Evaluation of a Questionnaire Designed to Measure Trait Differences of Students in Lecture, Individualized and Independent Learning Modes

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EVALUATION OF A QUESTIONNAIRE DESIGNED TO MEASURE TRAIT DIFFERENCES OF STUDENTS IN LECTURE, INDIVIDUALIZED AND INDEPENDENT LEARNING MODES

by

Ronald Svara

A Dissertation Submitted to the Faculty of the Graduate School of Loyola University of Chicago in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

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LIFE

The author, Ronald Svara, is the son of Frank Svara and Josephine (Jagodzinski) Svara. He was born March 27, 1938, in Chicago, Illinois.

His elementary education was obtained at the James Shields Elementary School, Chicago, Illinois and secondary education at the Thomas Kelly High School, Chicago, Illinois, where he graduated in 1955.

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CHAPTER I

INTRODUCTION

Outline of the Problem

During the past twenty years, in an effort to adapt teaching strategy to individual students, many new instructional designs have emerged. Enthusiastic educators, using what they felt were superior instructional sequences, prepared to significantly improve the quality of education through varied teaching strategies. The theoretical basis for the individualization of instruction was laid by many educators, one of whom was Benjamín Bloom. He pointed out that "individual students may need very different types and qualities of instruction to achieve mastery."¹ A host of studies were (and are still being) conducted comparing the individualized method with the traditional lecture method. Results of the studies are rather inconclusive.

Sackett conducted a study which was designed to compare achievement in three modes of instruction: (1) an open school, which was heavily oriented toward a humanistic approach to education with maximum of freedom for exploration, (2) a conventional self-contained classroom school, and (3) a conventional, but departmentalized, classroom school.

school. The open school children scored significantly lower (α = .05) in achievement than did the other two groups with the self-contained and departmentalized scoring the same. 2 Killough tested 150 students who attended a non-graded, open space facility for three years and 150 students who attended a traditional elementary school for three years. He found pupils that remained in the non-graded program for three years had significantly (α = .05) higher mean achievement gains in most cognitive areas than pupils in a program other than non-graded. 3 While these two studies yielded exactly opposite results, Warner found no significant difference in achievement scores between students in a self-contained classroom and students in an open space classroom at the second, third and fourth grade levels. 4

Welch reviewed 30 studies on secondary science programs devoted to comparing various instructional approaches, for example, lecture-expository versus guided, discovery or laboratory versus demonstration. He reported that 17 studies found no significant differences; 6 studies found mixed results; 6 studies favored the experimental


procedure; and one favored the control. Welch concluded that many of the studies were poorly conceptualized or designed. However, Melnick comments that

The ambiguity of the results may be due in part to the fact that the wrong research question was asked. Instead of asking simply, is IND (independent study) superior to more traditional methods of teaching? A more complex question is needed. One could well ask in what ways is IND superior, for what kinds of students, with what kinds of training, studying what subjects, with what degree of faculty interaction? By asking these more complex questions, both theoretically reasonable and consistent answers might be obtained.

Littlefield concurs when he states:

Instead of a comparative investigation research questions should concentrate on what effect does an instructional approach have on what kinds of students, what is their cognitive and affective performance, with what kinds of media, for which school subjects, and how much interaction with the teachers.

Lesser also concurs but adds:

Pitting one instructional method against another, while ignoring the suitability of either method to the individual characteristics of students, has been called "horserace" evaluation (by Messick). In contrast to "Horserace" evaluation of instruction, our premise is that no single, best way to teach anything to all people will ever be found. Instead of searching for such general, simple solutions, it is our contention that we should be pursuing the more fundamental search for different

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methods suitable to different students for achieving both universal and particular goals.8

Cronbach has stated: "I have no faith in any generalization upholding one teaching technique against another . . ."9

The theory that this investigator advocates is that there is no instructional method which is clearly superior to all other methods for all students. Different students learn by different instructional methods. Three methods of instruction are examined in this study: (1) lecture, (2) individualization, and (3) independent study. There is a hierarchy of freedom with respect to pacing and test taking in these methods, the former having the least freedom, the latter the most freedom. This hierarchy shifts the locus of control for the burden of learning from the instructor to the student. The degree of freedom that a student can handle may be related to such traits as the student's personality, motivational level, interest, aptitude, cognitive style, aggressiveness, etc. This study seeks to find out if there is an interaction between locus of control (lecture, individualized instruction, independent study) and the response to a questionnaire written by this investigator with the constructs of personality, motivation, cognitive style including some demographic data.

There is some theory in regards to such interactions and many studies showing interactions. Koback showed a relation between


cognitive style and teaching strategy. Witkin's\(^{10}\) cognitive style element of field independence versus field dependence and Kagan's\(^{11}\) cognitive style element of impulsivity versus reflectiveness was found to interact with the teaching methods of deductive teaching versus inductive teaching. Koback found that fifth graders being taught how to add signed numbers should be taught deductively if they are field dependent and reflective, and inductively if they are field dependent and impulsive.\(^{12}\)

Szabo and Fieldhusen found an interaction between some personality factors, as measured by the Guilford-Zimmerman Temperament Survey, and academic success in an independent study biology course. The results showed that both the restraint and ascendance scales of the GZTS were significantly correlated to academic success in the independent study mode. It was also found that the restraint scale was significantly correlated to the traditional teacher-directed biology course indicating that successful students in traditionally taught biology differ from successful students in independent study biology on the measure of ascendance. This indicates an interaction


between personality and mode of instruction.  

Smith conducted an experiment using audio tapes to teach the first unit of a community college biology course. The rest of the course was then taught by the lecture method. An opinion questionnaire filled out by the students at the end of the semester showed that 19 students felt they learned more in the lecture mode, 31 felt they learned more in the tape mode and 19 thought the modes were equal.  

Littlefield found that attitude and motivation were the most important discriminates in predicting high achievement or low achievement in an individualized high school biology course. Hall found an interaction between the California Psychological Inventory and success in an open campus high school. Ricketts found an interaction among one element of the California Test of Personality, sense of personal freedom, and achievement in a seventh grade individualized mathematics program.

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15 Littlefield, Student Characteristics. P. 155.  


Cronbach lays a theoretical foundation which could explain the contradictory results documented in the research. In his presidential address to the American Psychological Association, Cronbach distinguished "two historic streams of method, thought, and affiliation" in scientific psychology: experimental and correlational. In the experimental study of behavior, individual differences interfere with the discovery of significant results and in the correlational analyses of individual differences, variations among treatments simply amount to error. Cronbach made the point that neither approach is adequate by itself but feels both methods are necessary because some types of individuals respond to one treatment while other types respond to another treatment.18

Willingham uses graphs as an aid to show treatment-trait interactions. Figure one shows the type of regression lines necessary to show significant differences between two treatments. The dependent variable, criteria, must score consistently higher in one treatment on most, or all, scores of the independent variable. If the independent variable interacts with the criteria, as shown in figure two, then no significant differences will be observed in mean scores, but the best placement of a student can be achieved by assigning him to the treatment which has the greatest criteria for that student. The decision for placement about the intersection of the regression lines can be done in a number of ways. The easiest way to make the decision is to use the coordinate of the point of intersection as the cutoff score.

Figure 1. Illustration of a significant difference among two treatments.

Figure 2. Illustration of a non-significant difference among two treatments, but with interaction.
A second way is to select an interval around the x-coordinate and assign students who fall in that interval a treatment at random. Although Cronbach laid the groundwork for the application of decision theory to problems of alternate educational treatments in 1957, Willingham points out: "It was not until 14 years later that Hill made the only serious attempt to discuss college placement in the context of decision theory." 19

Snow summarizes the importance of trait-treatment interactions (TTI) stating "All attempts at adaptation or individualization of education rest implicitly or explicitly on (TTI) hypotheses." 20

This study is an effort to find interactions between the responses to constructs of a questionnaire written by the investigator and three modes of instruction: (1) lecture, (2) individualized instruction, and (3) independent study. The constructs of the questionnaire are personality, motivation, and cognitive style; some demographic data will be included. Some questions to be answered are:

1. Do student's scores on the questionnaire interact with the three modes of instruction?

2. Does certain demographic data have any discriminatory power in relation to the three modes of instruction?

3. Are there certain questions on the questionnaire which

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discriminate between degrees of success in the three modes of instruction?

If an interaction occurs between the student's scores on the questionnaire and method of instruction, then one may conclude that instructional strategy has an effect on educational outcomes. If no interaction occurs (the slopes of the regression lines are about the same) then one may conclude that one method of instruction is superior if the separation between the lines is sufficiently large. If the separation is not significant, then either the instructional strategy has no impact on educational outcomes, or the wrong questions were asked on the questionnaire.

Analysis of the demographic data appears to be less controversial. Conclusions can be drawn on a question by question basis, and the results will not be synthesized.

A multiple linear regression equation will be written for each mode of instruction. The coefficients for the equation will be calculated by a computer. A by-product of the computations will be a delineation of the variables ranked in the order of amount of variance accounted for by each question, with the question that accounts for the most variance listed first. The other variables are ranked according to how much additional variance is accounted for by each variable. This listing may identify certain questions which are sensitive to differences in success in the three modes of instruction. Further research could identify more questions which are sensitive to differences in success in the three modes of instruction. Perhaps, eventually, a highly sensitive instrument can be developed which can
be used for placement of students into the most appropriate mode of instruction for each student. Further discussion of sub-questions will be explored later in the paper.

**Definition of Terms**

**Attitude:** for this study Thurstone's definition will be used: "The intensity of positive or negative affect for or against a psychological object. A psychological object is any symbol, person, phrase, slogan or idea toward which people can differ as regards positive or negative affect."\(^{21}\)

**Cognitive style:** overt acts of a student, which a student can observe in himself, that will help categorize a student into one of three learning modes, (1) lecture, (2) individualized instruction or (3) independent study. In level of practicality, this definition would agree with Hill's.\(^{22}\)

**Independent study:** (one of the three instructional strategies examined in this study). The students are self paced and usually meet between three and six times during the semester with the instructor. Tests are given in a testing center.

**Individualized instruction:** Willingham points out that "Individualization has come to mean almost anything an institution does to pay more attention to the characteristics, goals, and interest of


\(^{22}\) J. E. Hill, *Cognitive Style as an Educational Science.* (Bloomfield Hills, Michigan: Oakland Community College Press, 1970.)
individual students."\textsuperscript{23} Weisgerber found that the Educational Resources Information Center (ERIC) "... had 59 descriptors of Individualized Learning."\textsuperscript{24} Glaser defines it as "... the adaption of institutional procedures to the requirements of the individual learner."\textsuperscript{25} To be more specific, individualized instruction in this study will be defined by the Keller plan which includes four characteristics:

1. go-at-your-own-pace through the semester. (This study differs, in that there are eight test dates which must be adhered to, but go-at-your-own-pace prevails in between test dates.)

2. the unit-perfection requirement for advance. (Mastery is not demanded in this study, only a 60% level.)

3. lectures are not a critical source of information. (In this study, class time is used for problem solving, and all lectures are on audio or video tapes.)

4. the use of proctors for testing, test scoring and tutoring. (In this study a testing center administers the tests which come in two forms. Test scoring is done by computer, usually overnight. Tutoring is done by the instructor and/or in a tutoring center.)\textsuperscript{26}

Instructional strategy: this refers to the three modes of instruction in this study, (1) lecture, (2) individualized instruction, and (3) independent study.

\textsuperscript{23} Willingham, \textit{College Placement}, p. 6.


\textsuperscript{26} Fred S. Keller, \textit{Neglected Rewards in the Educational Process}, paper read at the 23rd annual meeting of the American Conference of Academic Deans. (Los Angeles, January 16, 1967.)
Older, Middle Aged, Younger Students: older students, defined by this author as over 27 years old. Middle aged, defined as over 20, up to and including 27. Young students, defined as age 20 and under.

Personality: Mehrens and Lehmann point out "If 100 psychologists were asked to define personality, one might get 100 different definitions." 27

Cattell suggests a broad definition of personality which suits this study best: "... that which permits a prediction of what a person will do in a given situation." 28 The investigator uses four roots in generating personality questions for the questionnaire:

(i) attitude, (2) level of maturity, (3) level of discipline, and (4) self-actualization.

Self-actualizers: Maslow identifies them by:

... their relative independence of the physical and social environment. Since they are propelled by growth motivation, self-actualizing people are not dependent for their main satisfactions on other people, ... , or extrinsic satisfactions. Deficiency-motivated people must have other people available, since most of their main need gratifications can only come from other human beings. But growth-motivated people may actually be hampered by others. 29

Work load: as defined by this investigator is the sum of the number of credit hours a student is carrying and the average number of

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hours a week the student is working on an outside job. A heavy workload is 45 hours or more, medium is 32-44, and light is 31 or less.

Limitations

1. Conclusions drawn will be based on a questionnaire which does not have all possible discriminatory questions and may or may not be germane to the research questions.

2. The students were not randomly placed. Students of instructors who were willing to cooperate were used.

3. The questionnaire is not designed to predict success or failure, but instead the mode of instruction which is best for a particular student.

4. One mode of instruction, individualization, includes mathematics students only. Also, there is only one instructor, this author, involved in this mode of instruction.

Significance of the Study

If instructional strategies have a significant impact on educational outcomes, then the quality of education can be increased by placing students in an instructional environment which is most compatible with the student's mode of learning. This would indicate to future educational experimenters not to seek the single best instructional strategy for all, but to further identify and refine placement devices which correlate higher and higher with success. Future educational experimenters could then channel their efforts into finding a better placement device and not a better mode of
instruction.

Polly Chico Gross, a student at the University of Chicago Laboratory School, makes this comment:

While I agree that choice is not enough, I cannot resist adding, choice can be too much. Needless freedom can overwhelm the student with decisions which will either play no importance in his life, or steer him toward a course of action which may be based on mere momentary infatuation, and which he may regret later. Therefore, I would ask all educators to ponder the role they feel their high school should play, before they over individualize the high school years - a pattern which unnecessarily forces the student to play at adulthood.30

This investigator feels that over individualization is a danger. This investigator hypothesizes, based on seven years experience with non-traditional instruction, that in order for a student to be successful in non-traditional study he probably must have the characteristics of Maslow's self-actualizer. Maslow points out that "The extensive experiments by Asch and by McClelland permits us to guess that self-determiners (self-actualizers) come to perhaps 5% to 30% of our population depending on the particular circumstances."31 If only 5% to 30% of our population is fit for non-traditional learning, we may be doing harm to 70% to 95% of the students placed in a non-traditional learning mode at random.

Willingham discusses noncrossing interaction between trait and treatment.

Figure 3 . . . shows another possible outcome in which the two regression lines have different slopes but do not cross within the score range of the placement test. Superficially, treatment

A may appear generally superior since maximum learning takes place when all students take the precalculus course. But these figures take into account only learning outcomes. To represent adequately the net utility of each treatment, one would have to discount somewhat the expected benefit of treatment A to account for its greater cost. That result would suggest that only a portion of the students should take the precalculus course. For students who make a high placement test score, the slight advantage of taking precalculus simply would not be worth the extra time and cost.32

![Graph showing noncrossing interaction between student trait and treatment](image)

**Figure 3.** Noncrossing interaction between trait and treatment with a significant difference.

Identification of interaction could save time and money.

This study may help to decide:

1. What it is that makes a non-traditionally taught student successful.

2. If men differ from women in the way they learn.

3. If non-traditional study programs, with their built in

time flexibilities, are better for people with heavy work loads than traditional modes of learning.

4. If older people, who have been taught predominantly by traditional methods, can learn as effectively in new instructional settings.

While all conclusions in this study should be further researched, the conclusions are not as important as the point of view from which the study is being conducted, which is, there is no best mode of instruction for every student. Each student has an optimum method of learning and research should be conducted in an effort to identify each student's optimum learning mode.
CHAPTER II

REVIEW OF RELATED LITERATURE

Substantiation for Need

Dressel and Thompson suggest that "Few areas in higher education today are so vaguely eulogized, yet so little understood, so loosely defined, and so inadequately researched as self-directed learning." They base this view on a survey of 253 institutions, 70% of which had not evaluated their independent study offerings.

Littlefield suggest that:

One of the major problems in offering an individualized program is the lack of empirical knowledge concerning various individual characteristics as personality and motivation and how these factors are related to academic success in the individualized setting.

After completing his study he decided that "... the ultimate factors which appear to determine success are not knowledge but instead are attitude and motivation."

Weisgerber states that:

Planned programs for individualizing instruction require extensive data concerning pupil aptitude, achievement, interest, learning styles, and other qualities having implications for the

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34 Littlefield, Student Characteristics. P. 35.

35 Littlefield, Student Characteristics. P. 155.
diagnosis and planning of educational programs. 36

This study suggests a shift from trying to find the best learning mode for all students to trying to find the most appropriate learning mode for each student. Why should cognitive style, motivation and personality be chosen as constructs for the questionnaire? Why should a questionnaire and not an intelligence test be used for placement? Finally, why should the goals of research shift from finding the best mode of instruction to finding the best mode of instruction for each student?

The need for writing an objective questionnaire instead of a subjective one is pointed out by Cattell. He states: "... it is extremely important that progress be made with objective, behavioral tests-T-data"37 (in contrast to subjective tests called L-data and Q-data) because of the difficulty of rating in the subjective tests and the low reliability coefficients characteristic of subjective tests.

Divesta points out that "learning research is shifting toward the study of individual differences as they interact with various treatments. ... Which treatments have greatest payoff for subjects with which characteristics?"38

Finally Cronback summarizes:


37 Cattell, Objective Personality. P. 7.

The other line of evolution (of personality questionnaires) will be away from attempts simply to classify persons or to describe their present response tendencies, and toward the study of responses to distinct types of situations. Just as there is a growing concern for the interaction between abilities and alternative instructional treatments, which when understood, will permit us to place the individual in the kind of instruction best for him, so information about personality becomes useful when we understand the interaction between person and situation.39

The need for a device to aid in the placement of students in the proper learning mode appears to be a natural outgrowth of the failure to identify a learning mode which is superior for all students.

Present Status

Cronbach identifies "... three investigators who are most vigorously pursuing factor analysis of personality."40 H. J. Eysenck, W. T. Norman and R. B. Cattell.

Eysenck outlines four levels of personality. He calls the lowest level the specific response level. Specific responses are acts, such as responses to an experimental test or to experiences of everyday life, which are observed once, and may or may not be characteristic of the individual. The next level is called the habitual response level. It takes a number of selected observations from the specific response level to make up one kind in the habitual response level. The habitual responses are specific responses which tend to recur under similar circumstances; i.e., if the test is repeated, a

40 Cronbach, Psychological Testing. P. 523.
similar response is given, or if the life-situation recurs, the individual reacts in a similar fashion. A number of habitual responses which load on the same factor are categorized as a trait. Traits, such as irritability, persistence, rigidity, are theoretical constructs based on observed intercorrelations of a number of different habitual responses. In the language of the factor analyst, they may be conceived of as group factors. Traits which correlate are called type, such as introvert. An entire collection of types then make up what is called the personality. Eysenck points out the connection between his personality theory and factor analysis theory.

