THE INSTRUCTIONAL PROCESS AS A FUNCTION OF INTERACTIONS AMONG INSTRUCTIONAL SITUATION VARIABLES

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ABSTRACT

THE INSTRUCTIONAL PROCESS AS A FUNCTION OF INTERACTIONS AMONG INSTRUCTIONAL SITUATION VARIABLES

By

Elizabeth Joan Salmi

The purpose of this study was to examine the components of the instructional situation of a large undergraduate college course involving a large lecture-small discussion section format.

Through an interaction detection analysis an attempt was made to: 1) measure learning over time; 2) quantify learner characteristics contributing to performance in the instructional process; 3) measure instructor characteristics relevant to the instructional process; 4) and to relate the interactions of instructor and student characteristics to student learning. On this basis, three conceptualizations were examined: 1) a conception of the instructional process; 2) a conception of a set of instructor characteristics possibly important in problem solving activity among students; 3) and a conception of a strategy for research in the initial stage in the established classroom setting.

The first of these conceptions was that of the instructional process defined by the variables in the instructional situation. Specifically, the study was concerned with how certain sets of predictor factors (sets of student and instructor characteristics) were related to the instructional process outcome variables. The second conception pertained to the role of the instructor in the instructional process.

The third conception concerned the nature, role and feasibility of research in the ongoing instructional situation. The structure of the research design approximated the instructional process over time by extracting data at different points in time as the instructional process progressed. An attempt was made to maximize explanation by looking at changes in structure as well as changes over time. Eleven analyses of nine course outcomes were made on the basis of three sets of predictor factors.

The analysis indicated that coalescence occurred around certain classes or levels of given predictor variables in their description of an outcome, coalescence differing by instructional process conditions surrounding outcomes, contextually and over time. Interactions emerged on three dimensions. The analysis provided examination of the following: 1) interactions of levels of student characteristics to course outcomes, and interactions of levels of instructor characteristics with student characteristic levels to course outcomes; 2) interactions of instructional effects; 3) and interactions with and independent of multicollinearity. Certain variables operated differentially as facilitators or barriers to student performance in meeting outcomes. Factors operating consistently across all levels were those tied to a conceptual approach to learning. There were differing barriers or facilitators for ranges of student performance. An estimate of congruence was provided between the goals and assumptions of this instructional situation and the actual instructional process in terms of the extent to which 1) provision for individual differences among students was realized; 2) the extent to which the instructional process prepared students to use disparate information in a problem-solving approach to learning, 3) and the extent to which models of the behavior suggested as goals for students were provided by the instructors.

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Elizabeth Joan Salmi

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THE PROBLEM

Research on teaching and learning in the classroom has been criticized by both researchers and those who try to utilize findings from research studies in practical applications. Much of the criticism by researchers focuses on methodology related to problems such as failure in specificity of criterion, in maintaining homogeneity and independence, in clearly outlining research procedures, and in analyzing interactions. Those looking to research findings for aid in improving instruction in classrooms criticize research findings on the grounds that the results or implications are often difficult to generalize into the classroom setting and fail to lead to actual procedural efforts to improve instructional results.

These criticisms are confounded by viewpoint differences on theories of teaching and learning as applied to classroom instruction, differences on the scope of the problem to which a researcher should address himself, and differences on the purpose and nature of research strategies utilized in investigating problems. Theoretical differences are illustrated by the contrast between the viewpoint that a theory of teaching is just a variant of traditional theories of learning and hence explainable in terms of the latter, the view that research should focus on teacher operations since learning is not necessarily the most important criterion of instructor effectiveness, and the view that although inextricably connected to theories of personality, learning, motivation and development, theories of instruction must not be

developed solely by inference from these.[1] In addition, different views on the scope of the problem to which a researcher should address himself are due partly to the fact that many areas of education such as instructor effectiveness or creativity are complexes of many factors; hence views range from belief that these complexes present an opportunity for new conceptualization of research designs to belief that the scope of the problem should be limited so it is amenable to traditional classical experimentation. These views in turn are compounded by different opinions on the purpose and nature of research strategies in evaluating these complex factors. One extreme is the large-scale research project in which a curriculum is varied or special classes are established but lack of evaluative criteria or adequate design, because of its complexness, result in no evaluation of results.[2] On the other hand, studies utilizing traditional experimental designs in which variables are manipulated and their effects upon other variables observed encounter difficulty in handling complex educational problems. In pointing to these difficulties, Stanley cites as two consequences the tendency to choose trivial problems that lend themselves to neat designs, the results being statistically significant but lacking importance, and the tendency in more complex studies to report main effects but with interactions which are left to conjecture so that absence

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[1]N. L. Gage, "Paradigms for Research on Teaching," in N. L. Gage (Ed.), Handbook of Research on Teaching - A Project of the American Educational Research Association, (Chicago: Rand McNally, 1963), pp. 94-141.

[2]Frank B. Baker, "Experimental Design Considerations Associated with Large-scale Research Projects," in Julian Stanley (Ed.), Improving Experimental Design and Statistical Analysis, (Chicago: Rand McNally, 1967), pp. 214-217.

of significant differences in the findings is reported with monotonous regularity.[3]

The alternative proposals for improving educational research on instruction reflect these differing viewpoints in terms of where critics see the need to focus strategies. Stanley cites the need to alter strategies toward two specific problems in utilizing classical experimental designs. First, he criticizes the number of studies where main effects turn out to be of little or no interest and the interactions, vaguely explained, are of primary interest.[4] He cites the need for the researcher to do sufficient preliminary research and to incorporate this into the design of his investigation, rather than discovering after doing the study that he doesn't think the main effects very interesting. His second criticism is leveled at what he refers to as the "frozen methodology" of those who "set up a nice design that (they) like and know how to analyze and that is balanced," and into this model force all theoretical models or problems, by drastic alterations on the latter for the sake of the former, with the end result that findings may be significant but not important or even relevant to the original problem.[5] He is equally critical of the converse of drastic alterations on the problem, namely forcing the problem onto the statistical model by

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[3]J. C. Stanley, "On Improving Certain Aspects of Educational Experimentation," J. C. Stanley (Ed.), Improving Experimental Design and Statistical Analysis, (Chicago: Rand McNally, 1967), pp. 32-33.

[4]J. C. Stanley, "Symposium: Interactions in Psychometrics and Experimentation," Educational and Psychological Measurement, 1961, *21*, pp. 791-858.

[5]Stanley, op. cit., in Improving Experimental Design and Statistical Analysis, pp. 32-34.

ignoring the statistical assumptions underlying the model. In either case, he stresses the fallacy of controlling for variables without stopping to consider the kinds of questions that can be answered in such a manner, or whether the kinds of questions to which answers are wanted are actually being posed.

Stanley's assertion of the need to identify and explain interactions and to make them an integral part of the research design rather than shrugging them off, and the need to give careful consideration to the relationship between the research model and the questions being posed is extended by Box who feels "there tends to be much too much work in which people say, 'Given the model....' in the very first sentence of the paper and everything else follows, (when) usually the most important single question is the choice of the model in the first place."[6] The need is to select the optimal design for a particular situation. The results of an experiment depend far more on what variables the experimenter decides to include, what range, how many levels, and so on than on anything else, even the data. Thus two equally knowledgeable researchers arrive at somewhat different designs. Box concludes that, "We must regard experimentation as an iteration -- an adaptive learning process, in which we run a series of designs, adapting our strategy to results as they appear."[7] Whereas Stanley stresses the importance of incorporating in the initial phase of an investigation

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[6]G. Box, "Bayesian Approaches to Some Bothersome Problems in Data Analysis," in Julian Stanley (Ed.), Improving Experimental Design and Statistical Analysis, (Chicago: Rand McNally, 1967), p. 84.

[7]Ibid., p. 86

the search for interactions, Box adds the necessity that the initial phase provide the researcher with a picture showing the amount and nature of information obtainable at different points at which the research could continue. Although it is difficult to alter the habit of testing for one variable after another, if the data is full of interaction effects it is not meaningful to ask about the effects of one variable at a time. In addition, in the analysis of data derived from experiments involving large numbers of variables or suspected interactions, the argument can be made that significance tests are of doubtful value. Factors may show up as statistically significant which are not important in terms of reducing error.[8] The necessity persists of first locating those variables which seem most important in accounting for the variation in some specified dependent variable and evaluating the relative importance of those variables.[9]

The problem of findings which may have statistical significance but lack importance is extended by Campbell to the problem of generalizing from experimental findings in laboratory settings to actual classroom settings, since any "extrapolation is never logically certain but it is more plausible the greater the similarity of conditions and the less the distance in time and space.[10] He proposes

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[8]J. N. Morgan and J. A. Sonquist, "Problems in the Analysis of Data, and a Proposal," Journal of the American Statistical Association, 58, (June, 1963), pp. 415 - 35.

[9]H. M. Blalock, Jr., "Evaluating the Relative Importance of Variables," American Sociological Review, 26, (1961), pp. 866-874.

[10]D. T. Campbell, "Administrative Experimentation, Institutional Records, and Nonreactive Measures," in J. Stanley (Ed.), Improving Experimental Design and Statistical Analysis, (Chicago: Rand McNally, 1967), p. 260.

that since this implies the necessity to cross-validate in the actual classroom setting the findings from the laboratory situation, the experiments could begin in the classroom setting. This would provide a basis of experimentation where the extrapolation is small, and where the likelihood of valid extrapolation is great. Research is then part of the instructional setting, the measures being an integral element of the instructional process.[11] Campbell proposes the implementation of a research program within the already established classroom setting, the program to keep artificiality and obtrusive measures minimal by making such factors part of the setting, and over time to develop by replication a body of data to be used as the basis for additional testing of hypotheses about instructional variables, cross-validation occurring by other programs in similar situations. Initially, this necessitates the evaluation of those variables in the instructional complex to identify the factors having the greatest importance for that given instructional situation. The initial purpose, according to Campbell, is the discovery of the structure of relations among variables in a specified instructional setting, and under what conditions and through what intervening processes this relationship occurs.

The comments of Stanley, Box, and Campbell summarize the basic assumptions of research procedures -- a model of normalcy and homogeneity. Studies in the experimental tradition tend to look for dimensional differences, relegating everything else to either error or

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[11]<u>Ibid</u>., p. 260

unexplained interaction; studies in the relational tradition tend to look for population relationships and prediction, with non-relationships or inaccurate prediction being classed as error. These assumptions are wholly justified under a tradition of parsimony, of favoring precision and stability so as to arrive at unified conceptions or comprehensive theory.

These same principles of homogeneity and normalcy are assumed in much classroom instruction, without the traditions underlying their assumptions as in basic research. Despite the supposed innovations to provide for individual differences, the majority of classrooms still operate on such features as singular instructional methods, uniform content, or grading on the curve. However, within the instructional setting a structure of relations exists such that many circumstances with inherent violations of this normalcy and homogeneity become obvious to the point where the instructional efforts are forced to deal with differences and heterogeneity.

The purpose of this study is to discover the structure of relations among the variables in a given instructional setting, and under what conditions and through what intervening processes this relationship occurs. While the focus of discussion is the relative importance of instructional setting variables in the classroom, rather than methodology, the necessity of dealing with problems of criteria, design, and analysis are inherent. Criteria considerations are based not on whether one mode of presentation is better than another but on which conditions are thought to optimize the realization of instructional goals under clearly specified and delimited conditions. Under such criteria it may be erroneous to make implicit assumptions of homogeneity and independence of empirical conditions in the original design. Since independence of variables cannot be assumed, the need is present to identify and explain interactions rather than leaving them to conjecture in the analysis.

Purpose

The purpose of this study is to determine the relative importance of potentially important variables to relevant course criteria or outcomes in a manner which is functional to improving instructional conditions.

Importance refers to a given variable in terms of its weight or usefulness to a given instructional setting. In this context four characteristics of importance together provide the basis for evaluation of variables. The first characteristic associated with importance is expressed statistically, in terms of the relative amount of variance accounted for by the particular variable. While the relative amount of variance accounted for generally has been a primary criterion in virtually all research studies in either experimental or naturalistic settings, methodological difficulties continue to result in failure to account for variance that accumulates from an interaction.

The second characteristic associated with importance is that of location, inferring in the sense of interaction or of multicollinearity that some variables account for variance in special locations. For example, the researcher may be interested in the effects of test anxiety on student test performance and yet when trying to extrapolate what would be significant findings, in this instance the fact that test anxiety has some negative effect upon the ability to take tests, he finds the compounding factor that students who are highly motivated may suffer certain forms of test anxiety but have found ways, because of the positive effect of grade reward, to compensate for whatever deficits this anxiety creates. In this case there would possibly be an interaction in which course motivation would "wash out" the weight of test anxiety at the upper levels of test performance. Location can also pertain to multicollinearity in the sense that there may be a small but significant correlation between the independent and dependent variable but the correlation is small because while it is consistent across the high range and low range of scores it is either the highest and lowest groups correlating or possibly just the effect of the middle group minus the tails of the distribution.

The third characteristic associated with importance is that of time, referring to the relative appearance or increase and decrease of the variable accounting for a proportion of variance over the time setting of the course. For example, in the instance where students with knowledge or training in areas similar to course materials being used in a course they have just commenced, it could be that the previous training is an advantage carried consistently throughout the course, or it could be that the differences due to this increased advantage at the start would be lost over time. Or perhaps the variable appears simply in relation to one specific point in time in the course.

The fourth characteristic associated with importance is that of criterion, that is, accounting for variance in relation to the nature of the dependent variable. For example, there would seem to be a considerable difference as to what factors account for variance in a variable to which a grade has been attached.

The concept of importance embodying the characteristics of relative amount, location, time, and criterion can be discussed on two levels: in relation to the theoretical considerations which are the basis for the course or instructional process, and in relation to the actual outcomes of the course or instructional process. The first level raised the question of what, theoretically, is the relative importance of the instructional variables as embodied in the theoretical considerations behind the course or the instructional situation -- that is, the theoretical considerations which serve as the raison d'être for the course or instructional situation, the theoretical considerations being expressed in the form of course criteria which themselves are defined by the course objectives. The second level raised the question of what, in fact, is the relative importance of variables derived out of the instructional setting in terms of the actual course outcomes, the outcomes themselves defined in terms of assessed performance. Course development is a function of the evolvement of congruence between these two levels of importance.

In this context of the study, variables derived out of the instructional setting are referred to as instructional variables and include a set of learner intellectual and social characteristics, a set of environmental characteristics (including the teacher), and the learning itself in terms of changes of behavior toward specified objectives. The instructional setting is defined to include only the formal classrooms.

Implications and Expectations

The central question in this study is the relative importance of instructional variables at two levels -- theoretically and in actual practice -- and the congruence between the levels. Implied in this question is the problem of assessing the internal consistency between course goals and procedures, and student evaluated performance. Thus, the research strategy must first develop important combinations of instructional setting variables in describing different outcomes, and show how these descriptions change according to outcome by type and time. But equally necessary, in addition to homogeneous descriptions and relationships, the strategy must develop the important heterogeneous explanations and the important exceptions to general prediction.

These implications suggest a number of expectations. First, it would be expected that the results will show coalescence occurring around certain classes of variables, for instance those variables which are the most important initial descriptions of performance. Second, it would be expected that the results will show differences among outcome variables (represented by assessed student performance) in the type of predictor variables accounting for variance and in the extent of the prediction of variance. Third, since measures usually are proxies for a specified theoretical construct, sometimes more than one, several measured factors may together represent a weighting of theoretical constructs in the form of interaction. Fourth, it would be expected that certain instructional setting variables operate in differing sets as barriers to student performance in meeting course criteria and outcomes. Fifth, the results should show important isolated exceptions, normally relegated to measurement or statistical error, which represent real instructional problems. And finally, given the compilation of the above in combination with the course theoretical underpinnings, it would be expected that the results will demonstrate the degree of congruence between course criteria and actual outcomes in terms of relevant variables.[12]

Theoretical Considerations

Many of the criticisms by researchers of instructional studies focus on problems related to methodology and analysis. When the researcher has posed the problem and questions he wishes investigated, he then must ordinarily take into consideration two models. The first of these is the theoretical model upon which the design for the study is based. Whether the design is the type classed by Campbell and Stanley as "experimental" or one not involving the same assumptions as the former, the design is a representation of a theoretical model. There must be a functional representation between the questions being posed in the study and those the design is capable of answering.[13]

One of the reasons designs for instructional research in the classroom setting become complex is because of "the intransigence of the environment: because, that is, of the researcher's lack of

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[12]The expectations are restated in Chapter 3 specifically in terms of the instructional situation used for the study.

[13]Fred N. Kerlinger, Foundations of Behavioral Research, (New York: Holt, Rinehart and Winston, Inc., 1964), p. 370.

complete control."[14] Violations of the theoretical assumptions underlying the design can occur. Two of those most commonly violated are the assumptions of independence and homogeneity. For example, one common method of investigating the latest innovation in instructional procedure (such as the use of independent study) is to employ a design involving control-group comparison, comparing the "innovation" with some more "conventional" procedure. Analysis of the data from the comparison, using traditional approaches to analysis of variance, "assumes that each instructional procedure is independent of others and homogeneous within itself to permit its use as an independent variable."[15] However, the first assumption, independent learning environments in the "experimental" and "control" groups is questionable if the teacher used in the two procedures, feeling that the method of presentation for the experimental group improves the quality of their treatment, inadvertently alters methods in the control group to enhance his teaching. Under the same conditions, the second assumption, that of homogeneity, can be questionable if the treatment and the control conditions are regarded as uniform independent variables. Designating the control group "conventional classroom", for instance, and failing to take into account the differences that exist among "conventional classrooms" limits generalizability beyond the specific samples in the study.

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[14] Donald T. Campbell & Julian C. Stanley, Experimental and Quasi-experimental Designs for Research, (Rand McNally, 1963), p. 1.

[15] Laurence Siegel & Lila Siegel, "A Multivariate Paradigm for Educational Research," Psychological Bulletin, 1967, 68, 5, p. 308.

The research design essentially embodies the methods of securing adequate and proper data to which to apply statistical procedures. One purpose of each major statistical technique can be regarded as to provide in some form an answer to a general problem: "how to abstract from the sum of squares, which is a mélange of error, that portion which represents useful information relative to the questions raised by the researcher in the beginning of his inquiry."[16] While the statistical technique is inextricably tied to the research design, it also involves an underlying theoretical model. Many educational research problems outside the experimental laboratory setting have small resemblance to the precise models in the textbook examples. In the analysis of the data the researcher may find that there are statistical difficulties created by the data which make any results questionable or superficial.

The data generated from the study variables may reflect any number of conditions which might conflict with the assumptions of a particular statistical model. For instance, use of a large number of variables creates the problem of handling data in the form of a wide variety of information on each individual. Or, the measurement of the variable may involve classifications such as a set of classes designating the fields of study in which students are enrolled, or perhaps the data is in the form of answers to attitudinal questions which may not really have a rank order. Or the problem

[16] Solomon Diamond, Information and Error, (New York: Basic Books, 1959), p. vi.

may be that even though the measure seems to be a continuous variable, such as test scores, the effect is not necessarily linear; time expended studying does not necessarily change uniformly with changes in test scores at either extreme of the test score range, for example. Or perhaps the problem is intercorrelations between many of the explanatory variables to be used in the analysis, making it difficult to assess the relative importance of various factors, since their intercorrelations get in the way; for example, high grade point average of a student tends to go along with higher level of aspiration and expectation for performance, with lower test anxiety, and so on. Or the problem may be interaction effects. For example, high test anxiety in test-taking situations may have a much more deleterious impact among students with average grade points than among those with high GPA's when it comes to actually making that high grade needed (or wanted) on a test. Or the interaction may exist because the measured classifications are only proxies for the theoretical constructs, and several variables may have to interact to approximate the theoretical construct being investigated in the study.[17]

There are a number of methods of handling the problems outlined in the preceding paragraph. The first of these, the use of many factors in the study can be handled by examining each factor one at a time keeping in mind the degree to which the one factor is intercorrelated with the others. A second method is to build combinations of factors arbitrarily or via factor analysis. In this latter technique the danger exists of combining factors on the basis of their

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[17]Morgan & Sonquist, op. cit., pp. 415-435.

influence on the dependent variable may be in opposite directions, thus creating a factor with no correlation with the dependent variable. Or the problem of multiple factors can be handled by the use of multiple correlation techniques such as multiple regression analysis,[18] as can the problem of intercorrelations among predictors, assuming the number of explanatory factors is not too large. However, an underlying assumption of multiple regression analysis is variables in continuous form, raising a problem from the preceding paragraph, that of variables in classification form, such as sex or college major. This necessitates construction of arbitrary scales or the use of dummy variables.[19]

The last of the problems mentioned above is that of the presence of interactions. The assumption that no interactions exist makes for a very efficient analysis procedure, but this assumption, according to Stanley, has been responsible for the lack

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[18]Briefly, multiple regression analysis attempts to determine the effect of a given independent variable on the given dependent variable, while holding constant or removing the linear effects of the other independent variables, and to determine whether these effects are significant after taking into account the intercorrelations of the predictors. Thus, if the researcher wished to predict the academic success of freshmen entering college he would attempt to ascribe the correct amount of explained variation in the dependent variable to each factor considered in the prediction, within the limits of the linear and additive assumptions of the model. See N. Draper, Applied Regression Analysis, (New York: John Wiley and Sons, Inc., 1966).

[19]The use of dummy variables involves the assignment of a dummy variable to each class of a characteristic except one. It is called a dummy variable because it has the value 'one' if the individual involved belongs in that subclass, or a 'zero' if he does not. See Morgan and Sonquist, op. cit., p. 422, or see D. Suits, "The Use of Dummy Variables in Regression Equations," Journal of the American Statistical Association, 52, December 1957, pp. 548-551.

of significant findings related to main effects in many studies.[20] One method of identifying an interaction is to perform a separate analysis of tables of residuals (the amount not explained by the regression equation) derived from the initial multiple regression analysis, which isolates some subgroup on a combination of characteristics.[20] One difficulty is that data containing a number of complex interactions requires repetitions of the technique to confirm suspicions. Another method involves restricting the total number of variables, using cell means as basic data, and using a variance analysis which looks directly for interaction effects. The difficulty is to avoid getting empty cells, with very small numbers of cases involved in the analysis. A third method is that with some restrictions on the number of variables many feasible interactions can be built into the initial phase of the research. The difficulty is in knowing which interaction terms to introduce into the regression model in advance, particularly with factors unsupported by a body of data.

The need in studies in the "natural setting" of ongoing classroom activity where a complex network of variables is involved is to take into account the problems raised in the beginning of this chapter by Box and Stanley, that of reconciling the variables to the

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[20] In the separate analysis of residuals derived from a multiple regression analysis for the purpose of identifying an interaction, "an estimate of the expected average of that subgroup on the dependent variable can be derived by summing the multivariate coefficients multiplied by the subgroup distributions over each of the predictors. Comparing this expected value with the actual average for that subgroup indicates whether there is something more than additive effect." See Morgan & Sonquist, op. cit., p. 424.

assumptions underlying the methodological and statistical models. These problems become essential in relation to the problem raised by Campbell, that of developing research programs in the classroom setting as an integral part of that setting, and particularly acute in the initial phase, that of locating those instructional setting variables which seem most important not just to the outcomes specified in the particular setting but those which appear important, theoretically, to the improvement of instruction.

Blalock points out that in such exploratory phases the job is to locate those variables which seem most important in accounting for variation and to attempt to evaluate the relative importance of such explanatory variables,[21] "if only for the practical reason that both theorists and empiricists must limit themselves to a reasonable number of explanatory variables."[22]

The question arises of what should be the quantitative criteria to use in determining the relative importance of the various factors. One possible criterion is to compute some sort of measure of association between an independent and dependent variable. If there are several independent variables, their relative importance is assessed by comparing measures of association of each independent variable with the dependent variable, controlling for all the remaining independent variables. The measure could be some form of correlation coefficient in which case the respective partials are compared. Another

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[21]The importance of a given explanatory factor is also always a function of the amount of variation in that factor. See H. Blalock, Jr., *op. cit.*, p. 867.

[22]*Ibid.*, p. 866.

possible quantitative criterion to use in determining relative importance is a measure in the form of a prediction equation in which slopes are used to measure the change in the dependent variable produced by a given change in the independent variable. If there are a number of explanatory variables, as in the case of multiple regression analysis, beta weights can be computed which indicate the change in the dependent variable produced by standardized changes in each explanatory variable, controlling for all remaining variables.[23] However, the requirements of linearity and additivity assumed in multiple regression analysis makes the use of regression equations, such as prediction equations, difficult when the data involves many cases, much classificatory information, many intercorrelations, and many complex interaction effects.

The more the theoretical and statistical assumptions imposed on the data, the greater the reduction in the complexity of the analysis. The heart of a research strategy is its set of restrictions. However, in the initial phase of research in the natural setting of the ongoing classroom activities, attempting to identify and evaluate explanatory variables, variables appear in a range from classification to continuous, intercorrelations between explanatory variables make their effects difficult to assess, complex interactions among factors cannot be assumed away, and application of statistical tests of significance, under the assumption of random sampling models, is questionable.

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[23]See Quinn McNemar, Psychological Statistics, (New York: John Wiley & Sons, Inc., 1969), pp. 191-213, for discussion of beta coefficients and beta weights.

Under these conditions, the quantitative criterion for judging the relative importance of explanatory variables is not based on the researcher asking about the direct effects of one variable at a time all else held constant, but is more meaningfully based on the researcher asking what it is that is most critical to know in order to reduce predictive error a maximum amount. According to Sonquist and Morgan, the question is, given the units of analysis under consideration what is the relative capability of predictor variables to give maximum improvement in the researcher's ability to predict values of the "dependent" variable under consideration.[24]

Research as an integral part of ongoing instructional setting activity has been considered on the basis of two models the researcher must take into account in his study of the relative importance of instructional setting variables, one pertaining to methodological design, the other to statistical analysis. However, under such conditions there is a third model which must be taken into consideration, and that is the "model" or set of assumptions underlying the ongoing process in the instructional setting chosen for the researcher's study. This "model" is not the components of the physical setting. It is the set of assumptions which delineates the conditions under which the instructional process operates in that particular setting. While this delineation lacks the precision of the research design and statistical models, nonetheless this model is a set of assumptions

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[24]John A. Songuist, Multivariate Model Building, a paper presented at the Conference on Multivariate Models for Data Analysis in the Social Sciences, Institute for Advanced Studies, Vienna, Austria, September, 1969, pp. 1-37.

about learner characteristics, environmental characteristics, and instructional process expressed (however implicitly) by the course designers. It is a reflection of what is supposedly "important" as judged by the designers (on whatever basis they have chosen to make these judgments). These assumptions are reflected in the criteria (goals, objectives, and so on) specified for the particular instructional situation. The instructional process and the outcomes as reflected in the learners (the outcomes judged by whatever means designated by the designers) are supposedly reconciled to the theoretical assumptions in the designers' model. Since the researcher is going to operate within this given instructional setting, his research must include some assessment of the degree of congruence between the model of "important" variables and those which actually appear to be important in the ongoing instructional situation. Neither those of the model nor those in the ongoing classroom situation are necessarily synonymous with those having "importance" to the improvement of instruction.

The methodological criticisms by researchers of studies on teaching and learning in the classroom are mirrored by those looking to research findings for aid in improving instruction in classrooms, this time on grounds that results or implications are often difficult to generalize into the classroom setting and fail to lead to actual procedural efforts to improve instructional results. Hilgard has reflected this concern in his statement that "any isolation of basic science from applied science, when it persists, is unfortunate. Over the years advances in science have occurred in intimate relation with advances in technology. If we were to apply (these) historical lessons......we would expect an equal intimacy between theory and research in the basic process of learning and the applied aspects of instruction and training in the schools."[25]

Commenting on what instructional setting factors provide optimal value in classroom instruction, Hilgard notes that there are many relationships of practical importance derived from theories of learning. These relationships are held in substantial agreement by theorists.[26]

For example, one suggestion derived from a stimulus-response theory base is that the learner should be an active, rather than a passive listener or viewer, stimulus-response theory emphasizing the significance of the learner's responses. Frequency of repetition is another, in terms of acquiring skill and in terms of sufficient over-learning to ensure retention. The roles of generalization and discrimination in stimulus-response theory point to the importance of practice in various contexts so that learning is appropriate to a wider (or more restricted) range of stimuli.

The stimulus-response theory notion of the importance of meaningfulness in learning and retention is found also in cognitive theory expressed in terms of the fact that learning with understanding tends to greater transferability and permanency than does rote learning. Another suggestion from cognitive theories is that the direction from simple to complex learning is not from arbitrary meaningless parts to

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[25]Ernest R. Hilgard & Gordon H. Bower, Theories of Learning, (New York: Appleton-Century-Crofts, 1966), p. 541.

[26]Ibid., p. 562.

meaningful wholes, but rather from simplified to more complex wholes. The cognitive theory concept of figure-ground relatedness suggests the importance of the perceptual features associated with the problem the learner is working on in terms of providing directional signs as to the interrelatedness of what leads to what. Another suggestion derived from cognitive theories is the importance of divergent thinking in leading to inventive solutions of problems and the role of convergent thinking in arriving at logically corréct answers. In terms of motivation to learn, the importance of goal setting by the learner, and success and failure as determiners of future goal setting, find basis in cognitive theory.

Theories of personality and motivation also provide generalizations which Hilgard considers offer teachers suggestions of what factors are important in the classroom setting. For example, the need for affiliation in contrast with the need for achievement as motivating forces, based in motivation theory, suggests that the same classroom learning situation may tap appropriate motives for one learner and not for another. Studies of the role of anxiety in learning suggest that the anxiety level of the individual learner may determine the beneficial or detrimental effects of certain kinds of encouragement to learn. Such personality-related factors as degree of rigidity in behavior or tendency toward authoritarianism or extent of introversion suggest factors of the individual learner which are affected by the atmosphere in the classroom, such as highly competitive conditions, or those requiring considerable participation in group discussion activities.

Whether derived from the conditioning and reinforcement approach to learning such as the contiguous conditioning of Guthrie or the operant conditioning of Skinner, or derived from theories that treat learning more broadly, tending to take into account the way the learner perceives the situation, and variously characterized by such labels as cognitive, Gestalt, or field theory, or derived from corollaries of learning such as McClelland's view of the role of achievement motivation, the examples in the preceding paragraphs indicate the form in which suggestions as to important factors in classroom instruction are derived. A review of the suggestions makes it apparent that "laboratory knowledge does not automatically lead to its own applications."[27] It is understandable since the theorists' concern is with matters of uncertainty important in establishing a firmer foundation for their theories, and secondarily if at all in relation to matters of classroom instruction.[28] There have been successful applications to such aids as programmed instruction and simulators but within a limited context. As to the relative importance of the suggestions to classroom instruction, "when the practical conditions of learning have to be arranged for particular learners, there is general agreement that attention has to be paid to the nature of the learners, to careful analysis of the tasks that confront them; beyond that, there is rather general agreement on some broad generalizations from learning experiments and theory, but these are not

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[27] Ibid., p. 564.

[28] A. Raymond Cellura, "The Application of Psychological Theory in Educational Settings: An Overview," American Educational Research Journal, vol. 6, no. 3, May, 1969, p. 373.

uniquely bound to particular theoretical viewpoints, and are not very instructive in respect to specific problems of improving efficiency of learning."[29] However, Ausubel feels that while an adequate theory of learning may not be a sufficient condition for the improvement of instruction it is a necessary condition for the identification of important variables and he has developed a cognitive-structure theory of school learning dealing exclusively with meaningful verbal learning. He suggests that attempts to extrapolate from learning theory and its empirical evidence directly to classroom instructional problems has disastrous consequences because judgments of those factors from learning theory with important value to classroom instruction require additional research structured so as to take into account practical problems such as interactions in the instructional setting with factors not implicit in the learning principles.[30]

Another approach to determining the qualitative value of instructional setting variables is to identify those providing optimal value in classroom instruction by studying the instructional complex from a particular point of view. For example, the instructional complex can be viewed with an emphasis on the perspective of the learner. Such a conception focuses upon making explicit the behavior(s) or the characteristic(s) of learners as the most important determiners of the ongoing instructional setting. The interests, the abilities, the

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[29]Hilgard and Bower, loc. cit., p. 573.

[30]David P. Ausubel, "A Cognitive-Structure Theory of School Learning," Laurence Siegel (ed.), Instruction: Some Contemporary Viewpoints, (San Fransisco: Chandler Publishing Co., 1967), pp. 207-259.

achievements, the personality characteristics of the learner are specified as the important criteria defining the instructional complex. Such studies of potentially important learner variables are legion. For example, in a review of studies which have attempted to specify the relationship of personality variables to academic performance, Cattell lists no fewer than twenty-six personality variables (ranging from extent of freedom from neurotic orientation to degree of impulsivity or degree of endurance) used as potential associates of learner academic performance.[31] On the other hand, the instructional setting can be viewed with an emphasis on environmental variables in the classroom setting. For example, one particularly important facet in the learner's environment is the instructor. Questioning the assumption that effective teaching necessarily produces effective learning focuses upon making explicit the characteristics and instructional behaviors of teachers as the most important determiners of the instructional setting. Getzels and Jackson have annotated over eight hundred studies attempting to specify the relationship of factors, ranging from degree of authoritarianism to cognitive style, to teacher effectiveness, and were led to the conclusion that "despite the critical importance of the problem and a half-centry of prodigious research effort, very little is known about the relationship between teacher characteristics and teaching effectiveness."[32]

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[31] R. B. Cattell and J. H. Butcher, Prediction of Achievement and Creativity, (New York: Bobbs Merrill, 1967), pp. 106-107.

[32] J. W. Getzels and P. W. Jackson, "The Teacher's Personality and Characteristics," N. L. Gage (ed.), Handbook of Research on Teaching, (Chicago: Rand McNally & Co., 1963), pp. 506-581.

Such difficulties in identifying those qualities of potentially important variables which would be most useful in the improvement of instruction naturally result in criticism by those looking to research findings for help in improving instruction.[33] Bruner summarizes the extreme of such feeling in his statement that, "one is struck by the absence of a theory of instruction as a guide to pedagogy--a prescriptive theory on how to proceed in order to achieve various results, a theory neutral with respect to ends but exhaustive with respect to means. It is interesting that there is a lack of an integrating theory in pedagogy, that in its place there is principally a body of maxims."[34] Such criticism is excessive from the standpoint that the tradition of research has been to seek parsimony in explaining relationships among variables, basing the search on assumptions of normalcy and homogeneity. When attempts are made to extrapolate findings directly to classrooms, many circumstances with inherent violations of this normalcy and homogeneity reduce the effectiveness of parsimony. However, such criticism may be deserved as suggested by Campbell and Hilgard of the failure to provide consistent research within the classroom setting to serve as an intervening process between parsimony and application.

Difficulties in identifying those dimensions of potentially

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[33]Instruction is defined as the arrangement of external conditions of learning in such ways to optimally interact with the internal capabilities of the learner, to bring about a change in these latter capabilities.

[34]Jerome S. Bruner, Toward a Theory of Instruction, (Cambridge, Harvard University Press, 1967), p. 31.

important variables useful in the improvement of instruction parallels the previously discussed difficulty of defining importance in meaningful quantitative terms. In cases where such assumptions as homogeneity, lack of interactions, and independence cannot be made, parsimony may prove to be inadequate, and importance may be more meaningfully defined qualitatively in terms of location, time, and criterion, (each of these qualitative functions having been defined with examples in the earlier discussion of the purpose of the study).

Overview

The position has been developed in the previous discussion that in the majority of courses of instruction in formal educational settings the weakness persists of failing to compensate in instructional procedures for the dimensions of any factors beyond the homogeneous descriptions of predominant characteristics and of failing to take into consideration the important heterogeneous descriptions and exceptions to general prediction which create instructional problems.

Those looking for help in improving instruction in such settings direct their criticism at research on teaching and learning, for failure to provide satisfactory means of dealing with "the real world". One criticism is that the models of methodological design and statistical analysis used in basic research are rooted in a set of assumptions and a tradition of parsimony not tenable in the complex structure of the classroom. The second criticism is that attempts to analyze the classroom take the form of summative evaluation, indicating the weaknesses in the instructional complex but failing to suggest procedures for actual course development or to provide a basis for research as an integral operation within the instructional setting to act as an intervening process between results of "basic" research and their application to improvement of instruction.

This study investigates such a formative analysis. Perhaps nowhere else at any formal instructional level do more class settings qualify as exemplars of failure to compensate in instructional procedures for dimensions of factors beyond homogeneous descriptions of predominant characteristics than at the level of undergraduate college instruction. Such an instructional situation was chosen for this study.

The following chapter provides background for the study at two levels. The first section is a review of pertinent literature concerning problems of research on teaching and learning discussed in chapter one. The second section outlines the university instructional situation used in the study, and background under which it operated.

Chapter three develops a rationale upon which the choice of factors included in the study was based, describes the measures used as proxies for the factors, and outlines the study procedures including: subjects; study design; analysis strategy. Then the expectations raised in chapter one about the nature of instruction are restated in terms of the instructional situation used for the study.

In chapter four the data are summarized and displayed to illustrate the analysis strategy used in interpreting the data, and the data are discussed in terms of the concept of "importance".

In chapter five the data are intergrated and interpreted in a discussion of the issues and questions raised in chapters one and three with regard to classroom instruction.

CHAPTER II

REVIEW OF THE LITERATURE AND BACKGROUND OF THE STUDY SETTING

Review of the Literature

Many undergraduate college courses serve as exemplars of the failure to compensate in instructional procedures for the dimensions of any factors beyond the homogeneous descriptions of predominant characteristics in the instructional situation. Increasing numbers of students and increasing heterogeneity in their characteristics have been accompanied by apparent decreasing interest in the quality of undergraduate college courses on the part of faculty, and the movement of many colleges to more business-like production-cost accounting models of instruction such as the large lecture section of hundreds of students.

However, recently a great deal of attention has been directed toward the subject of improving instruction at all levels of higher education, particularly the instruction of undergraduates. Suggestions for improvement often appear to have an amorphous quality because the factors discussed as relevant to improvement are expressed as generalities, or global programs. Calvin B. T. Lee documents a series of articles by professors very much interested in improvement of instruction, the majority of articles dealing in broad generalities such as the role of values in the classroom, or the use of television to decrease class size, or the professor and his roles.[35] Suggestions

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[35]Calvin B. T. Lee (ed.), Improving College Teaching, (Washington, D. C.: American Council on Education, 1967), pp. 57-71, 347-69.

from students also reflect this tendency to generalize about factors they consider important in the instructional setting. For example, the Carnegie Commission on Higher Education reports that ninety-one per cent of seventy thousand students interviewed would like their course work to be more "relevant" and ninety-five per cent consider teacher "effectiveness" should be the primary criterion in faculty promotion.[36]

These examples from groups at two extremes are not uncommon. Although some overgeneralities might be assumed away as showing lack of careful thought or lack of skill in communication, the number of such examples in the literature suggests that this lack of specificity as to what dimensions of the factors in the instructional setting are of most relative importance in the improvement of instruction is partially a reflection of the criticisms of research on teaching and learning discussed in chapter one. Gage has documented the hundreds of studies in teaching and learning at all instructional levels.[37] Since the setting for this study is at the college level, the review of the literature is confined to studies of instructional setting variables at that level. The studies chosen are examples of a number of studies reflecting the problems of methodology and application to ongoing instructional settings discussed in chapter one.

The criticisms by researchers of methodology related to such problems as failure in specificity of criterion, in maintaining

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[36] Carnegie Commission on Higher Education, national survey of student opinion, excerpted by New York Times, January 16, 1971.

[37] N. L. Gage, Handbook of Research on Teaching, (Chicago: Rand McNally & Company, 1963).

homogeneity and independence, in analyzing interactions, or stopping to consider the kinds of questions that can be answered by the research procedures used, are reflected in the series of studies of the teacher as leader in the educational setting. These studies largely grew out of the conceptual framework of Kurt Lewin, particularly apparent in terms of climate-style research, and culminating in the research of Lippitt and White on social atmosphere. Their series of studies utilizing artificially-induced atmospheres (authoritarian, democratic, and/or laissez-faire) reported results on the tendency of the same group of people to behave in markedly different ways when operating under leaders who behave differently. In addition to the innovation of artificially-induced atmospheres in experimental design, the studies are illustrative of social interaction as a statistical analysis problem. These studies also illustrate a defect in later studies in which teachers manifest assigned patterns of behavior. It appears there is confusing of assumptions about what leadership "ought to be" with research-oriented questions of "what produces what". Authoritarianism was equated with behaviors which could be classed as unfriendly or threatening in an a-priori fashion.[38]

The relevancy of these previous experiments is especially pertinent to the series of studies that define leadership as points on an hypothetical continuum. Whether the hypothetical continuum ran

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[38]As examples of the studies of Lewin, Lippitt, and White, see K. Lewin and R. Lippitt, "An Experimental Approach to the Study of Autocracy and Democracy: A Preliminary Note," Sociometry, 1938, 1, pp. 292-300, and K. Lewin, R. Lippitt, and R. K. White, "Patterns of Aggressive Behavior In Experimentally Created Social Climates," Journal of Social Psychology, 1939, 10, pp. 271-299.

from authoritarianism to democratic, or student-centered to instructor-centered, or from directive to non-directive, the experimental differentiation between treatments was similar -- either/or. Two studies using this concept of the hypothetical continuum, one by Faw, another by Asch, reflect the same problems as those cited about the previous studies. The nature of the two studies was similar, involving similar group sizes and procedures, the general purpose being to evaluate the overall effectiveness of non-directive teaching of an undergraduate course in general psychology as compared with the traditional lecture-discussion method. In each study, an attempt was made to more precisely delineate the theoretical structure of the leadership role in terms of academic outcomes. In the first study, mean examination scores for students in the student-centered group were significantly higher, although the students in the student-centered group had doubts about the amount of information and help they received under this method. The second study findings in terms of academic achievement were in reverse to those of the Faw study. Those in the instructor-centered directive group did significantly better on the final examination, but the students in the student-centered group felt their class situation had been more helpful to them in learning subject matter for the examination than did those in the instructor-centered group.[39]

Ambiguity in the study findings is paralleled by findings of no significant differences. A study by Eglash was similar in form,

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[39] V. Faw, "A Psychotherapeutic Method of Teaching Psychology," The American Psychologist, vol. 4, 6, 1949, pp. 104-109, and M. J. Asch, "Non-directive Teaching in Psychology: an Experimental Study," Psychological Monographs: General and Applied, vol. 65, 4, 1951, pp. 1-24.

conceptual framework, treatment and subjects to those mentioned previously. However, there were no significant differences between groups on examination performance, and there were no differences on attitudinal measures in general. There was a significant difference involving a "Quantitative Teacher Evaluation Form". The lecture class significantly felt that the course objectives were better met and the instructor's presentation did enhance learning. These results would indicate that there is a difference between actual achievement and what one's feeling of achievement is, thus indicating that students' feelings of satisfaction are a function of style of presentation as well as the instructor's personality and course content, and suggests an interesting interaction.[40] Another study also suggesting an interaction, this time between student ability and method of instruction, involved a similar design. However, in addition, subjects were subdivided according to measures of ability. Although there were no significant differences between the two groups, as a whole, there were significant differences among the sub-groups as to recall, recognition, and more understanding. The group method resulted in more understanding in learning, longer retention, and greater expression of individual differences. The lecture-demonstration method resulted in greater expression of individual differences, and longer retained, more understanding-type learning by the lower group.[41]

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[40] A. Eglash, "A Group Discussion Method of Teaching Psychology," Journal of Educational Psychology, 45, 5, pp. 257-267.

[41] J. Ward, "Group-study Versus Lecture-demonstration Method in Physical Science Instruction for General Education College Students," Journal of Experimental Education, 1956, 24, pp. 197-210.

Other studies have also attempted to add a further dimension to the role of the leader in terms of group behavior. For example, three separate studies over a ten year period (Deutsch, Smith, and Haines and McKeachie) each investigated competition and cooperation as factors on group cohesiveness and achievement performance. Variables associated with developing from group growth became apparent under conditions where members of the group were urged to cooperate, but no significant differences appear between cooperative and competitive treatments in regard to achievement performance. This suggests that perhaps certain results logically lend themselves to cooperative group structure, whereas other results are more easily interpreted in terms of a competitive classroom atmosphere. It would appear that this could be logically interpreted as the natural outcome of the research designs. Situations where individuals are urged to cooperate would be expected to produce stronger group orientation than conditions under which competition is urged. Lack of significant difference of achievement between groups could be interpreted as the natural outcome, since in essence the cooperative setting results in the effect of compressed variance, whereas in the competitive situation the effect of normal variance due to individual differences in learning is obtained. The results of this experimental phenomena in terms of the analysis of variance model is the accumulation of an abnormally large error term nullifying any potential results.[42]

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[42] M. Deutsch, "An Experimental Study of the Effects of Cooperation and Competition Upon Group Process, Human Relations, 1949, 2, pp. 199-231, A. J. Smith, "Productivity and Recall In Cooperative and

The studies cited in this discussion were chosen as examples of work over a time span of 30 years[43] to illustrate how sequentially over time attempts have been made to increase the precision of the Lewin model both in terms of theory and methodology, and to achieve more specific results, and that the degree of increase in stringent empiricism or more specific theoretical structures is difficult to assess.

These studies of factors in group behavior, particularly in relation to the role of the leader, have been discussed at some length for two reasons. First, they are representative of groupings of studies that have occurred around many factors believed to be of some importance in classroom instruction, and representative of the methodological problems in such studies. Second, the conceptual framework of the role of leader and group behavior is particularly germane to undergraduate college instruction where many courses, particularly in the students' first years, involve an attempt to employ "small group discussion" in the form of a combination of huge-lecture-small-discussion-group within a given course starring teaching assistants in the role of "leader", nine times out of ten.

The methodological problems associated with the statistical analysis of data involving many variables, many subjects, presence of data in nominal form, and so on, can be illustrated by the example of

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Competitive Discussion Groups", Journal of Psychology, 1957, 47, pp. 193-204, D. Haines and W. McKeachie, "Cooperative Versus Competitive Discussion Methods In Teaching Introductory Psychology," Educational Psychology, 1967, 58, 6, pp. 386-340.

[43] J. Kerrick, "Lecture Versus Participation in the Health Training of Peace Corps Volunteers," Journal of Educational Psychology, 1967, 58, 5, pp. 259-265, as a recent study in the same vein.

the number of studies, over time, attempting to identify and assess the relative importance of factors believed to be important in predicting college success of a student. Astin attempted to identify those factors associated with students who drop out of college, in a four year longitudinal study of 6660 students,[44] while Sgan attempted to identify the importance of the Scholastic Aptitude Test in rank in graduating college class,[45] while Barger and Hall attempted to establish the relative importance of personality patterns on the Minnesota Multiphasic Inventory to achievement in college.[46] In a review of such studies, Hopfenspirger concludes that, "in spite of the many studies which have been made in order to find accurate predictions of college success, little progress toward improved predi-ction has been achieved. Current studies reflect findings similar in level and precision to those made thirty years ago. Despite inno-vations in statistical techniques it is unusual to find a correlation between college grades and other measures above the level of 0.60, and most correlations reported fall in the range of .45 to .55.[47] The

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[44]Alexander W. Astin, "Personal and Environmental Factors Associated with College Dropouts Among High Aptitude Students," Journal of Educational Psychology, 55, April, 1964, pp. 219-224.

[45]Matthew R. Sgan, "An Alternative Approach to Scholastic Aptitude Tests as Predictors of Graduation Rank at Selective Colleges," Educational and Psychological Measurement, 24, February, 1964, pp. 347-50.

[46]Ben Barger and Everette Hall, "Personality Patterns and Achievement in College," Educational and Psychological Measurement, 24, February, 1964, pp. 339-341.

[47]P. Hopfenspirger, "An Investigation of three statistical Techniques and Their Applicability in Prediction of College Success," (unpublished Master's thesis, George Washington University, 1967), p. 4.

predicting methodology has been, traditionally, linear regression using as few independent variables as possible to produce an estimate of the dependent variable, with the evaluation of precision typically being the amount of variation in the dependent variables "explained" by the independent variables. Hopfenspirger concluded that the statistical technique of regression analysis was capable of producing useful predictions, providing the data could be adjusted to meet the criteria of the regression model without excessive transformations which themselves could well affect results. However, under rigid assumptions of the linear models sufficient transformations made results dubious.[48]

Criticisms by those trying to use research findings to improve instruction are reflected in research difficulties of identifying and assessing the relative importance of instructional setting factors.

However, Hilgard's contention that learning theories can provide only global structures for instructional improvement is challenged by Ausubel on grounds that direct extrapolations fail but suggestions related to teaching course materials are best derived from learning theory.[49] According to Ausubel, cognitive learning theorists maintain that meaningful verbal learning is the "human mechanism best suited for acquiring and storing the vast quantity of ideas and information represented in any body of knowledge."[50] Whereas rote learning and retention are influenced primarily by the

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[48]Hopfenspirger, loc. cit., p. 31.

[49]Hilgard, loc. cit., pp. 571-572.

[50]Ausubel, loc. cit., p. 219.

interfering effects of similar rote materials learned immediately before or after a learning task, meaningful learning and retention are influenced primarily by the properties of the relevant subsuming ideas in cognitive structure with which they interact.[51] In his theory, new meanings are acquired when potentially meaningful symbols, concepts, and so on are related to and incorporated within the cognitive structure on a nonarbitrary, substantive basis. He has attempted to incorporate such learning theory propositions as cueing, overlearning, retroactive inhibition, and so on, into a framework applicable to classroom experimentation. For example, in a study on the learning of college text-type materials, Ausubel, Robbins, and Black demonstrated that memory of a passage on Buddhism was not affected adversely by later study of a passage on Christianity, and in fact when passages repeated points from the earlier material, memory was actually facilitated, if the passages were learned in accordance with his structure of "meaningfulness".[52]

Skinner's applications of principles of operant conditioning to programmed instructions, and of Lumsdaine's, who attempted to show that Guthrie's views more accurately account for what is done in programmed learning, tend to refute criticisms of those who question the value of learning theory in instructional improvement.[53]

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[51] Meaningful verbal learning is simply that kind of learning which takes place when potentially meaningful verbal material is substantially related to or subsummed under existing knowledge already held by an individual, and done in a nonarbitrary way. This presupposes a meaningful learning set on the part of the learner.

[52] D. Ausubel, P. Robbins, C. Lillian, and E. Blake, "Retroactive Inhibition and Facilitation in the Learning of School Materials, Journal of Educational Psychology, 1957, 48, pp. 334-343.

The question becomes, however, what should be the relative importance attached to such factors within the context of the classroom. Ausubel has confined his structures principally to less complex verbal learning rather than problem solving tasks, and the differential effects of learning set are still open to question. In the case of the relative importance of programmed instruction represented via teaching machines and workbooks, they may have many theoretical advantages over lecturing or other instructional methods of a conventional nature; however, little experimentation has been done at the college level to determine their usefulness within the interactive nature of factors affecting college student behavior.[53]

Another approach reflected in the literature to determine the qualitative value of instructional setting variables is to identify those providing optimal value in classroom instruction by studying the instructional complex from a particular point of view, such as focusing on characteristics of the learner or on certain environmental characteristics (including the teacher) which affect the learner.

However, at the college level, Nevitt Sanford points out that until very recently the college student has been "a familiar hero of psychological literature---intelligent, cheerful, and above all available, long a favorite subject of experiments designed to establish general truths about human behavior. But he has not often been investigated as a student; in other words, it is not often that

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[53]W. J. McKeachie, "Research on Teaching at the College Level," in N. L. Gage, (ed.), Handbook of Research on Teaching, (Chicago: Rand McNally and Company, 1963), p. 1155.

psychologists or other social scientists have studied his behavior as a response to the demands of the role of student."[54] But over time a number of studies have indicated student traits, abilities, attitudes, and so on, which appear important to student behavior in the classroom.

Past performance as a factor has been investigated both in terms of differences among students in mental abilities and differences in past academic performance. A series of studies by Cronbach, Henry, Dyer, Fishman, and Whitla indicate test scores on college "entrance" examinations such as college boards correlate .35 to .55 with college grade-point average.[55] Large-scale studies of the general intelligence of undergraduate students (Educational Testing Service, Fosmire[56]) infer that the average intelligence test scores of major groups of students regularly fall into an order in terms of major field of interest chosen for study, although Wolfle indicates that the interpretation of these findings can be misleading in that such

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[54]Nevitt Sanford (ed.), The American College, (New York: John Wiley and Sons, Inc., 1962), p. 531.

[55]See a series of studies: Lee J. Cronbach, Essentials of Psychological Testing, (New York: Harper & Bros., 1949), Ervin R. Henry, "Predicting Success in College and University," Handbook of Applied Psychology, Douglas H. Fryer et al (eds.) (New York: Rinehart & Co., 1950), pp. 449-453, Henry S. Dyer, College Board Scores, (New York: Colllege Entrance Examination Board, 1955), J. A. Fishman, "1957 Supplement to College Board Scores, No. 2", (New York: College Examination Board, 1957), Dean K. Whitla, Handbook of Measurement and Assessment in Behavioral Sciences, (Reading, Mass: Addison-Wesley, 1968).

[56]See Educational Testing Service, Annual Report, 1951-1952, F. R. Fosmire, "Generality of Some Academic Reputations, Science, 1956, 124, pp. 680-681.

fields as business or education, looking poor in terms of mean intelligence scores or overall score distribution, have about the same share of the top students as do the more academic fields.[57] The role of grade-point average in determination of current performance is complicated by the fact that GPA is itself a complex indice, involving such facets as student motivation and teacher grading practices.[58]

Achievement motivation as a factor in academic performance has been investigated both by questionnaire and projective technique. Studies involving the Edwards Personal Preference Schedule indicate a correlation between achievement motivation and academic performance;[59] the studies involving the Thematic Apperception Test report inconsistent findings, those of McClelland[60] and of Weiss[61] found a positive correlation, those by Haber[62] and by Farquhar and Krumboltz[63]

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[57]D. Wolfle, America's Resources of Specialized Talent, (New York: Harper Bros., 1954).

[58]David E. Lavin, The Prediction of Academic Performance, (New York: Russell Sage Foundation, 1965).

[59]Dean K. Whitla, "Research in College Admission," in Educational Evaluation: New Roles, New Means, Ralph W. Tyler (ed.), Chicago: National Society for the Study of Education, 1969), p. 90.

[60]David C. McClelland, "Issues in the Identification of Talent," in Talent and Society, David C. McClelland et al. (eds.), Princeton: Von Nostrand Co., 1958).

[61]Peter Weiss, "Achievement Motivation, Academic Aptitude, and College Grades," Educational and Psychological Measurement, 29, (Winter, 1959), pp. 663-666.

[62]Ralph N. Haber, "The Prediction of Achievement Behavior by an Interaction of Achievement Motivation and Achievement Stress," Dissertation Abstracts, Vol. 17, 1957, pp. 2686-2687.

[63]William W. Farquhar and John D. Krumboltz, "Reliability and Validity of the N-achievement Test," Journal of Consulting Psychology, 21, (1957), pp. 226-228.

found no correlation. Motivation by fear and motivation by hope were investigated by Atkinson and Litwin, who found male college students high in test anxiety were first to complete exams and did poorer work than during the course, as opposed to those students with positive motivation to succeed.[65] Studies using general measures of anxiety not related specifically to test-taking have not shown significant relations to measures of academic performance.[66]

Degree of interest in the subject being taught as a factor in academic performance is not clearly understood. Cronbach found such measures to have a low correlation with grades alone.[67] Studies of interest-test scores in relation to specific occupations are unclear. In studies of medical and engineering students, interest-test scores were unrelated to overall performance in that curriculum when ability was controlled, although related to some specific course aspects.[68]

Differences in attitudes among undergraduates has been viewed largely in terms of positions popularly regarded as "liberal" or "conservative". With some consistency, the most conservative groups are in applied rather than academic fields. Students in education

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[65] J. W. Atkinson and G. H. Litwin, "Achievement Motive and Test Anxiety Conceived as Motive to Approach Success and Motive to Avoid Failure," Journal of Abnormal Psychology, 60, 1960, pp. 52-63.

[66] Dean K. Whitla, in Ralph W. Tyler, loc. cit., p. 90.

[67] Cronbach, loc. cit., pp. 108-115.

[68] V. H. Hewer, "Vocational Interest-Achievement-Ability Interrelationships at the College Level," Journal of Counseling Psychology, 4, (1957), pp. 234-238.

are difficult to classify. Those in secondary education reflect the attitudes of their prospective teaching fields, and those in elementary and physical education tend to be among the most conservative groups.[69] The studies do not differentiate those with internalized attitudes from those whose attitudes are largely external "trappings" nor is it clearly specified as to the relationship of such attitudes in classroom interaction. The evidence indicates that major changes in attitudes or values of college students do not take place in the short space of time within a given course setting.[70] Jencks and Riesman contend that the docility registered in the majority of classes by students is simply a confirmation of the student attitude of the educator's irrelevance to contemporary culture.[71]

Authoritarianism as reflected in held beliefs has been investigated in a series of studies by Stern, Stein, Bloom, and Pace. Students high on a variable akin to authoritarianism (rigid, uncritical of held beliefs, as two examples) were found to gain more when taught in an homogeneous group and to prefer lecture conditions.[72] More

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[69]Carl Bereiter and Mervin Freedman, "Fields of Study and the People in Them," in The American College, Nevitt Sanford, (ed.), (New York: John Wiley and Sons, Inc., 1962), p. 568.

[70]Paul L. Dressel, "The Role of Evaluation in Teaching and Learning," Evaluation in the Social Studies, Harry D. Berg (ed.), (Washington D. C.: National Council for the Social Studies, 1965), p.5.

[71]C. Jencks and D. Riesman, The Academic Revolution, (New York: Doubleday, 1968), pp. 163-192.

[72]G. G. Stern, "Environments for Learning," in The American College, N. Sanford (ed.), (New York: John Wiley and Sons, Inc., 1962), pp. 690-730.

complicated are the findings of Koenig and McKeachie that flexible nonauthoritarian women participate more in small groups than do rigid women, but the relationship is reversed for men.[73]

Extent of student independence as a factor in classroom instruction has been investigated by Wispé. Students differentiated as "insecure" on TAT-like measures had unfavorable attitudes toward permissive teaching situations; those differentiated as "satisfied" had favorable attitudes toward instructors and fellow students and either permissive or directive teaching methods; "independent" students had moderately favorable attitudes toward fellow students and the instructors, but wanted more permissive teaching, regardless of method used.[74]

The studies cited in relation to learner characteristics represent examples of the foci of interest in such research. Over the past ten years reviewers in compendia of these studies, attempting to put them in perspective in terms of improving instruction, have noted similar problems: in many studies the differences among groups are very small and tentative; among similar studies, inconsistent findings.[75]

Similar results are reflected in the studies with primary

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[73] K. Koenig, and W. J. McKeachie, "Personality and Independent Study," Journal of Educational Psychology, 1959, 50, pp. 132-134.

[74] L. G. Wispé, "Evaluating Section Teaching Methods in the Introductory Course," Journal of Educational Research, 1951, 45, pp. 161-186.

[75] See Sanford (1962) op. cit., Gage (1963) op. cit., Lavin, (1965) op. cit., Whitla (1968) op. cit.

focus on teaching method. Studies of size of lecture class or size of discussion class in relation to exam performance, or instructor-centered versus student-centered teaching approaches in relation to exam performance and attitudes often reflect inconsistent findings among studies and nonsignificant differences due to the fact that optimal factors for some students are detrimental to the achievement of others. Some analyses of teaching methods take such individual differences into account. For example, Siegel's findings suggest a tendency for high ability students to gain more in course-related attitudes in small rather than large sections;[76] Calvin, Hoffman and Harden found less intelligent students did better in problem-solving situations conducted in an authoritarian manner rather than a permissive manner.[77]

Use of results of studies focusing on teacher characteristics have also encountered difficulties. For example, a number of scales have been developed to investigate teacher attitudes. Scores tend to be a function of grade level of teaching and of major field of interest. However, studies in relation to the role of these attitudes in the classroom tend to assume teaching involves a unitary attitude, and pool the data obtained from such scales. In addition, findings suggest that teacher attitudes vary in validity in terms of teacher effectiveness in the classroom according to the values held by students

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[76] L. Siegel, "Students' Thoughts During Class: A Criterion for Educational Research," Journal of Educational Psychology, 1963, 54, pp. 45-51.

[77] A. D. Calvin, F. K. