<0.90
Final	0.21	p<0.65

df (hypothesis) = 1
df (error) = 12

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