Factor theory distinguishes four types of factors; error factors, which are present only on one occasion, but not on others; specific factors, which are peculiar to a single test or trait whenever it occurs; group or primary factors, common to certain of the tests or traits, but absent in others; and general or second order factors, common to all the tests or traits used in an investigation. It will be noted that the four levels of personality organization correspond closely to the four types of factors.

An habitual response is merely a specific response diverted of its error component and made into a specific factor; a trait is a system of specific responses diverted of its error and specific variance; a type is a system of specific responses which has lost its error specific, and group-factor variance.

Norman outlines a four step approach which could be used in developing a personality theory: (1) Collect all trait names from a standard English dictionary. (2) From this set select that subset which possesses unambiguous denotative reference to limited classes of relevant observable phenomena. (3) Delete those words which are not needed to parsimoniously span the domain of phenomena referred to by

the entire collection. The first three steps are a natural sequence which may be used to develop a taxonomy for personality. Norman's experimentation is done in conjunction with the fourth step, (4) Organize the designator into an organization of the classes by experimentation on representative groups of persons.

Norman has reduced the descriptors to five factors:

I. Extroversion or Surgency

II. Agreeableness

III. Conscientiousness

IV. Emotional Stability

V. Cultures

Norman's rating scale is bipolar. There are four elements for each factor, for example, the four elements in Extroversion factor are (1) Talkative - Silent, (2) Frank, Open - Secretive, (3) Adventurous - Cautious, and (4) Sociable - Reclusive. Subjects are rated by their peers and a score is generated through the use of a complicated formula.

Norman compares his work with Cattell's and points out that his and Cattell's approach in developing personality factors is the same. The results are different because Cattell uses non-orthogonal rotational methods in identifying his factors while Norman uses orthogonal rotations. This is why Norman identifies only five factors while Catell identifies fifteen or sixteen. 42

Cognitive style has two distinct levels of definition, applied and theoretical. Experimenters involved at the theoretical level are interested in how people perceive, think, solve problems, learn, relate to others, etc. An example of this type is Herman Witkin's field dependence - field independence element of cognitive style. Witkin tries to determine to what extent is perception of an item determined by the surrounding framework.

One test devised by Witkin is the frame and rod test. A subject is placed in a completely darkened room. A luminous square frame is presented to the subject and rotated about its center. Pivoted at the same center is a luminous rod which can be rotated. The frame and rod are tilted at different angles and the subject, with remote control of the rod, is asked to rotate it into a vertical position. Other tests include rotating the observer. People are then classified by how many arc degrees off from the actual vertical the rod is placed. Those who are off the most are categorized as field dependent and those who are most accurate are categorized as field independent.43

An excellent summary of twelve cognitive style models can be found in Kay Martens'44 paper prepared for presentation at the American College Personnel Association Convention held in Atlanta, Georgia in 1975. Her table listing and summarizing twelve cognitive style

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43 Herman Witkin and others. Field Dependent and Field Independent Cognitive Styles.

44 Kay Martens, Two-Year College Development Center. State University of New York at Albany, New York; 12222.
models is given in Table 1.

At the applied level, experimenters are trying to relate cognitive style to instructional mode. Extensive work is being conducted by Joseph E. Hill at Oakland Community College near Detroit, Michigan. Diagnostic testing is conducted to find out how each student searches for meaning in his environment. The test data is computer analyzed and a cognitive map is produced for each student.

Courses are broken down into units which usually take the student, five or six days to complete. The student's cognitive map suggests the probable mode of understanding for each unit. There are five major modes of understanding:

1. Programmed text
2. Video Tapes
3. Youth tutor youths
4. Independent study
5. Seminar

The student is tested at the 90% level. Parallel forms of each test exist and may be taken after one hour of study. Four attempts at each test are permitted. 45

The questionnaire has 112 questions which reduce to 28 factors. For example, the following four questions are grouped into one factor:

#1. I think that rules and regulations should be followed.
#14. I follow the rules of most games and do not "cheat."
#19. I have no sympathy for people who break the law.

**TABLE 1.**

**TWELVE COGNITIVE STYLE MODELS**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DEFINITION</th>
<th>PRINCIPAL RESEARCH</th>
<th>MEASURING INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Field indep.-v. dependence</td>
<td>Differentiated (independent) v. undifferentiated figure-ground relationships. Field independents tend to extract a figure from its ground or background. Field dependents tend to see figures only in relation to their ground; they are superior to field independents in such tasks as memory for faces and they seem to be socially more sensitive.</td>
<td>Witkin</td>
<td>Embedded Figures Rod and Frame Test Body Adjustment Test</td>
</tr>
<tr>
<td>2. Scanning v. focusing defined as strategies, not as att. differences</td>
<td>Posed a problem requiring identification of relevant as opposed to irrelevant information, scanners look for attributes and proceed in a constraint-seeking, broad to narrow fashion while focusers generate more global, self-sufficient or all-encompassing hypotheses, proceeding in a trial-and-error fashion. If a scanner makes an error, he has nonetheless learned something while a focuser cannot tell which part of his hypothesis is wrong. When the focuser is</td>
<td>Menninger Foundation; Schlesinger; Bruner, Goodnow, Austin</td>
<td>Twenty Questions Concept Attainment Tasks (e.g., Bruner et. al. in <em>A Study of Thinking</em>)</td>
</tr>
</tbody>
</table>
right, however, he attains solution faster than a scanner.

3. Broad v. narrow categorizing

The broad categorizer prefers a small number of categories containing a large number of items, while the narrow categorizer prefers a larger number of categories with a small number of members. The broad categorizer admits more items or ideas as similar while the narrow categorizer rejects items and differentiates concepts more thoroughly.

4. Leveling v. Sharpening

In taking in new information, the leveler shows greater readiness to assimilate new stimuli to previous categories while the sharpener tends to differentiate new instances from old. While categorizing style applies to free categorizing exercises, leveling and sharpening are examined in a more controlled way using successive presentation of stimuli rather than simultaneous presentation.

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DEFINITION</th>
<th>PRINCIPAL RESEARCH</th>
<th>MEASURING INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Broad v. narrow categorizing</td>
<td>The broad categorizer prefers a small number of categories containing a large number of items, while the narrow categorizer prefers a larger number of categories with a small number of members. The broad categorizer admits more items or ideas as similar while the narrow categorizer rejects items and differentiates concepts more thoroughly.</td>
<td>Menninger Foundation</td>
<td>Category width Tasks</td>
</tr>
<tr>
<td>4. Leveling v. Sharpening</td>
<td>In taking in new information, the leveler shows greater readiness to assimilate new stimuli to previous categories while the sharpener tends to differentiate new instances from old. While categorizing style applies to free categorizing exercises, leveling and sharpening are examined in a more controlled way using successive presentation of stimuli rather than simultaneous presentation.</td>
<td>Menninger Foundation; Gardner; Santostephano</td>
<td>Schematizing Test; Wagon Test</td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITION</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
</tr>
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</tr>
<tr>
<td>5. <strong>Constricted v. flexible control</strong></td>
<td>Constricted control shows greater susceptibility to interference by irrelevant information while flexible control is evidenced by resistance to interference.</td>
<td>Menninger Foundation; Kleen</td>
<td>Stroop Color-Word Test</td>
</tr>
<tr>
<td>6. <strong>Tolerance v. intolerance for incongruous or unrealistic experiences</strong></td>
<td>Tolerance is revealed by more frequent reversals readier adaptation to unusual perceptions. Intolerance involves the demand for more information before the unusual is accepted.</td>
<td>Menninger Foundation</td>
<td>Aniseikonic lenses; reversible figures</td>
</tr>
<tr>
<td>7. <strong>Impulsive v. reflective responding</strong></td>
<td>Impulsivity is characterized by quick responding while reflectiveness involves considering alternative classification or responses. When he's right, the impulsive is faster; the reflective makes fewer errors.</td>
<td>Fels Institute; Jerome Kagan</td>
<td>Matching Familiar Figures; Identical Pictures</td>
</tr>
<tr>
<td>8. <strong>Analytic v. nonanalytic conceptualizing styles</strong></td>
<td>Analytic style entails differentiating properties or attributes while nonanalytic responses may be thematic-descriptive or relational. The analytic is more attentive to similarities in property,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fels Institute; Jerome Kagan</td>
<td>Conceptual Style Test</td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITION</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
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</tr>
<tr>
<td>9. Risk-taking v. Caution</td>
<td>The risk-taker will take the risk when there is a low probability of a high payoff, while caution entails preferring low risk with a high probability of low payoff. In cost-payoff situations, the risk-taker tries to outwit the odds, the cautious person tries to identify the safest odds.</td>
<td>Kogan and Wallach</td>
<td>Cost-payoff games</td>
</tr>
<tr>
<td>10. Cognitive complexity v. Simplicity</td>
<td>Cognitive complexity is characterized by hierarchic integration while cognitive simplicity is reflected by use of dimensions of difference. Cognitive simplicity is favored when only horizontal analysis along a dimension is necessary. Cognitive complexity is favored when vertical analysis of relations between dimensions is necessary.</td>
<td>Kelly; Shroder, Driver, Streufert</td>
<td>REP Test Paragraph completion This I Believe Test</td>
</tr>
<tr>
<td>11. McKenney two-dimensional model</td>
<td>The preceptive individual assimilates information to his concepts or categories while the receptive individual assimilates data as raw as possible. Pre-</td>
<td>McKenney, Keen, Nelson, Botkin</td>
<td>Tasks Assessing each mode: e.g., Identical Pictures (Receptive) Elaboration</td>
</tr>
</tbody>
</table>
TABLE 1. Continued

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DEFINITION</th>
<th>PRINCIPAL RESEARCH</th>
<th>MEASURING INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptive Planning:</td>
<td>Receptives categorize or chunk information as it comes to them while receptives can more often take a new look at the data presented, since they've stored it as data not concepts. Systematic individuals create orderly, sequential plans or strategies; if you have a good plan, you'll find a good solution. Intuitives prefer ideas, identifying the problem and skipping from part to whole analysis; a good solution for them is good because it solves the problem they defined.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systematic v. Intuitive</td>
<td></td>
<td>Liam Hudson</td>
<td>Finding useful parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(convergent)</td>
</tr>
<tr>
<td></td>
<td>12. Convergent v. Divergent thinking</td>
<td></td>
<td>Different uses</td>
</tr>
<tr>
<td></td>
<td>Analytic as opposed to synthetic abilities. The diverger is creative in the sense of being able to generate ideas; the converger is better able to come to a solution.</td>
<td></td>
<td>(divergent)</td>
</tr>
</tbody>
</table>
#109. Life is simple when I go by the rules.

The possible responses are: rarely, sometimes or usually. The factor for these four particular questions is Categorical, By-The-Rule way of thinking. Other examples of factors are:

#1. Ability to find meaning in words you hear.
#5. Sense of hearing
#10. Ability to synthesize
#22. Family influence in decision-making

The twenty-eight factors merge into these five constructs:

1. Modalities of Inference
2. Cultural Determinants
3. Qualitative Codes
4. Sensory Codes
5. Theoretical Symbols.

The student may ignore the prescription and stick to lecture.

This section of the review of the literature includes those studies that have only one treatment involved. In the next section, "Studies Closely Related to This Study," efforts involving more than one treatment will be examined. The twelve studies discussed in these sections are summarized in Table 2. A reader interested in a specific trait or treatment can use the table to save time in his search. Most research efforts center around finding a significant trait which means academic performance would need to be better for all or most measures of the trait.

Of the twenty-five significant traits and measures listed in Table 2, only eleven investigated for interaction. Of the eleven investigated, six found interactions. Two studies on traditional

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<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>TREATMENT 1</th>
<th>TREATMENT 2</th>
<th>TREATMENT 3</th>
<th>SIGNIFICANT TRAIT(S) OR MEASURES</th>
<th>INTERACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balik</td>
<td>Traditional</td>
<td></td>
<td></td>
<td>1. Cognitive style</td>
<td>Yes</td>
</tr>
<tr>
<td>Calhoun</td>
<td>Individualized</td>
<td></td>
<td></td>
<td>1. Expected grade</td>
<td>No</td>
</tr>
<tr>
<td>Cattell</td>
<td>Traditional</td>
<td></td>
<td></td>
<td>1. Personality</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Motivation</td>
<td>No</td>
</tr>
<tr>
<td>Gabel</td>
<td>Individualized</td>
<td></td>
<td></td>
<td>1. Self pacing</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Deadlines</td>
<td>Yes</td>
</tr>
<tr>
<td>Hall</td>
<td>Independent Study</td>
<td></td>
<td></td>
<td>1. California Psychological Inventory Scale</td>
<td>No</td>
</tr>
<tr>
<td>Littlefield</td>
<td>Individualized</td>
<td></td>
<td></td>
<td>1. Critical thinking</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Biographical data</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Personality</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Motivation</td>
<td>No</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. Scholastic aptitude</td>
<td>No</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6. Success in other classes</td>
<td>No</td>
</tr>
<tr>
<td>Couch</td>
<td>Traditional</td>
<td>Non-lecture</td>
<td></td>
<td>1. Traditional, a better mode</td>
<td>No</td>
</tr>
<tr>
<td>Haskel</td>
<td>Instructor Led</td>
<td>Lecture-discussion</td>
<td></td>
<td>1. Restraint</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Emotional stability</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Masculinity</td>
<td>No</td>
</tr>
<tr>
<td>AUTHOR</td>
<td>TREATMENT 1</td>
<td>TREATMENT 2</td>
<td>TREATMENT 3</td>
<td>SIGNIFICANT TRAIT(S) OR MEASURES</td>
<td>INTERACTION</td>
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</tr>
<tr>
<td>Lipp</td>
<td>Programmed Business</td>
<td>Simulation</td>
<td></td>
<td>4. General activity</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Learning</td>
<td></td>
<td></td>
<td>5. Friendliness</td>
<td>Yes</td>
</tr>
<tr>
<td>Maltin</td>
<td>Traditional</td>
<td>Individualized</td>
<td></td>
<td>1. Seven personality scales on the California Personality Inventory</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Tolerance</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Communality</td>
<td>No</td>
</tr>
<tr>
<td>Worley</td>
<td>Individualized</td>
<td>Traditional</td>
<td></td>
<td>1. Attitude</td>
<td>No</td>
</tr>
<tr>
<td>Gallagher</td>
<td>Lecture</td>
<td>Audible Multi-imagery</td>
<td>Independent Study</td>
<td>2. Self-direction</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1. Interest</td>
<td>Yes</td>
</tr>
</tbody>
</table>
instruction found three significant traits: cognitive style, personality, and motivation. These are the constructs used in this study to write the questionnaire.

Balik designed a study "... to investigate the effects of cognitive style on arithmetic achievement scores among boys and girls in the second, fourth, and sixth grades." The kinds of cognitive styles studied were: (1) descriptive analytic part-whole, (2) descriptive analytic global, (3) relational-contextual, and (4) inferential-categorical. The study included forty-eight boys and fifty-two girls in a suburban school district. Sigel's Cognitive Style Test, Forms M and F were used with the Stanford Achievement Test, Form W. Separate two-way analyses of variance were used, with the four cognitive style groups and sex as independent variable and arithmetic scores as the dependent variable. Post hoc t tests ($\alpha = .05$) showed that there were significant differences in arithmetic achievement between cognitive style groups; sex was not significant. Based on her study Balik concluded that cognitive style influenced achievement in a traditionally taught arithmetic course.

Cattell studied boys and girls in midwest schools, ranging in age from 13 to 17 years old. There were 169 sixth graders and 142 seventh graders involved. The independent variables included: (1) 14 personality factors as measured by the High School Personality questionnaire, (2) intelligence, as measured by the Culture Fair Intelli-

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gence Test, (3) 20 factors in motivation strength, measured by SMAT, (4) objectively measured attitudes within the family of parents to children by the new FAM, using objective devices, and (5) child rearing practices in the given family using an instrument developed by Dielman. The dependent variables were the gain in achievement over a year in five major areas: (1) Social Science, (2) English, (3) Mathematics, (4) Science, and (5) Total Scholastic Performance, as measured by both the ETS Achievement tests and school grades. Cattell found three factors which were virtually independent: (1) intelligence, (2) personality, and (3) motivation, each accounting for approximately 25% of the variance in achievement. The addition of the personality variables significantly increased the accuracy of the prediction of school grades above the accuracy predicted by using intelligence variables alone. This study points out that personality and motivation are factorially independent and are good predictors of achievement in a traditional mode of instruction.

Hall conducted a study on 600 randomly selected high school students in grades 10, 11, and 12. In two high schools in suburban Boston, Massachusetts, the traditional study hall is replaced with a variety of learning experiences, both on and off the campus. Five teachers rated academic success. Students who were rated most successful and most unsuccessful by a majority of their teachers were asked to respond to the California Psychological Inventory. Data on

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marks, absence and tardiness were collected from school files. An analysis of variance was applied to the CPI scores and significant F's were obtained (Ω=.05). The most successful group performs better academically and has fewer cases of absences and tardiness. They were found to be productive, dependable, self-denying, tolerant, independent and self-reliant. The most unsuccessful group was self-defensive, biased, deceitful, distrusting, impatient, disorganized and lacking in self-discipline and had a high rate of absences and tardiness. This study enumerates characteristics of successful students in the independent study mode. The present study hopes to identify differences in characteristics of successful students in three learning modes.

Of the following three studies on individualized instruction only two sought significant traits while one did a comparison of self-pacing with deadlines.

In the first study Calhoun used the Keller method to teach an undergraduate Psychology of Personality course (N = 231). This group had an average of 2 semesters of college credit. The instructional method had 6 characteristics: (1) self-pacing, more or less his own rate, (2) repeated testing to mastery, (3) immediate feedback, (4) small units, (5) peer proctors, and (6) optional lectures. A questionnaire was administered and the expected grade was the only question which was significantly related to a post test mastery score. Those who dropped the course were older, had been at the university

longer, and had transferred more credits than those who completed the course. Although only one significant result was found, Calhoun observed tendencies that knowledge and motivation were related to rate of progress. Thus, how well a student did over-all in this Keller type course seemed to be a function of his initial goals.\textsuperscript{50}

The second study, Littlefield's, was conducted at Glenbrook North High School located in Northbrook, Illinois. The students are from an upper middle class environment taking two semesters of high school biology. Included were 24 biology classes, 7 teachers and 405 students who were involved in 34 learning contracts. There was a single mode of instruction, individualized, and three levels of achievers: high, expected, and low. The independent variables were:

1. Ten pieces of biographical data.


3. High School Personality Questionnaire, form A, 140 items.

4. Scientific Attitude Inventory, 60 items.

5. Test on Understanding Science, form W, 60 items.


7. Classification and Placement Examination, designed to measure scholastic aptitude.

8. Endeavor VIII, a locally developed questionnaire designed

\textsuperscript{50}James Calhoun, "The Relation of Student Characteristics to Performance in a Personalized Course." \textit{(Educational Technology, April, 1975)}, p. 17.
to measure the students' feelings and attitudes toward the teacher and the course.

9. Success of students in their other courses.
The first five tests have reliability coefficients between .72 and .93 with construct validity of .58 to .77.

The dependent variable was success as measured by the Nelson Biology Test, forms E and F (65 items) and locally produced unit tests. Littlefield wanted to identify characteristics of students who do well in individualized science courses and those who do not do well. He points out that this should be considered an individualized course in contrast to an independent study course which would be less structured. This mode of instruction is similar to the Keller plan in that (1) the students progress at their own rate, (2) small units, (3) a testing center exists which is run by a paraprofessional to which the students report for the administration of examinations either during scheduled or unscheduled time, (4) optional teaching presentations, and (5) tutors. The students worked in the Science Instructional Materials Center which has audio equipped learning carrels with tapes of presentations and a lab room run by another team of teachers. A test confirmed the assumptions of normality and homogeneity of variance necessary for univariate analyses. A significant discriminant function ($\alpha=.05$) was found between high, expected and low achievers as follows:

1. Biographical data
2. Personality
3. Motivation
4. Scholastic aptitude
5. Critical thinking
6. Success of students in other classes.

More specifically, high achievers in individualized instruction were conscientious, less sociable, more self sufficient, had high grades in traditional courses, were highly motivated and interested with the last two traits being the most important. Low achievers had a tendency to disregard rules, were more socially group dependent, did not feel motivated or self directed, and did poorly in other subjects too.

The data on accomplishment is particularly disturbing to this investigator as it indicates that mode of instruction has no impact on the student. Another conclusion was that unscheduled free time and student choice in decision making is not desirable for all students.

Littlefield posed the following questions: "Might a different battery of variables prove to be better predictors of achievement?" "Would a battery of variables measuring only attitude, interest and motivation be enough?" "Does a modified course with more structure result in increased responsibility and/or achievement on the part of the student?"

The third study, with individualized instruction as the only mode, compares self-pacing with deadlines. This study is important because the individualized mode in this current study has test deadlines. Gabel and Herron conducted a study of students in 10 Indiana schools (four county schools involving four teachers and six city

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51 Littlefield, Student Characteristics. P. 161.
schools involving eight teachers). There were 1,022 students in 43 classrooms of the seventh grade. The teachers were randomly assigned. Many interactions were reported:

1. Working with a partner is an advantage for low ability children who had a deadline. These children performed significantly higher ($\alpha = .05$) on the retention test than did low ability children with deadlines who worked alone.

2. The effect of deadlines versus self-pacing on learning rate for city children was shown to be significant ($\alpha = .05$) for students working alone. Self-pacing had a higher learning rate particularly for low ability students.

3. Low ability students worked at lowest rates when working alone with deadlines and best when working alone with self-pacing.

4. For middle and high ability students, working with a partner produced higher learning rates.

Some significant results were recorded:

1. Self-pacing produced higher learning rates and retention scores than did deadlines.

2. As mental ability increased, so did rate ($p < .0001$).

3. City students in self-pacing had greater retention ($p < .0001$) over deadlines. (But, the poorest students didn't take the test because they were behind.)

4. County children who had a partner had higher retention scores ($p < .05$) than those without a partner.⁵²

This investigator observed, from one of their charts, that learning rates evened out by the last chapter. A compilation of these traits is included at the end of the next section "Studies Closely Related to This Study."

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Studies Closely Related to This Study

The first of the six studies reviewed in this section deals with two modes of instruction, individualized and traditional. The expressed purpose of the study was to develop criteria to help students, counselors and faculty make a judgement as to which students would or would not benefit from individualized instruction. The study was conducted by Worley on 765 college students enrolled in a college sociology course. The independent variables were (1) age, (2) educational rank, (3) level of attainment, (4) autonomy, endurance and achievement as measured by the Edwards Personal Preference Scale, (5) achievement as measured by grade point average, and (6) attitude, method of measurement not reported. The statistic used to test level of significance was the t test. The dependent variable was the score on locally produced tests. Worley found:

1. no difference in mean scores of traditional and individualized instruction.

2. no difference in attitudes toward individualized instruction and traditional instruction.

3. no difference in attitude toward individualized instruction by age, sex, and rank in school.

4. no difference in means according to level of attainment.

5. no correlation between students' scores and autonomy, endurance, achievement and grade point average.53

While no differences were observed, a multiple linear regression equation was not written and interactions were not tested for.

Couch's study is a classical comparison of non-lecture and lecture modes of instruction. Couch describes a new way of teaching microbiology at Athens, Alabama College. In the spring of 1972, as an alternative to the traditional lectures, a set of guided learning objectives were prepared. Objectives were outlined chapter by chapter and the students were told that the objectives reflected the most important matters in the course. The lecture was replaced by "question-and-answer" sessions, in which the chapters were discussed and students' questions were answered; however, no attempt was made to lecture. The control group, lecture, involved 31 students and the experimental group involved 21 students. The experimental group was academically superior to the control group, therefore, an analysis of covariance was made with grade point average as the variant. The experimental group earned significantly lower ($\alpha=.05$) grades. The interesting part of this study surfaced at the end of the semester when the course evaluation (no detailed description given) was taken. Couch decided that these results were caused by three basic human characteristics: procrastination, lack of self-discipline in accepting responsibility, and resistance to change. Apparently most students did not do the assigned reading in time for the discussions and therefore lost much of the benefit of those meetings. Couch observed it was the academically better students who asked most of the questions in these discussion periods and the better students enthusiastically endorsed the non-lecture method. He found that 50% to 75% of the
class did not like the way the experimental class was taught and almost all disliked the responsibility placed upon them.\textsuperscript{54}

A study conducted by Larry Maltin was based on the presumption that mode can be used as an independent variable with academic achievement, attitude toward self and school, and self-direction as dependent variables. This point of view is just the opposite of this investigator's which is that traits, such as attitude and self-direction, are almost impossible to change significantly; therefore, the mode should be adjusted to the trait and not the trait to the \checkmark mode. Maltin's study was financed under the Elementary and Secondary Education Act, Title III. It involved 120 fourth grade students from programs in the Nassau and Suffolk County region of New York. The study lasted one year concluding in May, 1974. The independent variables were mode of instruction, either individualized or traditional. Dependent variables were academic achievement, as measured by the Iowa Test of Basic Skills, in reading and mathematics. The California Test of Personality was grouped into three variables: (1) self-direction, (2) attitude toward self, and (3) attitude toward school. Self-direction was defined as a combination of personal freedom and personal responsibility. Attitude toward self was defined as a combination of personal worth, belongings, and sociability. Attitude toward school was defined as the degree to which the student feels his teachers like him, if he enjoys being with other students, and if he finds the school work is adapted to his level of interest and

maturity. It was found that students in the individualized mode scored significantly higher (p < .001) than their peers in the measures of attitude toward self and school. Self-direction was significant at the .055 level but there was no differences in achievement. The weakness of this study is that there was no indication of pretesting, we don't know if the groups started out the same. Another interpretation of the results could be that in order to yield the same achievement, a student must score significantly higher on the previously mentioned measures.  

Roger Haskell conducted a study with the same philosophy as the present study. It was designed to investigate the relationship between selected personality variables and the academic performance of learners under two modes of instruction: programmed instruction (N=78) and instructor-led lecture-discussion (N=67). Intact-groups of high school students took the Guilford-Zimmerman Temperament Survey, which measures ten specific personality traits, and the Wonderlic Personnel Test, which measures general mental ability. Haskell developed a multiple choice test which covered the content. A treatment by level of personality, 2 x 3 analysis of covariance statistical design, was used to test each research hypothesis with mental achievement as a covariant. It was found:

1. There was no significant difference in mean achievement test scores between the programmed and conventional groups.

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2. The following three traits identified students who did superior in both methods of instruction: Restraint (p < .001), Emotional Stability (p < .001), and Masculinity (p < .05).

3. Significant interactions between instructional method on General Activity (p < .05) and Friendliness (p < .05) was observed. The interaction suggests that the effectiveness of the method of instruction will vary as a function of these two personality characteristics. Programmed instruction appeared to hold promise for students who scored high on the Friendliness characteristic and low on the General Activity characteristic. Students who scored low on the Friendliness characteristic performed better under conventional instruction. It may be concluded that scores on the Friendliness Scale of the Guilford-Zimmerman Temperament Survey can be used to guide a student into one of these modes of instruction. In order to make a placement test more reliable, probably more constructs are needed.  

Another study shows that certain personality traits are related to success and may be discriminatory in placement. Lipp's study of college students taking an Introductory Business Management course supported two important conclusions. The independent variable was the measurement taken by the California Personality Inventory and the dependent variable was the score on the Inventory Business Management Examination developed by the Educational Testing Service of Princeton,  

New Jersey. A handout which described two teaching methods was given to the students at the beginning of the course. They were allowed to comment on which mode was best for them. The two methods were programmed learning and business simulations. The students were then placed in one of the treatments at random. The results found no significant difference in learning ($\alpha=.05$). The two important conclusions were:

1. There was no relationship between the achievement of students whose treatment matched their preference and those whose treatment did not match their preference.

2. Five personality scales on the California Personality Inventory were significant ($\alpha=.05$) for the programmed group but not for the business simulation group.

The significance of the first finding is that, apparently, the students cannot select ahead of time the mode of instruction which is best for them. This points to the need for a placement device to help the student. The second important conclusion is that the traits of Dominance, Responsibility, Achievement via Conformance, Achievement via Independence and Intellectual Efficiency as measured by the California Personality Inventory have discriminatory characteristics in the placement of students into one of these two modes of instruction. Only those who scored high on these measures should be placed in the programmed learning mode. This study identified a need for a placement device and showed that measures of personality can interact
The last study to be reviewed was the only study this investigator could find which involved three modes of instruction. Gallagher designed a study to determine the effect of: students' interest in health education subject matter, students' cognitive style, and instructional methodologies, all on short and long term memory. The study involved 197 college students who enrolled in a basic health course at Towson State College, Maryland. Students rated their interest in the units of: Sexuality, Mental Health, and Dying and Death as high, medium and low respectively. The independent variable of cognitive style was measured by the Schroder Paragraph Completion questionnaire. Two elements of cognitive style were identified, cognitive concrete (N=133) and cognitively abstract (N=64). The three modes of instruction were: independent study, audible multi-imagery (similar to individualized instruction) and lecture. A 3 x 3 x 2 mixed factorial research design served as the model for this study. The dependent variables, short and long term memory, were evaluated by locally developed paper and pencil tests. The data was subjected to a non-orthogonal analysis of covariance. It was concluded that level of interest and cognitive style were not significantly related to success. The three modes of instruction affected short and long term

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memory at the .05 level. 58

The predictors of success in the preceding studies are summarized in Table 3, "Significant Measures in Three Instructional Modes." The present review of the literature is by no means exhaustive but suggests perhaps, as a dissertation project, a more detailed review of the literature in this area and an effort to synthesize studies already completed.

TABLE 3.

SIGNIFICANT MEASURES IN THREE INSTRUCTIONAL MODES

TRADITIONAL

1. Siegel's Cognitive Style Test
2. Culture Fair Intelligence Test
3. Motivation by SMAT
4. High School Personality Questionnaire
5. Scoring low on Friendliness of Guilford-Zimmerman Temperament Survey

INDEPENDENT STUDY

1. California Psychological Inventory, elements of Productive, Dependable, Self-denying, Tolerant, Independent and Self-reliant

INDIVIDUALIZED INSTRUCTION

1. Expected grade
2. High School Personality Questionnaire
3. School Motivation Analysis Test
4. Classification and Placement Examination
5. Watson-Glaser Critical Thinking Appraisal
6. California Test of Personality
7. Guilford-Zimmerman Temperament Survey (2 measures only)
8. California Personality Inventory (traits of Dominance, Responsibility, Achievement and Intellectual Efficiency)
CHAPTER III

METHOD

Subjects

The students involved in this study are community college students. The college is located in a southwest suburb of Chicago and serves a population of 310,000. The district contains 139 square miles. There are 51 grade schools and 14 high schools in the district. Large vacant tracts of land exist in the district including many forest preserves. The median family income of the communities served by the institution range from a low of $8,192 in one town to $18,762 in another town, according to the 1970 census. The district represents a microcosm of national industry. Industries from light to heavy are included. The median number of years of school attended for residents 25 years and older is 12.2. The average household size is 3.56. The community is 95% white, 4.5% black, and .3% other.

The fall 1976 head count was 10,516 students carrying semester hours equal to 5,096 full time students. The average student age is 27.

Materials

Introduction

This section will include a theoretical justification of the
constructs and the method of writing the test. Caveats of test writing are also included.

In an effort to improve the quality of instruction this investigator, with a colleague, designed and created an individualized learning system similar to the Keller method. In this author's opinion the system appeared superior to the lecture mode because of a self-pacing feature. The design showed no significant difference in achievement when compared to a lecture class on the basis of comparing mean scores on a final exam (α=.05). Some students seemed to thrive by the method, many dropped out. The investigator decided that the system was good, but not for everyone. How, then, will students who do well be identified? Are there differences in some constructs that will discriminate among modes of instruction? If students belong in different modes, there may be an interaction between trait and treatment.

In a study conducted by Ellis comparing a Continuous Progress Mathematics (N=150) group to a traditional (N=150) group, it was found that: "There was very little interaction between the two variables of teaching method and mental ability."59 This study was conducted on seventh grade students using the score on the 1970 Metropolitan Achievement Test as the dependent variable and mode of instruction as the independent variable. This investigator did not use mental ability as one of the constructs in the placement test.

Aptitude is another potential construct. Might aptitude for learning interact with mode of instruction? Bracht has exhaustively reviewed studies designed to investigate aptitude-treatment interactions. Based on his review there is virtually no solid evidence for the existence of such interactions. Apparently, tailoring teaching methods to individuals varying in aptitude will not substantially improve educational effectiveness.  

How many constructs should be involved? Thorndike states the most effective form of a test battery:

Two or three predictor measures chosen because they are each good predictors when taken singly and because they are as independent of one another as possible, each yielding new and different information, will usually do about as much for us as the most elaborate and extensive battery.  

This investigator selected three constructs: personality, motivation, and cognitive style. Some demographic data were also collected. Cattell found "... personality and motivation measures are substantially mutually independent..."  

Cronbach states: "In order to show that a given construct applies to a test, it is necessary to derive hypotheses about test behavior from theory related to the construct and to verify them


For the construct of motivation, studies already reviewed in this paper (Littlefield and Cattell) have shown significant relations to success in both individualized instruction and traditional instruction. After a study conducted on high school students, Fitt concluded that: "Self-motivation needs to be a built-in factor in an individualized self-instructional course."64 This investigator recognizes that motivation is important in any mode of instruction but theorizes that as the learning mode affords more freedom to the student, a significantly higher motivational level will be necessary to achieve success.

For the personality construct, studies already reviewed in this paper (Cattell, Littlefield, Szabo and Fieldhusen) have shown significant relations to success in traditional, individualized and independent instructional settings. However, Cattell and Warburton pointed out: "Psychological common sense, and even a slight acquaintance with existing multivariate statistical analyses, should suffice to convince one that no single test is likely to tap more than a slight fraction of all the dimensions of personality."65

This investigator feels that it is not important that the


65 Cattell, Objective Personality. P. 2.
constructs of a test have the same factor loadings so long as individual items are discriminatory. The items in the questionnaire will be analyzed individually to see how discriminatory each is.

For the cognitive style construct, studies already reviewed in this paper (Koback and Balik) have shown interaction between cognitive style and learning.

Validity

Cattell and Warburton's definition of validity is in the generic sense, the ability of a test to predict something other than itself. Cattell prefers the type of research which is pure, not worrying about the application of the results. He would further refine the definition of validity as "... a uniquely rotated factor or cofactor rotation as a source trait or state dimension and pattern." The degree of abstraction of the constructs run from conceptual or abstract to concrete or particular. Cattell seems to be a purist who would advocate research for research sake. He would probably be happy finding more items that factor load on some identified factor than a practical application of the factors. This investigator's test would be criticized because it is concrete-particular and will not find out why the prediction occurs; but, Cattell concedes that applied research is more frequently interested in the capacity to predict a quite particular concrete performance.

Willingham comments on validity of placement tests:

The primary purpose of the assessment measure is to identify

66Cattell, Objective Personality. PP. 32-33.
students who will perform differently in alternate treatments. Therefore the trait-treatment interaction provides the most unequivocal evidence that such a measure is valid for this purpose.

How does one establish that a placement test is effective for the purpose, that is to say, valid for placement? The foregoing suggests that there are basically two methods: (1) demonstrating a TTI or (2) establishing content validity. It should come as no surprise that the first is the recommended method but also the most difficult and the least likely to be employed in actual practice. In fact, published instances are quite rare. Evidence that the test is valid for making placement decisions at that particular point in the sequence would be based on finding differential regression (prediction) for the groups.67

Three kinds of validity will be discussed: construct, content, and criterion.

Mehrens and Lehmann define construct validity as:

."... the degree to which the test scores \textit{trait} can be accounted for by certain explanatory constructs in a psychological theory. Constructs are normally considered as unobservable phenomena, such as intelligence, motivation, and interest, that help to explain an individual's behavior."68

Content validity is defined by Lyman as: "Logical evidence that the item content of a test is suitable for the purpose for which the test is to be used; this concept is used principally with achievement tests."69 Mehrens and Lehmann describe it as how well the items of the test represent the domain of the subject matter about which inferences are to be made and points out that there is no numerical expression for content validity.

Since the investigator is not relating each construct, person-

\begin{itemize}
  \item \textit{67} Willingham, \textit{College Placement}. PP. 28 and 84.
  \item \textit{69} Howard B. Lyman, \textit{Test Scores and What They Mean}. 2nd ed. (Prentice-Hall, 1971.) P. 187.
\end{itemize}
ality, motivation and cognitive style, to each mode of instruction under question, it is not necessary to decide if the items in the placement test are a representative sample of each construct. In fact, for the traits under examination it would probably be difficult to get the experts in the field to agree on a representative sampling of items. The constructs used in writing this placement test were used as guidelines and no effort was made to get a representative sample of each construct. Inferences will be made on the test as a whole or on individual items, not on the constructs.

Cronbach's definition of content validity is more general:

Examining content validity therefore requires judging whether each item--and the distribution of items as a whole--covers what the tester wants to measure.70

Criterion validity is defined by Lyman as:

Test validity based on data from practical situations; i.e., a correlation coefficient between a set of test scores and a set of criterion values. Syn. empirical validity.71

Cronbach comments on the quality of the correlation:

What is a good validity coefficient? The only sensible answer is the best you can get. If a criterion can be predicted only with validity .20, the test may still make an appreciable practical contribution.72

Because this is a placement test, Cattell's statement on validity is germane:

In the simplest sense the validity of test x, as a measure of X, depends not only on the goodness of its correlations with X, but also upon its not correlating with not - X . . . the test of X

70 Cronbach, Psychological Testing. P. 148.
71 Lyman, Test Scores. P. 188.
72 Cronbach, Psychological Testing. P. 135.
should behave to the not - X in the ways that X does.\(^{73}\)

Mehrens points out that there are two kinds of criterion-related validity, concurrent and predictive. If we are interested in assessment of current status, then we would measure for concurrent validity. If the criterion data and the test data are collected at approximately the same time, then we would measure concurrent validity.

If the criterion data is collected at a later date, then we would measure predictive validity. Predictive validity will usually be less than concurrent validity unless the trait is perfectly stable. The questionnaire under examination will measure predictive validity.

Reliability

Lyman defines reliability as the: "... consistency or stability of a test or other measuring instrument; necessary for, but not sufficient for, validity. Commonly expressed as a reliability coefficient or a standard error of measurement."\(^{74}\) The standard error of measurement is an estimate of the standard deviation of a distribution of scores which a particular subject would make if he were retested many times under identical conditions, presuming no learning has occurred. They must be independent tests.

Cattell claims that the variance arises from two sources, fluctuation of the trait itself and error of measurement.\(^{75}\) Mehrens

\(^{73}\)Cattell, Objective Personality. P. 34.

\(^{74}\)Lyman, Test Scores. P. 194.

\(^{75}\)Cattell, Objective Personality. PP. 36-37 and 44.
points out that to make a long range prediction, long term stability is important. The evaluation of this placement questionnaire included a long term (15 week interval) study. This is an effort to show that long term measurements of the items in the questionnaire are stable. A long term questionnaire stability indicates stability of the trait. A compiled list of what causes the error of measurement, according to Cattell and Mehrens, follows:

1. Differences due to administrator.
2. Controlled conditions of administration.
3. The fact the subjects have taken the test before.
4. Sampling error.
5. Scoring error.
6. Health, motivation, degree of fatigue of the person.
7. Good or bad luck in guessing.

Another possible source of variance, not listed by Cattell or Mehrens but listed by Edwards, may be the subject's interpretation of questions. If a subtle ambiguity exists in any of the questions, two subjects may make two interpretations of the same question leading to two different responses.

This placement questionnaire was administered to a group of students twice, with a two week interval. The same person admin-

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76 Mehrens, Standardized Tests. P. 37.
77 Cattell, Objective Personality. P. 47.
78 Mehrens, Standardized Tests. P. 33.
istered the test; the investigator feels that most of the seven errors of measurement listed previously will be eliminated except, perhaps, for the fact that the subjects will have taken the test before. Short-term stability indicates stability of the test. Reliability will be discussed further in the "Procedures" section of this chapter.

Some of the caveats of test writing considered were Cattell and Warburton's:

1. (In an effort to find out how timid a person is for example): All too often the constructed tests were only a thinly disguised form of simply asking the person if he was timid. The questions need to be subtle, but not too subtle.

2. Do not make the test an ability test or puzzle.

3. The more emotionally involved and moved the subject becomes by the test, the better the test may be in penetrating the personality sphere.

4. Beware of the desire to please the examiner. 80

Edwards warns:

1. Avoid statements that may be interpreted in more than one way.

2. Avoid statements that are likely to be endorsed by almost everyone or by almost no one.

3. Keep the language simple, clean and direct.

4. Statements should be short, rarely exceeding 20 words.

5. Each statement should contain only one complete thought.

6. Avoid universals such as all, always, none.

7. Use simple rather than compound sentences if possible. 81

80 Cattell, Objective Personality. PP. 88-90.

Discussion of Questionnaire Items

A discussion of the questionnaire items will center around the three constructs and demographic data. The first construct to be examined is cognitive style. The writing of questions 8, 9, 11, 12, 14, 18, 25, 28, 30, and 36 was guided by the definition of cognitive style given in this paper.

Question 8. While in high school I usually did the following number of hours of homework per week: 

A. under 3.
B. 3 to 5.
C. 6 to 9.
D. 10 to 14.
E. 15 or over.

This question was designed to try to discover how much unsupervised work the student has done in the past. Students who have a past history of doing a lot of unsupervised work are expected to do well in the independent study mode, while students with low unsupervised ratings will probably need to be placed in the lecture mode.

Question 9. While in high school, my participation in extra curricular activities (player or spectator) was

A. very heavy.
B. heavy.
C. about average.
D. light.
E. none or practically none.

This question is also aimed at trying to find out how the student uses unscheduled time; the rationale is the same as question 8.

Question 11. In my opinion, my note-taking abilities are

82 This question was asked in a questionnaire written by this writer in 1969, Report to the President, Moraine Valley Community College. P. 25.
An independent study student probably will need good note-taking abilities. Usually course work is not as well outlined in the independent study mode as in a lecture or individualized instructional mode. The individualized instructional mode often involves work in a workbook, and this mode would probably not require a high level of note-taking ability.

Question 12. While in a class, how often do you ask questions?

A. very often
B. more than the average student
C. about average
D. less than the average student
E. rarely

The person who asks a lot of questions will probably have the most time to do so in the individualized instructional mode. This kind of person would probably have trouble in the independent study mode. People who are successful and rarely or never ask questions will probably carry this success with them through a mode of instruction which offers little chance to ask questions, the independent study mode.

Question 14. While doing my homework, I

A. need a quiet and secluded place because I am easily distracted.
B. need a secluded place because I am fairly easily distracted.
C. find I am not too easily distracted.
D. find that very few outside distractions bother me.
E. find practically nothing distracts me.
This question tries to find out how well disciplined the student is. Those who are not well disciplined (A or B) will probably not do well in independent study and will have a hard time in the individualized instructional mode. In a lecture mode more deadlines are set and more goading is encountered, so a lesser amount of discipline is required.

Question 18. In lecture classes I find the teacher is covering the material

A. too slowly most of the time.
B. a little too slowly.
C. at about the right rate.
D. at a rate which is often too fast for me.
E. at a rate too fast for me most of the time.

One feature of independent study programs is self-pacing. A student who finds the instructor is moving too slowly will probably be happier in the independent study mode. Being able to learn the material more quickly is probably a good motivator to complete the course.

If the lecturer is going too fast, the individualized instruction mode would probably be best; the student is allowed to spend more time on a particular subject, within reason. The favorable responses for this mode are expected to be D and E.

Question 25. While working on a project, I would rather work

A. in a large group.
B. with 4 or 5 other students.
C. with 2 or 3 other students.
D. with a best friend.
E. alone.

Successful independent study students will probably select E. Lecture oriented students will probably answer A or B, while individualized instructional students' best answer would be C or D.

Question 28. I think the amount of reading I do
A. should be greatly increased.
B. should be increased.
C. is about right.
D. should probably be lessened.
E. should probably be greatly lessened.

Independent study students will probably have to do a lot of reading and E would be the best selection.

Question 30. The lectures given by my high school teachers on the subject material were
A. very often boring and could put me to sleep.
B. often boring.
C. as good as could be expected.
D. often interesting and motivating.
E. often very interesting and motivating.

The attitude toward lecturing is important in this question. Students seeking another mode of instruction will answer this question A or B.

Question 36. If I have an enjoyable afternoon activity planned, such as going to a ball game, and something happens which forces me to change my plans, such as a rainy day, I would
A. wind up brooding and staying at home.
B. try to carry the original plans through anyway.
C. stay at home and do something else.
D. go somewhere else even though it wouldn't be as much fun.
E. plan to go somewhere else where I would have as much fun.

This question stems from Witkin's discovery about field independent students. The field independent student seems to be the kind of person who will be successful in an independent study mode. One characteristic of a field independent student is that he is flexible and adapts to circumstances. For a summary of expected outcomes on cognitive style questions see Table 4.

In the personality construct portion of the placement
<table>
<thead>
<tr>
<th>QUESTION</th>
<th>LECTURE</th>
<th>INDEPENDENT STUDY</th>
<th>INDIVIDUALIZED INSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>could be A-E</td>
<td>D or E is desirable</td>
<td>D or E is desirable</td>
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<tr>
<td></td>
<td></td>
<td>A is undesirable</td>
<td>A is undesirable</td>
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<tr>
<td>9</td>
<td>could be A-E</td>
<td>D or E is desirable</td>
<td>C, D or E is desirable</td>
</tr>
<tr>
<td>11</td>
<td>C, D or E is desirable</td>
<td>D or E is desirable</td>
<td>could be A-E</td>
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<td></td>
<td></td>
<td>A is undesirable</td>
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<td>12</td>
<td>could be A-E</td>
<td>D or E is desirable</td>
<td>could be A-E</td>
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<td>A is undesirable</td>
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<td>14</td>
<td>could be A-E</td>
<td>D or E is desirable</td>
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<td>A is undesirable</td>
<td>A is undesirable</td>
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<td>18</td>
<td>C is desirable</td>
<td>A is desirable</td>
<td>D or E is desirable</td>
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<tr>
<td>25</td>
<td>A or B is desirable</td>
<td>E is desirable</td>
<td>C, D or E is desirable</td>
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<td>A or B is desirable</td>
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<td></td>
<td></td>
<td>A is undesirable</td>
<td></td>
</tr>
</tbody>
</table>
questionnaire four attributes served as guidelines for writing the questions: (1) self-actualization (see definition), (2) attitude, (3) level of discipline, and (4) level of maturity. While these four traits are important for every student, the investigator theorizes they are most important for the successful student in the individualized mode and indispensable for the successful student in the independent study mode. As the locus of control for learning shifts from instructor to student (lecture, individualized instruction, and independent study respectively), it is expected responses must also shift toward the E part of the answer spectrum, except Question 27 where the opposite is expected.

Self-actualizer questions are numbered 13, 22, 34, and 35.

Question 13. If I get behind in my homework, I

A. usually let most of it slide.
B. work a little quicker and make up some of the work.
C. spend a little extra time and make up some of the work.
D. spend some extra time and make up most of the work.
E. spend extra time and always make up all the back work.

Question 22. While in high school I should have done

A. much more homework.
B. more homework.
C. no more nor no less homework.
D. less homework.
E. much less homework.

Question 34. If homework assignments are not collected, I

A. usually won't do them.
B. would probably do about half of them.
C. would probably do parts of most of them.
D. would probably do parts of all of them.
E. would probably do most of all of them.
Question 35. When given a homework assignment, I usually

A. put it off as long as possible.
B. will not start on it right away, but will complete it at the last minute.
C. start on it right away but don't complete it until it's due.
D. start on it right away and sometimes complete it early.
E. start on it right away and work until it's completed.

Attitude questions are numbered 24, 26, 27, and 29.

Question 24. I would describe my interest in academic work in high school as

A. little interest.
B. some interest.
C. about average.
D. above average.
E. usually interested.

Question 26. I think the most important element in learning is the

A. teacher.
B. books.
C. school.
D. subject.
E. homework.

Question 27. In my opinion, the way teaching machines are made nowadays,

A. if used properly there is no need for a teacher.
B. if used properly there is little need for a teacher.
C. the combination of machines and help from a teacher are needed.
D. the use of the machines are not as important as direction from the teacher.
E. the teacher is still the most important ingredient.

Question 29. Generally I find school

A. very difficult.
B. difficult.
C. about as difficult as every one else does.
Modified question: Response A in question 27 is the preferred response for independent study.

Self-discipline questions are numbered 23, 31, and 32.

Question 23. I think my absentee rate in high school was
   A. very high.
   B. high.
   C. about average.
   D. light.
   E. about zero.

Question 31. I feel I
   A. need a lot of goading to get things done.
   B. usually need goading to get things done.
   C. am about average in self-discipline.
   D. am a fairly self-disciplined person.
   E. am an extremely self-disciplined person.

Question 32. How many hours per week do you think you will need to work for this class?
   A. 0 to 2.
   B. over 2 but less than 4.
   C. 4 to 6.
   D. over 6 but less than 8.
   E. over 8.

Maturity questions are numbered 33 and 40.

Question 33. The most important mission of colleges is to teach/develop
   A. academic material which will prepare one for a job.
   B. academic material in general.
   C. reading.
   D. the ability to listen objectively.
   E. the realization that there are two sides to every story.

Question 40. In non-traditional learning, the burden of learning is even more on the shoulders of the learner than in lecture classes. Do you believe you would be able to handle this extra burden?
A. with great difficulty
B. with some problem
C. I don't know
D. without too many problems.
E. easily

The last construct, motivation, deserves the same rationale for test interpretation as did the personality construct. While motivation is important for any mode of instruction, the investigator theorizes that only those with above average motivation will succeed in individualized instruction. Only those who are highly motivated, answering toward the E end of the question spectrum, will be successful in independent study. Questions 15, 16, 17, 19, 20, 21, 37, 38, and 39 are designed to measure level of motivation.

**Question 15.** The most important single reason for my going to college is that

A. my friends went.
B. a high school teacher or counselor motivated me.
C. my parents wanted me to go.
D. I want to gain knowledge to get a good job.
E. I want to gain knowledge to increase position at present job.

**Question 16.** I think that grades should be

A. abolished.
B. lessened in importance.
C. used as they are presently used.
D. used to indicate to me how well I can do compared to others.
E. used to indicate to employers how well I can do compared to others.

**Question 17.** My reasons for coming to college are

A. very hazy--have not been thought out.
B. not clear.
C. still being thought out in my mind.
D. fairly clear in my mind.
E. clearly defined in my mind.
Question 19. This subject

A. is not my major, but is required.
B. is just an elective.
C. has little to do with my major, but is interesting to me.
D. is important to my major.
E. is part of my major.

Question 20. I will

A. probably not transfer, I'm not sure what I want to do yet.
B. probably not transfer to another college.
C. not transfer to another college, but complete all my college work here.
D. definitely transfer to another college but I am not sure which one.
E. definitely transfer to another college, and I have already selected the college.

Question 21. What grade do you expect to earn in this course?

A. I will probably have to work very hard to get a C.
B. Probably a C
C. If I work hard, I could get a B.
D. Probably a B
E. Probably a A

Question 37. If directions from an instructor are not clear, I would

A. probably not be able to do the project.
B. wait until the next class and have them clarified even though the project would be late.
C. call a friend and see if he could clarify the instructions.
D. do the project the best I can with what I understand.
E. usually be able to figure out what the instructor probably wants and work from there.

Question 38. Non-traditional learning would probably be good for me because

A. traditional teaching doesn't work well for me.
B. I don't like attending regularly scheduled classes.
C. I would just like to see how it is.
D. attending regularly scheduled classes would be very difficult.
E. it is almost impossible to earn college credit any other way because of my schedule.

Question 39. The single best opinion that I have which could make me successful in non-traditional learning is

A. with the negative experiences I have had with traditional learning, anything would be better.
B. traditional learning isn't so good.
C. it would be a new experience, and I would be interested.
D. in the past I have been able to learn on my own.
E. I have had previous non-traditional learning experiences and have been successful.

Question 10 does not fall into any of the mentioned categories, but the results may prove interesting in analysis. It will measure the impact previous experiences with learning modes other than lecture have on the outcome of the present effort.

Question 10. In previous classes I have (choose one answer only. If more than one applies, choose the one furthest along in the alphabet. For example if B, D and E apply, darken in E.)

A. never experienced any teaching other than lecture.
B. had little experience with teaching methods other than lecture.
C. had a class in which some of the teaching was done with audio tapes, TV tapes or programmed instruction books.
D. had a class in which much of the teaching was done with audio tapes, TV tapes or programmed instruction books.
E. had experience with an independent study or individualized instruction course.

The demographic questions are numbered 1 through 7.

Question 1. Age
A. 18 or under  
B. Over 18 up to and including 20  
C. Over 20 up to and including 23  
D. Over 23 up to and including 27  
E. Over 27  

Question 2. Sex  
A. Male  
B. Female  

Question 3. The number of credit hours I am carrying this semester is  
A. 18 or more.  
B. 16 or 17.  
C. 14 or 15.  
D. 12 or 13.  
E. 11 or less.  

Question 4. If I add the number of credit hours I am carrying to the average number of hours I am working per week, I would get  
A. 45 or more.  
B. 38 to 44.  
C. 32 to 37.  
D. 26 to 31.  
E. less than 26.  

Question 5. Marital status  
A. Not married  
B. Married  

Question 6. The number of credits that I now have earned is  
A. 0-10.  
B. 11-20.  
C. 21-33.  
D. 34-46.  
E. 47 or more.  

Question 7. In high school my grade point average was  
A. below C minus.  
B. C or C minus.  
C. B minus or C plus.  
D. B plus or B minus.  
E. A or A minus.
pilot Study

Preliminary data on two modes of instruction, using the above questionnaire, were used in a pilot study in the fall of 1976. The two modes were the traditional lecture group and individualized instruction group. The former involved 95 students, the latter 52 students. Pearson product-moment correlation coefficients were calculated and used to generate the coefficients and constant for the multiple linear regression equation.

In the lecture group 53% of the variance in grades could be accounted for by this questionnaire. The first nine predictors were used to calculate a predicted grade for six students. The first nine predictors accounted for 35% of the variance. The results were:

<table>
<thead>
<tr>
<th>Student</th>
<th>Predicted Score</th>
<th>Actual Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.67</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>5.51</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>5.45</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>4.67</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>4.44</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>6.44</td>
<td>X</td>
</tr>
</tbody>
</table>

This institution does not have a failing grade. Only five grades are used, they are A, B, C, D, and a grade of X. The X grade includes students who withdraw, fail, or stop coming to class. A re-analysis of the data, excluding students with an X grade, gave the following results. The amount of variance accounted for by the questionnaire for the lecture group increased from 53% to 68%.

In the individualized instruction group the forty questions accounted for 80% of the grade variance. The correlation between
predicted and actual grades was .89. This investigator used the 6 best predictors, which accounted for 43% of the variance. The results using 6 variables were:

<table>
<thead>
<tr>
<th>Student</th>
<th>Predicted Score</th>
<th>Actual Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.35</td>
<td>B</td>
</tr>
<tr>
<td>2</td>
<td>9.12</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>7.34</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>6.67</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>6.10</td>
<td>X</td>
</tr>
<tr>
<td>6</td>
<td>5.89</td>
<td>X</td>
</tr>
</tbody>
</table>

In excluding students with an X grade, the amount of variance in the individualized group accounted for by the questionnaire increased from 80% to 96%.

It appears that the questionnaire will not be as effective for predicting who will pass or fail, as it will be for placing those who will pass a course in the mode of instruction which is best for them.

Both groups had predicted scores higher than they should logically earn. If an A is equivalent to 5.00, a score of 9.35 is impossible. This is accounted for by the fact that a number of later coefficients are negative. The regression "line", however, appears to be parallel to the "line" of predicted scores. This can easily be adjusted by merely changing the regression constant.
The lecture classes were selected on the basis of instructors' willingness to cooperate with the data gathering process. While the classes were not selected at random, there is no reason to believe that the student selection of the classes will be anything other than random. One history, one humanities, two mathematics, one geography and one psychology class comprise this group. Six instructors and approximately 160 students were involved.

The individualized instruction group were mathematics students. The material covered is ninth and part of eleventh grade high school algebra. Past experiences indicate that more than 95% of these students do not know that the mode of instruction will not be the traditional lecture mode. There were five classes involving 157 students. Selection of this group was determined by the fact that this investigator is the only one on this campus to use this mode of
instruction as defined in this paper.

All of the spring 1977 independent study students, including classes in art, business, communications, economics, history, humanities, mathematics, natural science, political science and psychology, were mailed the questionnaire. This was about 300 students. The investigator's goal of a return of about 150 questionnaires was realized when 137 students responded. The questionnaire was administered by this investigator to all students in the lecture and individualized instruction samples. The questionnaire is included in this paper.

The students in the lecture and individualized modes marked their responses on International Business Machine cards. The students in the independent study group marked their answers directly on the questionnaire and mailed them back to this investigator. The data were then transferred to cards.

This investigator administered the questionnaire a second time to two lecture classes two weeks after the initial administration. Fifteen weeks after the initial administration the investigator administered the questionnaire a second time to three individualized instructional classes.

Correlations were calculated for the short and long term test-retest. The purpose of the short term (two weeks) retest is to see if the instrument is reliable. The correlation calculated for the long term retest will indicate if the traits are stable.

Final grades for all students were collected at the end of the semester.
Statistical Design

The statistical design will be discussed in four phases. In the first phase multiple linear regression equations were written for each mode of instruction. Students' final grades, as predicted by each equation, are examined. The validity of the questionnaire written by this author is examined in phase two. Phase three discusses long and short term reliability of each question. Results on a question by question basis will be examined in phase four.

The data were key punched by Moraine Valley Community College's Computer Center. The key punched cards were then taken to Loyola University's Computer Center for analysis on an IBM 360-65 using the Statistical Package for Social Science (SPSS).

Phase One - Multiple Linear Regression Equations

A multiple linear regression equation with forty coefficients, using the Statistical Package for Social Science, was written for each mode of instruction. The questionnaire provided forty independent variables, with the final grade as the dependent variable. Students with a final grade of A or B were then selected.

The multiple linear regression equation calculated from data generated from all lecture students was used to predict mean final grades of the A and B students in each learning mode.

The multiple linear regression equation calculated from data generated from all individualized instruction students was used to predict mean final grades of the A and B students in each learning mode.
The multiple linear regression equation calculated from data generated from all independent study students was used to predict mean final grades of the A and B students in each learning mode.

The major hypothesis for phase one was:

If the multiple linear regression equations discriminate between successful students in each mode of instruction, then the equations can be used for placement.

The null hypotheses were:

1. There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for lecture students.

2. There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for individualized instruction students.

3. There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for independent study students.

A one-way analysis of variance for unequal groups was done for each null hypothesis (SPSS). An hypothesis will be accepted or
rejected at the .05 level. The probability of each F ratio is reported in Tables 9 through 11. If the predicted grades were significantly different, the Scheffe S was calculated and used to identify where the difference exists. See Table 5 for a summary.

**TABLE 5**

**REGRESSION EQUATION BY MODE OF INSTRUCTION**

*(MEAN SCORES)*

<table>
<thead>
<tr>
<th>Predicted Mean Grade of Lecture Students with a Final Grade of A or B</th>
<th>Predicted Mean Grade of Individualized Instruction Students with a Final Grade of A or B</th>
<th>Predicted Mean Grade of Independent Study Students with a Final Grade of A or B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture Students' Regression Equation</td>
<td>$\bar{x}_1$</td>
<td>$\bar{x}_2$</td>
</tr>
<tr>
<td>Individualized Instruction Students' Regression Equation</td>
<td>$\bar{x}_4$</td>
<td>$\bar{x}_5$</td>
</tr>
<tr>
<td>Independent Study Students' Regression Equation</td>
<td>$\bar{x}_7$</td>
<td>$\bar{x}_8$</td>
</tr>
</tbody>
</table>

**Phase Two - Questionnaire Validity**

This phase examines criterion validity and the standard error of estimate. To establish criterion validity a stratified random sample (N=60) of the population was placed into a mode of instruction.
Ten students in each of six categories were randomly selected and placed into the mode of instruction which is best for each student as determined by the multiple linear regression equation. The student was placed into the mode of instruction which predicted the highest grade for him. The six categories are:

a. Independent study students with a final X grade.
b. Independent study students with a final grade of A or B.
c. Individualized instruction students with a final X grade.
d. Individualized instruction students with a final grade of A or B.
e. Lecture students with a final X grade.
f. Lecture students with a final grade of A or B.

The null hypothesis was:

4. There is no difference in placement of students over the eighteen cells.

The eighteen cells consist of each mode of instruction with each of the six categories. If the equations were not significant, then the expected mean for each cell would have been 3.33.

A Chi squared test on proportions was performed. The hypothesis will be accepted or rejected at the .05 level.

The standard error of estimate for each equation was calculated. A stratified random sample (N=24) was selected from each of the three groups. A .68 and .95 confidence interval was calculated.

Phase Three - Reliability of Questions

The questionnaire was tested for long and short term
reliability. Test-retest data was used to calculate a Pearson r for each question, 8 through 40. The short term test-retest effort involved forty-nine lecture students. The retest was administered two weeks after the initial administration. The chance probability of the correlations was observed. If any question is ambiguous, the short term correlation will not be significant. If the chance probability of the short term correlation is greater than .05, the question will be classified as ambiguous.

The long term test-retest effort involved forty-six individualized instruction students. The retest was administered fifteen weeks after the initial administration to establish long term reliability. The chance probability of the correlation was observed. If the trait that the question is trying to measure changes, the long term correlation will not be significant. If the chance probability of the long term correlation is greater than .05, the question will be classified as too unstable to be used for long term predictions.

The long term standard error of measurement was calculated for questions 8 through 40. A question with a long term standard error of measurement greater than 1.0000 will be considered too unstable for long range predictions.

Phase Four - Miscellaneous Questions

Phase four examines age, sex and work load in relation to mode of instruction. Do young, middle aged and older students function equally well in each of the three modes of instruction? The null hypotheses were:
5. There is no significant difference in mean grade point averages of older students (over 27) by mode of instruction.

6. There is no significant difference in mean grade point averages of middle aged students (over 20, up to and including 27) by mode of instruction.

7. There is no significant difference in mean grade point averages of young students (age 20 and under) by mode of instruction.

In an effort to discover if all ages do equally well in each mode of instruction, the following null hypotheses were tested:

8. There is no significant difference in mean grade point averages in lecture mode by age of student.

9. There is no significant difference in mean grade point averages in the individualized mode by age of students.

10. There is no significant difference in mean grade point averages in the independent study mode by age of students.

A one-way analysis of variance for unequal groups was performed for each null hypothesis (SPSS). An hypothesis will be accepted or rejected at the .05 level. The probability of each F ratio was reported. If the grades were significantly different, the Scheffe S was calculated and used to identify where the difference lies. See Table 6 for a summary.

To discover if there is an interaction between sex and mode of
TABLE 6

AGE BY MODE OF INSTRUCTION
(MEAN SCORES)

<table>
<thead>
<tr>
<th></th>
<th>Lecture</th>
<th>Individualized Instruction</th>
<th>Independent Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old</td>
<td>$\bar{x}_{10}$</td>
<td>$\bar{x}_{11}$</td>
<td>$\bar{x}_{12}$</td>
</tr>
<tr>
<td>Middle Aged</td>
<td>$\bar{x}_{13}$</td>
<td>$\bar{x}_{14}$</td>
<td>$\bar{x}_{15}$</td>
</tr>
<tr>
<td>Young</td>
<td>$\bar{x}_{16}$</td>
<td>$\bar{x}_{17}$</td>
<td>$\bar{x}_{18}$</td>
</tr>
</tbody>
</table>

instruction, the following null hypotheses were tested:

11. There is no significant difference in mean grade point averages by mode of instruction for men.

12. There is no significant difference in mean grade point averages by mode of instruction for women.

13. There is no significant difference in mean grade point averages between men and women in the lecture mode.

14. There is no significant difference in mean grade point averages between men and women in the individualized instruction mode.

15. There is no significant difference in mean grade point averages between men and women in the independent study mode.

A one-way analysis of variance for unequal groups was
performed for each null hypothesis (SPSS). A hypothesis will be accepted or rejected at the .05 level. The probability of each F ratio was reported. If the grades were significantly different, the Scheffe S was calculated and used to identify where the difference lies. See Table 7 for a summary.

**TABLE 7**

| SEX BY MODE OF INSTRUCTION  
<table>
<thead>
<tr>
<th>(MEAN SCORES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Males</td>
</tr>
<tr>
<td>Females</td>
</tr>
</tbody>
</table>

In an effort to discover if there is an interaction between work load and mode of instruction, the following null hypotheses were tested:

16. There is no significant difference in mean grade point averages for students with a heavy work load (school credit hours plus outside job hours greater than or equal to 45) by mode of instruction.

17. There is no significant difference in mean grade point averages for students with a medium work load (school credit hours plus outside job hours between 32 and 44 inclusive) by mode of instruction.
18. There is no significant difference in mean grade point averages for students with a light work load (school credit hours plus outside job hours less than 32) by mode of instruction.

A one-way analysis of variance for unequal groups was computed for each null hypothesis (SPSS). A hypothesis will be accepted or rejected at the .05 level. The probability of each F ratio was reported. If the grades were significantly different, the Scheffe S was calculated and used to identify where the difference lies. See Table 8 for a summary.

<table>
<thead>
<tr>
<th></th>
<th>Lecture</th>
<th>Individualized Instruction</th>
<th>Independent Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy</td>
<td>$\bar{x}_{25}$</td>
<td>$\bar{x}_{26}$</td>
<td>$\bar{x}_{27}$</td>
</tr>
<tr>
<td>Medium</td>
<td>$\bar{x}_{28}$</td>
<td>$\bar{x}_{29}$</td>
<td>$\bar{x}_{30}$</td>
</tr>
<tr>
<td>Light</td>
<td>$\bar{x}_{31}$</td>
<td>$\bar{x}_{32}$</td>
<td>$\bar{x}_{33}$</td>
</tr>
</tbody>
</table>

Questions which accounted for the most variance in final grades were listed (see Table 30). Other individual questions were examined and significant correlations were reported.

The last statistical problem to be faced is deciding if the number of subjects in each cell was large enough to warrant valid
conclusions. Byrkit suggests the following procedure:

1. **Estimate the maximum possible standard deviation of the population.** In this study the total range of scores is from 1 to 4, with a difference of 3. If we presume that all scores fall within two standard deviations of the mean, then the maximum possible population standard deviation is .75; \( \sigma = .75 \).

2. **Decide how close you wish to come to the true score.** In this study, if we would like to come within .4 of the true score, then \( E = .4 \).

3. **Decide on your confidence interval.** In this study, if we wish to use a confidence interval of .95, then \( |z| = 1.96 \).

4. Thus

\[
n = \left[ \frac{|z| \sigma}{E} \right]^2
\]

(in this study)

\[
= \left[ \frac{1.96 \cdot .75}{.4} \right]^2
\]

\[
= 14.44
\]

\[
\therefore \ n \geq 14
\]

Therefore, the minimum number of students necessary for each cell is 14.83

---

CHAPTER IV

RESULTS AND INTERPRETATIONS

This chapter presents the results of the study in four phases. In phase one, the three multiple linear regression equations were examined to see if they discriminate among successful students in each mode of instruction. Phase two examines the validity of the questionnaire. Phase three tests the questionnaire for long and short term reliability. Phase four examines age, sex and work load in relation to mode of instruction.

Phase One - The Multiple Linear Regression Equations

This phase attempted to determine if the multiple linear regression equations can be used to place students into one of the three learning modes. If the equations distinguish between students who are successful in each of the three learning modes, then the equations can be used to calculate three different scores for each student. The student would then select the learning mode associated with the highest score.

These results are explained in the following three sections, one for each multiple linear regression equation.

Section 1. Lecture

The equation using the data from the lecture students was
written with results of the analysis of variance summarized in Table 9. The F ratio is 9.92, which is significant beyond the .01 level. The Scheffe S for this data is .416. That is, any difference in means greater than .416 is significant at the .05 level.

The inference can be made that this equation can be used to identify successful lecture and independent study students. These two groups had predicted grade point averages which were about the same. Both of these groups had predicted grade point averages which were higher ($\alpha = .05$) than the predicted grade point average of the individualized instruction group.

The predicted mean grade point averages using the lecture equation by mode of instruction were:

\[ \bar{X}_1 \text{ (lecture students, } N = 56) = 3.450 \]
\[ \bar{X}_2 \text{ (individualized instruction students, } N = 52) = 2.781 \]
\[ \bar{X}_3 \text{ (independent study students, } N = 47) = 3.383 \]

TABLE 9

ANALYSIS OF VARIANCE FOR LECTURE EQUATION

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>14.2</td>
<td>2</td>
<td>7.1</td>
<td>9.92</td>
</tr>
<tr>
<td>Within Samples</td>
<td>108.9</td>
<td>153</td>
<td>.7165</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>123.1</td>
<td>155</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p < .01) $N = 155$
Null hypothesis number 1 (There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for lecture students.) is rejected. ($\alpha = .05$)

**Summary of Section 1.**

Even though a significant F ratio was observed, the lecture equation did not distinguish between successful lecture and independent study students. Questions must be written which will distinguish the successful lecture group from the successful independent study group.

**Section 2. Individualized Instruction**

The equation using the data from the individualized instruction students was written with results of the analysis of variance summarized in Table 10. The F ratio is 12.92, which is significant beyond the .01 level. The Scheffe S for this data is .408. That is, any difference in means greater .408 is significant at the .05 level.

This equation can be used to distinguish between successful individualized instruction students and successful independent study students. The difference in the predicted mean grade point averages of the individualized instruction students and the lecture students was only .401 which is not significant at the .05 level. The predicted mean grade point averages of the individualized instruction equation by mode of instruction were:
\( \bar{X}_4 \) (lecture students, \( N = 56 \)) = 2.776

\( \bar{X}_5 \) (individualized instruction students, \( N = 52 \)) = 3.177

\( \bar{X}_6 \) (independent study students, \( N = 47 \)) = 2.378

### TABLE 10

ANALYSIS OF VARIANCE FOR INDIVIDUALIZED INSTRUCTION EQUATION

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>17</td>
<td>2</td>
<td>8.5</td>
<td>12.92</td>
</tr>
<tr>
<td>Within Samples</td>
<td>100</td>
<td>153</td>
<td>.6579</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>117</td>
<td>155</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\((p < .01)\ N = 155\)

Null hypothesis number 2 (There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for individualized instruction students.) is rejected. \((\alpha = .05)\)

**Summary of Section 2.**

The equation written with data from the individualized instruction students can be used to distinguish between successful individualized instruction students and successful independent study students.
Section 3. Independent Study

The equation using the data from the independent study students was written with results of the analysis of variance summarized in Table 11. The F ratio is 4.51 which is significant beyond the .05 level (An $\alpha$ of .01 requires an F ratio greater than 4.61). The Scheffe S for this data is .524. That is, any difference in means greater than .524 is significant at the .05 level.

The inference can be made that this equation can be used to distinguish successful independent study students from successful individualized instruction students. The equation is not sensitive enough to distinguish successful independent study students from successful lecture students. The difference in predicted means was .481. The Scheffe S requires a difference of .524. The predicted scores of the lecture and the individualized instruction students were not statistically different ($\alpha = .05$).

The predicted mean grade point averages of the independent study equation by mode of instruction were:

$$\bar{X}_7 \text{ (lecture students, } N = 56) = 2.744$$

$$\bar{X}_8 \text{ (individualized instruction students, } N = 52) = 2.479$$

$$\bar{X}_9 \text{ (independent study students, } N = 47) = 3.225$$

Null hypothesis number 3 (There are no significant differences in predicted mean final grades of students whose actual final grades were A or B, in each mode of instruction, as predicted by the multiple linear regression equation developed for independent study students.)
is rejected.  ($\alpha = .05$)

TABLE 11
ANALYSIS OF VARIANCE FOR INDEPENDENT STUDY EQUATION

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degree of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>15</td>
<td>2</td>
<td>7.5</td>
<td>4.51</td>
</tr>
<tr>
<td>Within Samples</td>
<td>253</td>
<td>153</td>
<td>1.664</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>268</td>
<td>155</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

($p < .05$)  $N = 155$

Summary of Section 3.

The equation written with data from the independent study students can be used to distinguish between successful individualized instruction students and successful independent study students.

Summary of Phase One

The three equations did not uniquely identify the groups they were designed for. Table 12 lists the results of all possible pairs of mean scores.

Phase Two - Validity of the Questionnaire

In this phase an attempt was made to determine if the questionnaire was valid. The results are examined in two sections. The first section will examine placement of students using the equations and the second section will report the standard error of estimate
TABLE 12
SUMMARY OF SIGNIFICANT ($\alpha=.05$) AND NONSIGNIFICANT DIFFERENCES IN PREDICTED MEAN SCORES OF STUDENTS WITH A FINAL GRADE OF A OR B

<table>
<thead>
<tr>
<th>Equations</th>
<th>Comparisons of Predicted Mean Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>Lect. = I.S.</td>
</tr>
<tr>
<td></td>
<td>I.I. $\neq$ Lect.</td>
</tr>
<tr>
<td></td>
<td>I.I. $\neq$ I.S.</td>
</tr>
<tr>
<td>Individualized Instruction</td>
<td>Lect. = I.S.</td>
</tr>
<tr>
<td></td>
<td>I.I. = Lect.</td>
</tr>
<tr>
<td></td>
<td>I.I. $\neq$ I.S.</td>
</tr>
<tr>
<td>Independent Study</td>
<td>Lect. = I.S.</td>
</tr>
<tr>
<td></td>
<td>I.I. = Lect.</td>
</tr>
<tr>
<td></td>
<td>I.I. $\neq$ I.S.</td>
</tr>
</tbody>
</table>

Lect. is Lecture students.
I.S. is Independent study students.
I.I. is Individualized instruction students.

for each equation.

Section 1. Criterion Validity

In this section ten students were randomly selected from each of the following six groups:

1. Independent study students with a final X grade.
2. Independent study students with a final grade of A or B.
3. Individualized instruction students with a final X grade.
4. Individualized instruction students with a final grade of A or B.
5. Lecture students with a final X grade.
6. Lecture students with a final grade of A or B.

The equations were used to predict the student's final grade and the student was placed in the mode of instruction which predicted the
highest grade.

The results of the analysis are contained in Table 13. A Chi square test of proportions was 26.400 which is significant beyond the .10 level but not the .05 level. A Chi square of 27.587 is necessary for significance at the .05 level and 24.769 is necessary for significance at the .10 level.

Null hypothesis number 4 (There is no difference in placement of students.) is accepted. (α=.05)

TABLE 13
BEST MODE OF INSTRUCTION AS IDENTIFIED BY THE THREE MULTIPLE LINEAR REGRESSION EQUATIONS

<table>
<thead>
<tr>
<th></th>
<th>Independent Study</th>
<th>Individualized Instruction</th>
<th>Lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent study students with a final X grade.</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Independent study students with a final grade of A or B.</td>
<td>7</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Individualized instruction students with a final X grade.</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Individualized instruction students with a final grade of A or B.</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Lecture students with a final X grade.</td>
<td>2</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Lecture students with a final grade of A or B.</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

Chi Square Test of Proportions = 26.400  p<.10  df = 17
Summary of Section 1.

If the multiple linear regression equations were used for placement, 83% of the students who failed would have been placed in one of the other two modes of instruction. Sixty-three per cent of the students with a final grade of A or B would remain in the same mode. Out of the sixty randomly selected students, only one would have had a choice of two modes because two of his predicted scores were about the same.

Of the students shifted, with a final X grade in independent study or individualized instruction, seventy-five per cent were placed in the lecture mode. Of the students shifted, with a final X grade in the lecture mode, seventy-eight per cent were placed in the individualized instruction mode.

It appears that students with a final X grade in one of the two non-traditional modes of instruction would function better in the traditional lecture mode. Students with a final X grade in lecture may improve their performance if they select the individualized instruction mode. It must be pointed out that shifting students from one mode of instruction to another does not guarantee an improvement in academic success.

Section 2. Standard Error of Estimate

In this section the standard error of estimate for each question is reported. A random sample (N = 24) was selected from each of the three groups: lecture, individualized and independent study. A .68 and .95 confidence interval is reported for the predicted final
grade,  
The Pearson r, correlating predicted grade with actual grade, calculated for the lecture group sample was .74 (significant at .005 level). The standard deviation of the criterion variable, actual final grade, was 1.4715. This data yielded a standard error of estimate of .9897. This means that the multiple linear regression equation written for the lecture group would predict a final grade within .9897 (about one) full grade of the actual grade 68% of the time. A .95 confidence interval would yield a prediction error of ± 1.9794.

The Pearson r, correlating predicted grade with actual grade, calculated for the individualized instruction group sample was .68 (significant at the .005 level). The standard deviation of the criterion variable, actual final grade, was 1.2992. This data yielded a standard error of estimate of .9526. This means that the multiple linear regression equation written for the individualized group would predict a final grade within .9526 (about one) full grade of the actual grade 68% of the time. A .95 confidence interval would yield a prediction error of ± 1.9052.

The Pearson r, correlating predicted grade with actual grade, calculated for the independent study group sample was .65 (significant at the .005 level). The standard deviation of the criterion variable, actual final grade, was 1.6812. This data yielded a standard error of estimate of 1.2776. This means that the multiple linear regression equation written for the independent study group would predict a final grade within 1.2776 grades of the actual grades 68% of the time. A .95 confidence interval would yield a prediction error of ± 2.552.
The inference can be made that 2 out of 3 equations, the lecture and individualized instruction equations, predict the final grade within one grade 68% of the time. This author feels that the equations should predict the final grade within one full grade 68% of the time.

**Summary of Section 2.**

The correlations between the predicted grade and the actual grade were significant at the .005 level for each of the three groups. The lecture and the individualized instruction groups are more predictable than the independent study group. The standard error of estimate for 68% of the lecture and individualized instruction students was less than one grade. The standard error of estimate for 68% of the independent study group was almost 1.3. The author feels that the predictions must be within one grade of the actual final grade for 68% of the students. This means that the independent study equation must be improved.

**Summary of Phase Two**

The equations shifted 83% of failing students into a different mode of instruction and left 63% of the successful students in the same mode. The equations predicting the lecture and individualized instruction students' grades appear to be valid. The equation predicting the independent study students' grades can be used but needs to be improved.
Phase Three - Reliability of the Questions

In this phase an attempt was made to determine if the questions on the questionnaire are reliable. The results are examined in three sections. The first section will evaluate the reliability of the questions. The second section will evaluate reliability of the trait. In the third section the long term standard error of measurement will be evaluated and reported.

Section 1. Short Term Reliability

This section will evaluate the short term reliability (test-retest with a two week interval) of the questions. The results of the analyses are contained in Table 14. If any question is ambiguous, the short term correlation will not be significant. The chance probability of the resulting Pearson r in 31 of the 33 questions was less than .001. Every question had a chance probability of less than .05. The inference can be made that the questions are not ambiguous.

Summary of Section 1.

In the short term retest all questions, but two, had a Pearson r greater than .47. All questions had a correlation with chance probability less than .05. It appears that all questions are reliable in the short term interval, two weeks.

Section 2. Long Term Reliability

This section will evaluate the long term reliability (test-retest in a fifteen week interval) of the questions. The results of the analyses are contained in Table 14. If the trait that the
<table>
<thead>
<tr>
<th>Question Number</th>
<th>Short Term Pearson r Correlation Coefficient</th>
<th>Chance Probability</th>
<th>Long Term Pearson r Correlation Coefficient</th>
<th>Chance Probability</th>
<th>Change in Pearson r Correlation Coefficient</th>
<th>Long Term Standard Error of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
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<td>.4705</td>
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<tr>
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<td>.7497</td>
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<tr>
<td>Question Number</td>
<td>Short Term Pearson r Correlation Coefficient</td>
<td>Chance Probability</td>
<td>Long Term Pearson r Correlation Coefficient</td>
<td>Chance Probability</td>
<td>Change in Pearson r Correlation Coefficient</td>
<td>Long Term Standard Error of Measurement</td>
</tr>
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<td>-----------------</td>
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<td>.001</td>
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<td>.6481</td>
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<td>1.1178</td>
</tr>
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<td>.6126</td>
</tr>
<tr>
<td>32</td>
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<td>-.380</td>
<td>.6663</td>
</tr>
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<td>33</td>
<td>.531</td>
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<td>.077</td>
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<td>1.1587</td>
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<td>.8628</td>
</tr>
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</tr>
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<td>.001</td>
<td>.119</td>
<td>.216</td>
<td>-.257</td>
<td>.8586</td>
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</tbody>
</table>
question measures is unstable, the long term correlation will not be significant.

The chance probability of the resulting Pearson r in 27 of 33 questions was less than .05. The inference can be made that 27 questions have long term reliability, fifteen weeks.

The two questions with the largest drop in correlation, comparing short term to long term, were questions 20 and 15. Question 20, dealing with the student's plans to transfer, had a short term correlation of .877. This dropped to a long term Pearson r correlation coefficient of .277, the largest drop of all questions, indicating that the extra time in school had a significant impact on the student's plans. The second largest drop in correlations, .525, was observed for question 15 which deals with the most important single reason for going to college.

Four of the questions which maintained a high correlation over the longer retest interval were:

11. In my opinion, my note taking abilities are
   A. very poor.
   B. poor.
   C. average.
   D. good.
   E. excellent.

14. While doing my homework, I
   A. need a quiet and secluded place because I am easily distracted.
   B. need a secluded place because I am fairly easily distracted.
   C. find I am not too easily distracted.
   D. find that very few outside distractions bother me.
   E. find practically nothing distracts me.

29. Generally I find school
A. very difficult.
B. difficult.
C. about as difficult as every one else does.
D. easier than many students do.
E. easier than most students do.

35. When given a homework assignment, I usually

A. put it off as long as possible.
B. will not start on it right away, but will complete it at the last minute.
C. start on it right away but don't complete it until it's due.
D. start on it right away and sometimes complete it early.
E. start on it right away and work until it's completed.

It appears, from question 11, that note-taking abilities did not change. The degree that outside distractions influenced the learner did not change, as evidenced by the results of question 14. Level of difficulty of learning experienced by the student seems to be stable in the long term. Promptness in doing homework did not change.

Summary of Section 2.

In the long term correlation all questions, but six, were reliable. The long term correlation is used because long term predictions will be made. Questions 16 (having to do with student's opinion about grades and their use) and 17 (dealing with how clear, in the student's mind, were his reasons for coming to college) were categorized as unreliable. Questions 32 (asking how many hours per week the student thought he would need for class work) and 33 (dealing with the student's opinion of what is the most important mission of the college) were also categorized as unreliable. Questions 39 and 40, dealing with a comparison of traditional and non-traditional learning, had the highest chance probability of all questions. (p=.2).
Section 3. Standard Error of Measurement

In this section the long term standard error of measurement is analyzed. The results of the analyses are contained in Table 14. If the criterion that a standard error of measurement greater than 1.0000 would categorize the question from the questionnaire as too inaccurate for use, then four questions would be judged too inaccurate for long term prediction.

Questions 10 (having to do with the student's previous experience in non-traditional learning) and 19 (concerning whether the course is an elective or part of his major) had a long term standard error of measurement greater than 1.0000 and were categorized as too inaccurate for use in long term predictions. Questions 26 (dealing with the student's opinion of the most important element in learning) and 33 (regarding the most important mission of colleges) also had a long term standard error of measurement greater than 1.0000.

Summary of Phase Three

All questions were shown to be reliable in the short term. The questions do not appear to be ambiguous. In the long term all questions, except six, were shown to be reliable. They were questions 16, 17, 32, 33, 39 and 40 which had a long term Pearson r which resulted in a chance probability greater than .05. (See Table 14.) None of these six questions ranked high in accounting for the variance in final grades, except question 40. Question 40 accounted for 2.9% of the variance in final grades in the independent study group. (See Table 31.)
Questions numbered 10, 19, 26 and 33 were judged too unreliable for long term predictions. Each had a standard error of measurement greater than 1.0000. Question 26 accounted for 2.5% of the variance in final grades for the individualized instruction group. Question 19 accounted for 6.5% of the variance in final grades for the independent study group. Question 19 ranked first with this percentage in that group.

The equations for the lecture and individualized instruction groups appear reliable. The equation for the independent study group can be used, but needs improvement.

**Phase Four - Analysis of Individual Questions in Relation to Mode of Instruction**

This phase examines specific questions from the questionnaire in five sections. Section one examines relationships between age and mode of instruction. Section two examines relationships between sex and mode of instruction. Section three examines relationships between work load and mode of instruction. Section four lists six questions which accounted for the most variance in final grades. (See Table 31 for the variance.) Section five examines significant correlations ($\alpha=.05$) between individual questions and final grade for each mode of instruction.

**Section 1. Age**

This section examines significant relationships between age and mode of instruction. The results of the analyses are contained in Tables 15 through 20.
Older Students

In a one-way analysis of variance of mean grade point averages of older students, for the three modes of instruction, the F ratio was 1.027. (See Table 15.) The chance probability of this ratio is .36. This indicates there is no best mode of instruction for students over the age of 27.

The mean grade point averages by mode of instruction were:

- $\bar{X}_{10}$ (older students in lecture mode, $N = 55$) = 2.82
- $\bar{X}_{11}$ (older students in individualized mode, $N = 74$) = 2.89
- $\bar{X}_{12}$ (older students in independent study mode, $N = 14$) = 2.29

TABLE 15

ANALYSIS OF VARIANCE FOR OLDER STUDENTS (OVER 27)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>4.34</td>
<td>2</td>
<td>2.172</td>
<td>1.027</td>
</tr>
<tr>
<td>Within Samples</td>
<td>296.17</td>
<td>140</td>
<td>2.116</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>300.52</td>
<td>142</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .36) $N = 143$

Null hypothesis number 5 (There is no significant difference in mean grade point averages of older students (over 27) by mode of instruction.) is accepted. ($\alpha = .05$)
Middle Aged Students

In a one-way analysis of variance of mean grade point averages of middle aged students, for the three modes of instruction, the F ratio was 3.471. (See Table 16.) The chance probability of this ratio is .03. The Scheffe S for this data is .634. That is, any difference in means greater than .634 is significant at the .05 level.

The inference can be made that middle aged students (over 20 to 27) did significantly better in the lecture and individualized modes than in the independent study mode.

The mean grade point averages by mode of instruction were:

\[ \bar{X}_{13} \] (middle aged students in lecture mode, \( N = 83 \)) \( = 2.43 \)

\[ \bar{X}_{14} \] (middle aged students in individualized mode, \( N = 57 \)) \( = 2.42 \)

\[ \bar{X}_{15} \] (middle aged students in independent study mode, \( N = 50 \)) \( = 1.80 \)

### TABLE 16

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>14.562</td>
<td>2</td>
<td>7.2808</td>
<td>3.471</td>
</tr>
<tr>
<td>Within Samples</td>
<td>392.28</td>
<td>187</td>
<td>2.0977</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>406.84</td>
<td>189</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( (p = .03) \) \( N = 190 \)

Null hypothesis number 6 (There is no significant difference
in mean grade point averages of middle aged students (over 20, up to and including 27) by mode of instruction.) is rejected. ($\alpha=.05$)

Young students

In a one-way analysis of variance of mean grade point averages of young students, for the three modes of instruction, the F ratio was 5.451. (See Table 17.) The chance probability of this ratio is .0054. The Scheffe S for this data is 1.157. That is, any difference in means greater than 1.157 is significant at the .05 level.

The inference can be made that young students (age 20 and under) did significantly better in the lecture mode than in the individualized mode. The differences in the means between individualized mode and the independent study mode (.93) was not significant at the .05 level.

The mean grade point averages by mode of instruction were:

$\bar{X}_{16}$ (young students in lecture mode, $N = 22$) $= 3.36$

$\bar{X}_{17}$ (young students in individualized mode, $N = 26$) $= 1.85$

$\bar{X}_{18}$ (young students in independent study mode, $N = 73$) $= 2.78$

Null hypothesis number 7 (There is no significant difference in mean grade point averages of young students (age 20 and under) by mode of instruction.) is rejected. ($\alpha=.05$)

Lecture Mode

In a one-way analysis of variance of mean grade point averages in the lecture mode by age of student, the F ratio was 3.626. (See
Table 17.

ANALYSIS OF VARIANCE FOR YOUNG STUDENTS (20 AND UNDER)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>29.097</td>
<td>2</td>
<td>14.549</td>
<td>5.451</td>
</tr>
<tr>
<td>Within Samples</td>
<td>314.968</td>
<td>118</td>
<td>2.669</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>344.065</td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .0054) N = 121

Table 18.) The chance probability of this ratio is .029. The Scheffe S for this data is .8801. That is, any difference in means greater than .8801 is significant at the .05 level.

The inference can be made that young students did better than middle aged students in the lecture mode, with no significant difference (α=.05) for the older students.

The mean grade point averages by age were:

\[ \bar{X}_{10} \] (older students in lecture mode, N = 55) = 2.818

\[ \bar{X}_{13} \] (middle aged students in lecture mode, N = 83) = 2.433

\[ \bar{X}_{16} \] (young students in lecture mode, N = 22) = 3.364

Null hypothesis number 8 (There is no significant difference in mean grade point averages in lecture mode by age of student.) is rejected. (α=.05)
TABLE 18

ANALYSIS OF VARIANCE FOR THE LECTURE MODE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>16.336</td>
<td>2</td>
<td>8.168</td>
<td>3.626</td>
</tr>
<tr>
<td>Within Samples</td>
<td>353.657</td>
<td>157</td>
<td>2.253</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>369.993</td>
<td>159</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .029) N = 160

Individualized Mode

In a one-way analysis of variance of mean grade point averages in the individualized mode by age of student, the F ratio was 6.085. (See Table 19.) The chance probability of this ratio is .0029. The Scheffe S for this data is .7576. That is, any difference in means greater than .7576 is significant at the .05 level.

The inference can be made that older students did significantly better (α=.05) than young students in the individualized mode with middle aged students falling in between but not significantly different than the young or older students.

The mean grade point averages by age were:

\[ \bar{X}_{11} \] (older students in the individualized mode, \( N = 74 \)) = 2.89

\[ \bar{X}_{14} \] (middle aged students in the individualized mode, \( N = 57 \)) = 2.42

\[ \bar{X}_{17} \] (young students in the individualized mode, \( N = 26 \)) = 1.85
TABLE 19

ANALYSIS OF VARIANCE FOR THE INDIVIDUALIZED MODE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>22.477</td>
<td>2</td>
<td>11.239</td>
<td>6.085</td>
</tr>
<tr>
<td>Within Samples</td>
<td>284.414</td>
<td>154</td>
<td>1.847</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>306.891</td>
<td>156</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .0029) N = 157

Null hypothesis number 9 (There is no significant difference in mean grade point averages in the individualized mode by age of students.) is rejected. (α=.05)

**Independent Study Mode**

In a one-way analysis of variance of mean grade point averages in the independent study mode by age of student, the F ratio was 5.257. (See Table 20.) The chance probability of this ratio is .0063. The Scheffe S for this data is .7412. That is, any difference in means greater than .7412 is significant at the .05 level.

The inference can be made that young students did better than middle aged students in the independent study mode with older students falling in between, but not significantly different than either young or middle aged students.

The mean grade point averages by age were:

$$\bar{X}_{12} = 2.29$$
\( \bar{X}_{15} \) (middle aged students in the independent study mode, \( N = 50 \)) = 1.80

\( \bar{X}_{18} \) (young students in the independent study mode, \( N = 73 \)) = 2.78

**TABLE 20**

**ANALYSIS OF VARIANCE FOR THE INDEPENDENT STUDY MODE**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>28.665</td>
<td>2</td>
<td>14.332</td>
<td>5.257</td>
</tr>
<tr>
<td>Within Samples</td>
<td>365.350</td>
<td>134</td>
<td>2.727</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>394.015</td>
<td>136</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(\( p = .0063 \)) \( N = 137 \)

Null hypothesis number 10 (There is no significant difference in mean grade point averages in the independent study mode by age of students.) is rejected. (\( \alpha = .05 \))

**Summary of Section 1.**

The data indicates students over the age of 27 did equally well in each mode of instruction. Students over the age of 20, up to 27, did significantly better in the lecture and individualized modes than in the independent study mode (\( \alpha = .05 \)). Students, age 20 and under, did significantly better in the lecture mode than in the individualized mode (\( \alpha = .05 \)).

In the lecture mode young students did better than middle aged students with older students scoring between, but not significantly
different ($\alpha=.05$) than either of the other two age groups.

In the individualized mode older students did significantly better ($\alpha=.05$) than young students, with middle aged students falling in between, but not significantly different than either of the other two age groups.

In the independent study mode young students did significantly better ($\alpha=.05$) than middle aged students, with older students falling in between, but not significantly different than either of the other two age groups.

Section 2. Sex

This section examines relationships between sex and mode of instruction. The results of the analyses appear in Tables 21-25.

Men

In a one-way analysis of variance of mean grade point averages of men in the three modes of instruction, the F ratio was 2.77. (See Table 21.) The chance probability of this ratio is .066. This indicates there are no significant differences in mean grade point averages ($\alpha=.05$) for men by mode of instruction.

The Scheffe S for this data is .552. That is, any difference in means greater than .552 is significant at the .05 level. Even though there are no significant differences at the .05 level, it appears that the individualized mode is most promising for men, with the other two modes about the same.

The mean grade point averages by mode of instruction were:
\( \bar{x}_{19} \) (men in lecture mode, \( N = 97 \)) = 2.361

\( \bar{x}_{20} \) (men in individualized mode, \( N = 79 \)) = 2.848

\( \bar{x}_{21} \) (men in independent study mode, \( N = 75 \)) = 2.387

**TABLE 21**

ANALYSIS OF VARIANCE FOR MEN

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>12.295</td>
<td>2</td>
<td>6.147</td>
<td>2.77</td>
</tr>
<tr>
<td>Within Samples</td>
<td>550.333</td>
<td>248</td>
<td>2.219</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>562.628</td>
<td>250</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( p = .066 \) \( N = 251 \)

Null hypothesis number 11 (There is no significant difference in mean grade point averages by mode of instruction for men.) is accepted. \( (\alpha = .05) \)

**Women**

In a one-way analysis of variance of mean grade point averages of women in the three modes of instruction, the F ratio was 7.660. (See Table 22.) The chance probability of this ratio is .0006. The Scheffe S for this data is .641. That is, any difference in means greater than .641 is significant at the .05 level.

The inference can be made that women did significantly better in the lecture mode than in the individualized or independent study mode.
modes.

The mean grade point averages by mode of instruction were:

\[ \bar{x}_{22} \text{ (women in lecture mode, } N = 63) = 3.206 \]

\[ \bar{x}_{23} \text{ (women in individualized mode, } N = 78) = 2.244 \]

\[ \bar{x}_{24} \text{ (women in independent study mode, } N = 62) = 2.355 \]

**TABLE 22**

ANALYSIS OF VARIANCE FOR WOMEN

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>36.684</td>
<td>2</td>
<td>18.342</td>
<td>7.660</td>
</tr>
<tr>
<td>Within Samples</td>
<td>478.882</td>
<td>200</td>
<td>2.394</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>515.566</td>
<td>202</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .0006) N = 203

Null hypothesis number 12 (There is no significant difference in mean grade point averages by mode of instruction for women.) is rejected. (\(\alpha = .05\))

Lecture Mode

In a one-way analysis of variance of mean grade point averages of men and women in the lecture mode, the F ratio was 12.589. (See Table 23.) The chance probability of this ratio is .0005. The F ratio necessary for a significant difference at the .05 level is 3.92. The inference can be made that women did significantly better than men.
in the lecture mode.

The mean grade point averages were:

\[ \bar{x}_{19} \text{ (men in the lecture mode, N = 97)} = 2.361 \]

\[ \bar{x}_{22} \text{ (women in the lecture mode, N = 63)} = 3.206 \]

**TABLE 23**

ANALYSIS OF VARIANCE BY SEX IN THE LECTURE MODE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>27.305</td>
<td>1</td>
<td>27.305</td>
<td>12.589</td>
</tr>
<tr>
<td>Within Samples</td>
<td>342.688</td>
<td>158</td>
<td>2.169</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>369.993</td>
<td>159</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( p = .0005 \)  \( N = 160 \)

Null hypothesis number 13 (There is no significant difference in mean grade point averages between men and women in the lecture mode.) is rejected. (\( \alpha = .05 \))

**Individualized Mode**

In a one-way analysis of variance of mean grade point averages of men and women in the individualized mode, the F ratio was 7.599. (See Table 24.) The chance probability of this ratio is .0065. The F ratio necessary for a significant difference at the .05 level is 3.92. The inference can be made that men did significantly better than women in the individualized mode.
The mean grade point averages were:

\[ \bar{X}_{20} \text{ (men in individualized mode, } N = 79) = 2.848 \]

\[ \bar{X}_{23} \text{ (women in individualized mode, } N = 78) = 2.244 \]

**TABLE 24**

ANALYSIS OF VARIANCE BY SEX IN THE INDIVIDUALIZED MODE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>14.343</td>
<td>1</td>
<td>14.343</td>
<td>7.599</td>
</tr>
<tr>
<td>Within Samples</td>
<td>292.548</td>
<td>155</td>
<td>1.887</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>306.891</td>
<td>156</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p = .0065) \( N = 157 \)

Null hypothesis number 14 (There is no significant difference in mean grade point averages between men and women in the individualized instruction mode.) is rejected. (\( \alpha = .05 \))

**Independent Study Mode**

In a one-way analysis of variance of mean grade point averages of men and women in the independent study mode, the F ratio was .012. (See Table 25.) The chance probability of this ratio is .91. The F ratio necessary for a significant difference at the .05 level is 3.92. There was no significant difference in mean grade point averages of men and women in the independent study mode.

The mean grade point averages were:
\( \bar{X}_{21} \) (men in independent study mode, \( N = 75 \)) = 2.387

\( \bar{X}_{24} \) (women in independent study mode, \( N = 62 \)) = 2.355

**TABLE 25**

ANALYSIS OF VARIANCE BY SEX IN THE INDEPENDENT STUDY MODE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>.035</td>
<td>1</td>
<td>.0345</td>
<td>.012</td>
</tr>
<tr>
<td>Within Samples</td>
<td>393.980</td>
<td>135</td>
<td>2.9184</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>394.015</td>
<td>136</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(\( p = .91 \)) \( N = 137 \)

Null hypothesis number 15 (There is no significant difference in mean grade point averages between men and women in the independent study mode.) is accepted. (\( \alpha' = .05 \))

**Summary of Section 2.**

The data indicated men did equally well in all three modes of instruction. Although there are no significant differences at the .05 level, it appears that the individualized mode is the most promising.

Women did significantly better (\( p = .0065 \)) than women in the other two modes. Grade point averages in the individualized mode and the independent study mode were about the same.

Women did significantly better (\( p = .0005 \)) than men in the lecture mode. Men did significantly better (\( p = .0065 \)) than women in
the individualized mode. The mean grade point averages of men and women in the independent study mode were about the same.

The results are summarized in Table 26.

TABLE 26

<table>
<thead>
<tr>
<th>SEX</th>
<th>Mode of Instruction</th>
<th>Lecture</th>
<th>Individualized Instruction</th>
<th>Independent Study</th>
<th>Probability of F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>Lecture</td>
<td>2.361</td>
<td>2.848</td>
<td>2.387</td>
<td>.066</td>
</tr>
<tr>
<td></td>
<td>Individualized Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Independent Study</td>
<td>2.387</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>Lecture</td>
<td>3.206</td>
<td>2.244</td>
<td>2.355</td>
<td>.0006</td>
</tr>
<tr>
<td></td>
<td>Individualized Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Independent Study</td>
<td>2.355</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability of F Ratio</td>
<td>.0005</td>
<td>.0065</td>
<td>.91</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section 3. Work Load

This section examines relationships between work load (the sum of number of credit hours carried by the student and the number of hours working on a job) and mode of instruction. The results of the analyses are contained in Tables 27-29 and summarized in Table 30.

Heavy Work Load (45 or more hours per week)

In a one-way analysis of variance of mean grade point averages of students with a heavy work load, the F ratio was 2.627. (See Table 27.) The chance probability of this ratio is .074. An F ratio of 2.99 is necessary to indicate a difference at the .05 level. This infers there are no significant differences in mean grade point averages by mode of instruction for students with a heavy work load.
The Scheffe $S$ for this data is .582. That is, any difference in means greater than .582 is significant at the .05 level. Even though there are no significant differences at the .05 level, it appears that the lecture mode should be considered over the independent study mode.

The mean grade point averages by mode of instruction were:

$\overline{X}_{25}$ (lecture students with heavy work load, $N = 76$) = 2.961

$\overline{X}_{26}$ (individualized instruction students with heavy work load, $N = 75$) = 2.600

$\overline{X}_{27}$ (independent study students with heavy work load, $N = 103$) = 2.418

**TABLE 27**

**ANALYSIS OF VARIANCE BY INSTRUCTIONAL MODE FOR HEAVY WORK LOAD STUDENTS**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>13.019</td>
<td>2</td>
<td>6.509</td>
<td>2.627</td>
</tr>
<tr>
<td>Within Samples</td>
<td>621.927</td>
<td>251</td>
<td>2.478</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>634.946</td>
<td>253</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$(p = .074) \ N = 254$

Null hypothesis number 16 (There is no significant difference in mean grade point averages for students with a heavy work load (school credit hours plus outside job hours greater than or equal to 45) by mode of instruction.) is accepted. $(\alpha = .05)$
Medium Work Load (32-44 hours per week)

In a one-way analysis of variance of mean grade point averages of students with a medium work load, the F ratio was .164. (See Table 28.) The chance probability of this ratio is .849. An F ratio of 3.11 is necessary to indicate a difference at the .05 level. This infers there are no significant differences in mean grade point averages by instructional mode for students with a medium work load.

The mean grade point averages by mode of instruction were:

\[ \bar{X}_{28} \text{ (lecture students with medium work load, } N = 39) = 2.282 \]
\[ \bar{X}_{29} \text{ (individualized instruction students with } \text{ medium work load, } N = 47) = 2.404 \]
\[ \bar{X}_{30} \text{ (independent study students with medium work load, } N = 12) = 2.167 \]

TABLE 28

ANALYSIS OF VARIANCE BY INSTRUCTIONAL MODE For MEDIUM WORK LOAD STUDENTS

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>Degrees of Freedom</th>
<th>Mean Squares</th>
<th>F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Samples</td>
<td>.668</td>
<td>2</td>
<td>.3339</td>
<td>.164</td>
</tr>
<tr>
<td>Within Samples</td>
<td>192.883</td>
<td>95</td>
<td>2.0303</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>193.551</td>
<td>97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( p = .849 \) \( N = 98 \)

Null hypothesis number 17 (There is no significant difference in mean grade point averages for students with a medium work load (school credit hours plus outside job hours between 32 and 44
inclusive) by mode of instruction.) is accepted. (a(=.05)

Light Work Load (less than 32 hours per week)

In a one-way analysis of variance of mean grade point averages of students with a light work load, the F ratio was .412. (See Table 29.) The chance probability of this ratio is .664. An F ratio of 3.09 is necessary to indicate a difference at the .05 level. This infers there are no significant differences in mean grade point averages by instructional mode for students with a light work load.

The mean grade point averages by mode of instruction were:

\[ \bar{X}_{31} \quad \text{(lecture students with light work load, N = 45)} = 2.600 \]

\[ \bar{X}_{32} \quad \text{(individualized instruction students with light work load, N = 35)} = 2.629 \]

\[ \bar{X}_{33} \quad \text{(independent study students with light work load, N = 22)} = 2.272 \]

| TABLE 29 |
|---|---|---|---|---|
| **Source of Variance** | **Sum of Squares** | **Degrees of Freedom** | **Mean Squares** | **F Ratio** |
| Between Samples | 2.008 | 2 | 1.004 | .412 |
| Within Samples | 241.335 | 99 | 2.438 | |
| Total | 243.343 | 101 | | |

(p = .664) N = 102

Null hypothesis number 18 (There is no significant difference
in mean grade point averages for students with a light work load (school credit hours plus outside job hours less than 32) by mode of instruction.) is accepted. \((\alpha = .05)\)

**Summary of Section 3.**

The data indicated there were no significant differences in mean grade point averages by mode of instruction for students with a heavy, medium or light work load. Allowing students with a busy work schedule into the independent study mode of instruction seems to be unwise.

The results are summarized in Table 30.

**TABLE 30**

**SUMMARY OF MEAN GRADE POINT AVERAGES WORK LOAD BY MODE OF INSTRUCTION**

<table>
<thead>
<tr>
<th>Work Load</th>
<th>Lecture</th>
<th>Individualized Instruction</th>
<th>Independent Study</th>
<th>Probability of F Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy</td>
<td>2.961</td>
<td>2.600</td>
<td>2.418</td>
<td>.074</td>
</tr>
<tr>
<td>Medium</td>
<td>2.282</td>
<td>2.404</td>
<td>2.167</td>
<td>.849</td>
</tr>
<tr>
<td>Light</td>
<td>2.600</td>
<td>2.629</td>
<td>2.272</td>
<td>.664</td>
</tr>
</tbody>
</table>

**Section 4. Variance**

In this section the six questions accounting for the most variance in final grades are listed in Table 31.

**Summary of Section 4.**

No question was ranked in the top six for all three modes of
### Table 31

**Questions Accounting for Variance in Final Grades**

<table>
<thead>
<tr>
<th>Rank of Questions Accounting for the Most Variance</th>
<th>Independent Study Equation - Question Number</th>
<th>Per Cent of Variance</th>
<th>Lecture Equation - Question Number</th>
<th>Per Cent of Variance</th>
<th>Individualized Instruction Equation - Question Number</th>
<th>Per Cent of Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>19</td>
<td>6.5</td>
<td>2</td>
<td>7.6</td>
<td>1</td>
<td>8.0</td>
</tr>
<tr>
<td>Second</td>
<td>1</td>
<td>5.5</td>
<td>21</td>
<td>6.3</td>
<td>2</td>
<td>4.9</td>
</tr>
<tr>
<td>Third</td>
<td>29</td>
<td>4.6</td>
<td>7</td>
<td>5.3</td>
<td>21</td>
<td>4.3</td>
</tr>
<tr>
<td>Fourth</td>
<td>40</td>
<td>2.9</td>
<td>4</td>
<td>2.7</td>
<td>12</td>
<td>3.3</td>
</tr>
<tr>
<td>Fifth</td>
<td>38</td>
<td>2.3</td>
<td>12</td>
<td>2.4</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>Sixth</td>
<td>8</td>
<td>2.2</td>
<td>24</td>
<td>2.4</td>
<td>26</td>
<td>2.5</td>
</tr>
</tbody>
</table>
instruction. Four questions appear in two modes of instruction.

Question number 1, on age, ranked second in the independent study equation and first in the individualized instruction equation. Age was the only question which ranked in the top six in the two non-traditional modes of instruction.

Question number 2, on sex, ranked first in the lecture equation and second in the individualized instruction equation.

Question number 12, "While in class, how often do you ask questions?", ranked fifth in the lecture equation and fourth in the individualized instruction equation.

Section 5. Miscellaneous Questions

In this section significant correlations ($\alpha = .01 \text{ or } .05$) between individual questions and final grades in each mode of instruction will be examined. The questions will be examined in three parts. There will be a part for each mode of instruction. The results are summarized in Table 32.

**Lecture**

The student's recollection of high school grade point average (question number 7) is significantly related ($\alpha = .01$) to his final grade in lecture. There is no significant correlation for this question in the non-traditional modes. It can be inferred that a student who did not fare too well in high school may be wise to select one of the non-traditional modes of instruction. Apparently, success in the lecture mode correlates with success in high school, whereas, success in the other two modes is independent of success in high school. This
<table>
<thead>
<tr>
<th>Question</th>
<th>Lecture</th>
<th>Individualized Instruction</th>
<th>Independent Study</th>
</tr>
</thead>
<tbody>
<tr>
<td># 5. Marital status (not married - negative married - positive)</td>
<td>N.S.</td>
<td>-.2107**</td>
<td>.2277**</td>
</tr>
<tr>
<td># 7. Students's recollection of high school grade point average</td>
<td>.2866*</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>#12. Frequency of question asking in class</td>
<td>N.S.</td>
<td>.1773**</td>
<td>N.S.</td>
</tr>
<tr>
<td>#19. Elective or part of major</td>
<td>N.S.</td>
<td>N.S.</td>
<td>.2250**</td>
</tr>
<tr>
<td>#21. Expected grade</td>
<td>.3271*</td>
<td>.3100*</td>
<td>.1512***</td>
</tr>
<tr>
<td>#24. Academic interest in high school</td>
<td>.2799*</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>#30. High school lectures, from boring to interesting</td>
<td>-.1818**</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>#31. Self-Discipline</td>
<td>N.S.</td>
<td>.2018**</td>
<td>N.S.</td>
</tr>
<tr>
<td>#32. Hours per week the student thinks he will need to work for this class</td>
<td>N.S.</td>
<td>-.2460*</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

* Significant at the .01 level
** Significant at the .05 level
*** Significant at the .08 level
N.S. Not Significant
implies that non-traditional modes reach a different population than the traditional lecture mode. It is interesting to note that question number 24, concerning academic interest in high school, showed the same results.

Question number 21, "What grade do you expect to earn in this course?", correlated with final grade at the .01 level. It can be inferred that the higher the expected grade, the higher the earned grade.

An interesting result was observed in question number 30, "The lectures given by my high school teachers on the subject material were . . . ." A correlation of -.1818 was observed, which is not significant at the .01 level, but is significant at the .05 level (\(-.1638\) value is necessary). It can be inferred that the more boring the high school lectures were, the higher the final grade.

**Individualized Instruction**

Question number 5, on marital status, correlated negatively with final grade at the .05 level. It can be inferred that students who were not married tended to do better in individualized instruction than students who were married.

Results on question number 12, "While in class, how often do you ask questions?", indicated students who tend to ask a lot of questions had a higher final grade. The individualized instruction mode is designed to facilitate individuals asking questions. This is the only mode which showed a significant correlation (\(\alpha=.05\)) with this question.
Question number 21, "What grade do you expect to earn in this course?", correlated with final grade at the .01 level. It can be inferred the higher the expected grade, the higher the earned grade.

Question number 31, "I feel I

A. need a lot of goading to get things done.
B. usually need goading to get things done.
C. am about average in self-discipline.
D. am a fairly self-disciplined person.
E. am an extremely self-disciplined person."
correlated with final grades at the .05 level. It can be inferred that the higher the level of self-discipline, the higher the earned grade.

Question number 32 showed a negative correlation between final grades and the number of hours per week a student thought he would need to work for the class. The negative correlation, significant at the .01 level, showed that those who thought they would not need much outside time to be successful in the class were correct. It can be inferred that those who anticipated much outside work did not earn as high a grade as those who did not anticipate much outside work.

Independent Study

Question number 5, marital status, correlated with final grade at the .05 level. It can be inferred that students who were married tended to have a higher final grade in independent study than students who were not married. The exact opposite result was observed in the individualized instruction mode.

Question number 19, "This subject

A. is not my major, but is required.
B. is just an elective.
C. has little to do with my major, but is interesting to me.
D. is important to my major.
E. is part of my major."
correlated with final grade at the .05 level. It can be inferred that students taking subjects which are important to, or part of, their major do better in independent study than students taking subjects which are required, but not part of their major or are just an elective.

Question number 21, the expected grade significantly correlated ($\alpha = .01$) with final grade in the lecture and individualized modes. This question was not significantly correlated ($\rho = .08$) with final grade in the independent study mode. Normally this level of significance ($\alpha = .08$) is not reported, however, this is the only question which was important for predicting final grade for all modes of instruction.

Summary of Section 5.

The only mode of instruction in which the student's recollection of his high school grade point average correlated significantly with final grades ($\alpha = .01$) was the lecture mode. This may imply that the student is accustomed to this mode and knows what to expect from it. The student's recollection of his high school grade did not correlate with final grade in the non-traditional modes of instruction, indicating the actual outcomes were different from what the student previously experienced.
Summary of Phase Four

Results in Section 1 indicated that for persons under the age of 27, mode of instruction is important. Students just out of high school had the highest mean grade point average in the lecture and independent study modes. Older students seem to do best in the individualized mode.

Results in Section 2 indicated men did equally well in all three modes of instruction. Women did significantly better ($p=.0006$) in the lecture mode than in the other two modes. Women did significantly better ($p=.0005$) than men in the lecture mode while men scored higher ($p=.0065$) than women in the individualized mode.

Results in Section 3 indicated there were no significant differences in mean grade point averages by mode of instruction for students with a heavy, medium or light work load. However, results imply that people with a heavy work load should not be placed in a time-flexible mode of instruction. The data indicated if a student with a heavy work load had to choose between the independent study mode and the lecture mode, he would probably be wise to choose the lecture mode.

Results in Section 4 indicated age appears to be an important variable in the individualized and independent study modes. It accounted for 8.0% and 5.5% of the variance in final grades, respectively.

Expected grade was important in lecture and individualized modes. It accounted for 6.3% and 4.3% of the variance in final grades, respectively.
Results in Section 5 indicated that grade point average by mode of instruction correlates with different questions. It appears that traits, as measured by different questions, interact with mode of instruction. The only question that was significant \( p < .08 \) across all three modes of instruction pertained to expected grade.
Summary and Conclusions

This summary is outlined in four phases. In phase one the three multiple linear regression equations are examined. In phase two the validity of the equations is discussed. Phase three examines the reliability of the equations and phase four summarizes the results of the analyses of individual questions. Phase five of this chapter contains conclusions.

Phase One - Multiple Linear Regression Equations

The individualized instruction equation distinguished between successful individualized instruction students and successful independent study students. (α=.05) This equation did not uniquely identify successful individualized instruction students and must be improved.

The independent study equation distinguished between successful independent study students and successful individualized instruction students. (α=.05) This equation did not uniquely identify successful independent study students and must be improved.

The lecture equation filtered out individualized instruction students, but did not identify differences between students with a final grade of A or B in the independent study mode and the lecture mode. None of the equations distinguished between successful lecture
and successful independent study students. See Table 12 for a summary of significant ($\alpha = .05$) and nonsignificant differences in predicted mean scores of students with a final grade of A or B.

The reader may conjecture that students who did not do well in each mode of instruction may have the same characteristics, as measured by this questionnaire, as the students who did well, because mean scores of failing students were not examined in this study. The significant correlations ($\alpha = .005$) between the predicted score and the criteria (lecture group, $r = .74$; individualized instruction group, $r = .68$; independent study group, $r = .65$) indicate the questionnaire identifies differences between successful and unsuccessful students in each mode of instruction. This refutes the conjecture that students with a D or X final grade would have the same characteristics, as measured by this questionnaire, as students with a final grade of A or B. If all students had the same characteristics, the correlations would not be significant.

It appears from Table 13, the three multiple linear regression equations are discriminatory and can be used to place students in one of the three modes of instruction. However, even though the equations would move 83% of the students who failed into a different mode of instruction and leave 63% of the students who earned a grade of A or B in the same mode of instruction, there is no guarantee that drop-out rates will decline or mean grade point averages will increase. Further studies must be conducted to measure the impact on the drop-out rate and grade point averages.
Phase Two - Validity

In this phase validity was examined. If the students were placed in a mode of instruction using the highest z-score predicted by each multiple linear regression equation, the placement would have been random at the .05 level but would not have been random at the .07 level. The Chi-squared test of proportions indicated a change in placement, moving 83% of the students who failed into a different mode of instruction. Of the students with a final grade of A or B, 63% would have remained in the same mode of instruction. Using the criterion that the equations should shift failing students in another mode of instruction and retain A, B students in the same mode of instruction, the test appears to have criterion validity. The data showed that the lecture and individualized instruction equations predicted the final grade, within 1.000 grades, 68% of the time. It appears that the grade predicted by these two equations is valid.

The independent study equation predicted the final grade, within 1.28 grades, 68% of the time. This author feels that the equation should be able to predict the final grade within 1.000 grade 68% of the time. The predictive validity of this equation should be improved.

Phase Three - Reliability

Reliability was examined in phase three. A short term test-retest (2 week interval) correlation was calculated. All questions had a correlation (Pearson r) greater than .47 (p < .05). It appears
that none of the questions was ambiguous.

A long term test-retest (15 week interval) correlation also was calculated. The chance probability of the resulting Pearson r in 27 of 33 questions was less than .05. The inference can be made that 27 questions have long term reliability.

The standard error of measurement for each question was calculated using the long term test-retest data. Four questions had a standard error of measurement greater than 1.000 and were categorized as unreliable. Three of the questions categorized as unreliable by using the standard error of measurement were different than the six categorized as unreliable using the Pearson r correlation. Therefore, a total of nine questions were categorized as unreliable. They were questions 10, 16, 17, 19, 26, 32, 33, 39 and 40.

All ten questions that this author categorized as cognitive style questions proved to be reliable. All four questions written with the characteristics of Maslow's self-actualizer in mind proved to be reliable. If these questions do represent the trait as intended by this author, then one may conclude that cognitive style and self-actualization are stable traits.

Of the nine questions categorized by this author as motivation questions, four appear to be unreliable. Two questions categorized by this author as level of maturity questions proved to be unreliable. If these questions do represent the traits of motivation and maturity, one may conclude that these traits changed during the fifteen week interval between tests. Perhaps the semester in college had a significant impact on the students in relation to these two traits.
Of the four questions written using attitude as the construct, one appears to be unreliable. Of the three questions written using self-discipline as the construct, one appears to be unreliable. If these questions do represent attitude and self-discipline traits, this author feels that no conclusion may be drawn. (See Table 33.)

TABLE 33

SUMMARY OF RELIABILITY OF CONSTRUCTS

<table>
<thead>
<tr>
<th>Construct</th>
<th>Number of Questions</th>
<th>Number of Questions Categorized Reliable</th>
<th>Number of Questions Categorized Unreliable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Style</td>
<td>10</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Self-Actualizer</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Motivation</td>
<td>9</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Level of Maturity</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Attitude</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Self-Discipline</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Phase Four - Miscellaneous Questions

This phase examined individual questions. The data on age of student yielded three conclusions. First, young students do best in the lecture mode. Their most recent learning experiences were probably in a lecture mode and, as a group, they probably had the most difficulty adjusting to different modes of instruction.
Second, the middle aged students did significantly better ($\alpha = .05$) in the lecture and individualized modes than in the independent study mode. These students probably have been away from formal education for one to six years and were able to adjust to the individualized mode. They perhaps found it difficult to contend with the freedom that the independent study mode affords.

Third, of the three age groups, older students were most adaptable to mode of instruction. No significant differences were observed for older students by mode of instruction. As locus of control shifts from instructor to student, a more mature student may fare better.

Of the three age groups, young students appear to be least adaptable to non-traditional modes of instruction. Middle aged students appear to be more adaptable because they did significantly better in two modes of instruction, lecture and individualized, than in the independent study mode. Older students appear to be most adaptable because all three modes appear to be about equal. Perhaps one may conclude that as a person gets older he becomes more adaptable to learning modes.

The most promising mode of instruction for men appears to be the individualized mode. Women did significantly better ($p = .0006$) in the lecture mode than in the other two modes. Women did significantly better ($p = .0005$) than men in the lecture mode, while men did significantly better ($p = .0065$) than women in the individualized mode. They did about the same in the independent study mode.

The analyses of interaction between work load and mode of
instruction yielded one interesting result. Students with a heavy work load scored highest in the lecture mode and lowest in the independent study mode. The probability of the F ratio was .074. The notion that a person with a busy schedule will benefit from a time-flexible learning mode appears incorrect. In fact, it appears that a busy person will do well to select the lecture mode, which has structure and demands that the student be in a certain place at a certain time.

The most important question appears to be number 21, "What grade do you expect to earn in this course?" This question correlated with actual final grade at the .01 level in the lecture and individualized instruction groups. It was the only question attaining this level of significance in two modes of instruction. While it did not correlate significantly at the .05 level with actual final grade in the independent study group, the chance probability of the resulting Pearson r correlation coefficient was .08.

Marital status showed opposite correlations in individualized instruction and independent study. Being married appears to have some positive bearing on independent study students and not being married appears to have some positive bearing on individualized instruction students.

The student's recollection of high school grade point average (question number 7) is significant in the lecture mode only. The final grade in the lecture mode is related to what the student remembers as his high school grade point average. There is no significant correlation for this question in the non-traditional modes. This
means that a student who did not fare too well in high school may be wise to select one of the non-traditional modes of instruction. Apparently, success in the lecture mode correlates with success in high school, whereas success in the other two modes is independent of success in high school. This implies that non-traditional modes reach a different population than the traditional lecture. It is interesting to note that question number 24, dealing with the student's interest in academic work in high school, showed the same results.

The individualized instruction mode is designed to facilitate individual question asking. This is the only mode which showed a significant correlation ($\alpha = 0.05$) with question number 12. (While in a class, how often do you ask questions?) Apparently, in the other two modes, it is not important if you ask questions.

It is this author's opinion that the independent study mode requires a student be highly motivated to be successful. Being a part of the student's major, question number 19, turned out to be important in the independent study group only. Apparently, a student is highly motivated to complete a course successfully if it is part of, or important to, his major. This had no bearing on success in the other two modes of instruction.

The last comparison involves the results of question number 32, dealing with the number of hours per week a student thought he would need to work for the class. The individualized instruction mode showed a negative correlation with this question. This infers that those who thought they would not need much outside time to be successful in the class were correct. This was not true in either of the
Phase Five - Conclusions and Recommendations

This author concludes that the three modes of instruction are suited for different types of students. The individualized instruction multiple linear regression equation did not differentiate individualized instruction students with a final grade of A or B from students with an A or B in the other two modes of instruction at the .05 level. The equation did uniquely differentiate individualized instruction students at the .07 level. The other two equations did not do as well but tended toward sorting out differences. The conclusion drawn in phase four of this summary, success in the lecture mode correlates with success in high school, whereas success in the other two modes is independent of success in high school, implies that non-traditional modes reach a different population than the traditional lecture and also supports the conclusion.

If we presume that the lecture mode of instruction is predominant in high school, then one may conclude that students don't do well because they are in the wrong mode of instruction. This conclusion is supported by the conclusion reached in phase four. It was found that success in the non-traditional modes of instruction was independent of academic interest and grade point average in high school. This does not mean that all students who did not do well in high school should be placed in non-traditional learning modes in college. If there was a significant negative correlation between what the student remembers as his high school grade and final grades in the
college class then unsuccessful high school students would be placed in non-traditional learning modes. Such a negative correlation does not exist.

The top five questions which accounted for the most variance in final grades would describe a successful independent study student as a person under the age of 20. This student finds school easy and finds it difficult to earn college credit in the traditional manner. The subject should be his major, or closely related to his major. He feels he can handle the responsibility involved in learning in the independent study mode.

A person who will do well as an individualized instruction student probably will be a male over the age of 27. He will expect to do well, asks a lot of questions and feels homework is important.

Women appear to do better than men in the mode of instruction which has the most structure; the lecture. It appeared that men functioned better than women in the looser structure of the individualized mode. However, the two groups appear to score equal in the independent study mode.

Non-traditional study programs, with their built in time flexibilities, are not better for people with heavy work loads than traditional modes of learning. In fact mean final grades tend to increase as course structure increases.

Older people (over the age of 27) who have been taught predominantly by traditional methods, can learn as effectively in new instructional settings. The highest mean final grade for older students, although not statistically significant at the .05 level, was
observed in the individualized mode.

Finally, a multiple linear regression equation must be written for each mode of instruction by type of class. A multiple linear regression equation should be written for mathematics, social studies, history, etc. The multiple linear regression equation written for the individualized instruction students probably did very well in differentiating students with a final grade of A or B in individualized instruction from students with a final grade of A or B in the other two modes of instruction, because the only students in this group were mathematics students. The reason that the other two multiple linear regression equations did not do as well is probably because many different kinds of classes were involved in these two modes. This author suggests further study in the lecture and independent study modes with mathematics students only.

The next study the author intends to conduct will involve writing a multiple regression equation (not necessarily linear) for the lecture and individualized instruction groups. The instrument which will be used as the independent variable will be the Guilford-Zimmerman Temperament Survey. In this author's search of the literature this instrument was used in several studies and appeared to have discriminatory powers with regards to the two modes of instruction in question.

If the instrument does discriminate successful lecture students from successful individualized instruction students in mathematics it will be used to place students into the two learning modes. An analysis will then be conducted to see if mean grade point averages
increase and if the per cent of students who successfully complete the
course increases. An effort, by this author, to increase the quality
and quantity of students completing his mathematics classes will
continue.
REFERENCES


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1. Age
   A. 18 or under
   B. Over 18 up to and including 20
   C. Over 20 up to and including 23
   D. Over 23 up to and including 27
   E. Over 27

2. Sex
   A. Male
   B. Female

3. The number of credit hours I am carrying this semester is
   A. 18 or more.
   B. 16 or 17.
   C. 14 or 15.
   D. 12 or 13.
   E. 11 or less.

4. If I add the number of credit hours I am carrying to the average number of hours I am working per week, I would get
   A. 45 or more.
   B. 38 to 44.
   C. 32 to 37.
   D. 26 to 31.
   E. less than 26.

5. Marital status
   A. Not married
   B. Married

6. The number of credits that I now have earned is
   A. 0-10.
   B. 11-20.
   C. 21-33.
   D. 34-46.
   E. 47 or more.
7. In high school my grade point average was
   A. below C minus.
   B. C or C minus.
   C. B minus or C plus.
   D. B plus or B minus.
   E. A or A minus.

8. While in high school I usually did the following number of hours of homework per week:
   A. under 3.
   B. 3 to 5.
   C. 6 to 9.
   D. 10 or 14.
   E. 15 or over.

9. While in high school, my participation in extra curricular activities (player or spectator) was
   A. very heavy.
   B. heavy.
   C. about average.
   D. light.
   E. none or practically none.

10. In previous classes I have (choose one answer only. If more than one applies, choose the one furthest along in the alphabet. For example, if B, D and E apply, darken in E.)
    A. never experienced any teaching other than lecture.
    B. had little experience with teaching methods other than lecture.
    C. had a class in which some of the teaching was done with audio tapes, TV tapes or programmed instruction books.
    D. had a class in which much of the teaching was done with audio tapes, TV tapes or programmed instruction books.
    E. had experience with an independent study or individualized instruction course.

11. In my opinion, my note-taking abilities are
    A. very poor.
    B. poor.
    C. average.
    D. good.
    E. excellent.
12. While in a class, how often do you ask questions?
   A. very often
   B. more than the average student
   C. about average
   D. less than the average student
   E. rarely

13. If I get behind in my homework, I
   A. usually let most of it slide.
   B. work a little quicker and make up some of the work.
   C. spend a little extra time and make up some of the work.
   D. spend some extra time and make up most of the work.
   E. spend extra time and always make up all the back work.

14. While doing my homework, I
   A. need a quiet and secluded place because I am easily distracted.
   B. need a secluded place because I am fairly easily distracted.
   C. find I am not too easily distracted.
   D. find that very few outside distractions bother me.
   E. find practically nothing distracts me.

15. The most important single reason for my going to college is that
   A. my friends went.
   B. a high school teacher or counselor motivated me.
   C. my parents wanted me to go.
   D. I want to gain knowledge to get a good job.
   E. I want to gain knowledge to increase position at present job.

16. I think that grades should be
   A. abolished.
   B. lessened in importance.
   C. used as they are presently used.
   D. used to indicate to me how well I can do compared to others.
   E. used to indicate to employers how well I can do compared to others.

17. My reasons for coming to college are
   A. very hazy—have not been thought out.
   B. not clear.
   C. still being thought out in my mind.
   D. fairly clear in my mind.
   E. clearly defined in my mind.
18. In lecture classes I find the teacher is covering the material
   A. too slowly most of the time.
   B. a little too slowly.
   C. at about the right rate.
   D. at a rate which is often too fast for me.
   E. at a rate too fast for me most of the time.

19. This subject
   A. is not my major, but is required.
   B. is just an elective.
   C. has little to do with my major, but is interesting to me.
   D. is important to my major.
   E. is part of my major.

20. I will
   A. probably not transfer, I'm not sure what I want to do yet.
   B. probably not transfer to another college.
   C. not transfer to another college, but complete all my college work here.
   D. definitely transfer to another college but I am not sure which one.
   E. definitely transfer to another college, and I have already selected the college.

21. What grade do you expect to earn in this course?
   A. I will probably have to work very hard to get a C.
   B. Probably a C
   C. If I work hard, I could get a B.
   D. Probably a B
   E. Probably an A

22. While in high school I should have done
   A. much more homework.
   B. more homework.
   C. no more nor no less homework.
   D. less homework.
   E. much less homework.

23. I think my absentee rate in high school was
   A. very high.
   B. high.
   C. about average.
   D. light.
   E. about zero.
24. I would describe my interest in academic work in high school as
   A. little interest.
   B. some interest.
   C. about average.
   D. above average.
   E. usually interested.

25. While working on a project, I would rather work
   A. in a large group.
   B. with 4 or 5 other students.
   C. with 2 or 3 other students.
   D. with a best friend.
   E. alone.

26. I think the most important element in learning is the
   A. teacher.
   B. books.
   C. school.
   D. subject.
   E. homework.

27. In my opinion, the way teaching machines are made nowadays,
   A. if used properly there is no need for a teacher.
   B. if used properly there is little need for a teacher.
   C. the combination of machines and help from a teacher are needed.
   D. the use of the machines are not as important as direction from the teacher.
   E. the teacher is still the most important ingredient.

28. I think the amount of reading I do
   A. should be greatly increased.
   B. should be increased.
   C. is about right.
   D. should probably be lessened.
   E. should probably be greatly lessened.

29. Generally I find school
   A. very difficult.
   B. difficult.
   C. about as difficult as every one else does.
   D. easier than many students do.
   E. easier than most students do.
30. The lectures given by my high school teachers on the subject material were
   A. very often boring and could put me to sleep.
   B. often boring.
   C. as good as could be expected.
   D. often interesting and motivating.
   E. often very interesting and motivating.

31. I feel I
   A. need a lot of goading to get things done.
   B. usually need goading to get things done.
   C. am about average in self-discipline.
   D. am a fairly self-disciplined person.
   E. am an extremely self-disciplined person.

32. How many hours per week do you think you will need to work for this class?
   A. 0 to 2.
   B. over 2 but less than 4.
   C. 4 to 6.
   D. over 6 but less than 8.
   E. over 8.

33. The most important mission of colleges is to teach/develop
   A. academic material which will prepare one for a job.
   B. academic material in general.
   C. reading.
   D. the ability to listen objectively.
   E. the realization that there are two sides to every story.

34. If homework assignments are not collected, I
   A. usually won't do them.
   B. would probably do about half of them.
   C. would probably do parts of most of them.
   D. would probably do parts of all of them.
   E. would probably do most of all of them.

35. When given a homework assignment, I usually
   A. put if off as long as possible.
   B. will not start on it right away, but will complete it at the last minute.
   C. start on it right away but don't complete it until it's due.
   D. start on it right away and sometimes complete it early.
   E. start on it right away and work until it's completed.
36. If I have an enjoyable afternoon activity planned, such as going to a ball game, and something happens which forces me to change my plans, such as a rainy day, I would

A. wind up brooding and staying at home.
B. try to carry the original plans through anyway.
C. stay at home and do something else.
D. go somewhere else even though it wouldn't be as much fun.
E. plan to go somewhere else where I would have as much fun.

37. If directions from an instructor are not clear, I would

A. probably not be able to do the project.
B. wait until the next class and have them clarified even though the project would be late.
C. call a friend and see if he could clarify the instructions.
D. do the project the best I can with what I understand.
E. usually be able to figure out what the instructor probably wants and work from there.

38. Non-traditional learning would probably be good for me because

A. traditional teaching doesn't work well for me.
B. I don't like attending regularly scheduled classes.
C. I would just like to see how it is.
D. attending regularly scheduled classes would be very difficult.
E. it is almost impossible to earn college credit any other way because of my schedule.

39. The single best opinion that I have which could make me successful in non-traditional learning is

A. with the negative experiences I have had with traditional learning, anything would be better.
B. traditional learning isn't so good.
C. it would be a new experience, and I would be interested.
D. in the past I have been able to learn on my own.
E. I have had previous non-traditional learning experiences and have been successful.

40. In non-traditional learning, the burden of learning is even more on the shoulders of the learner than in lecture classes. Do you believe you would be able to handle this extra burden?

A. with great difficulty
B. with some problem
C. I don't know
D. without too many problems
E. easily
APPROVAL SHEET

The dissertation submitted by Ronald Svara has been read and approved by the following Committee:

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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Education.

December 21, 1978  
Date

Lois M. Lackner  
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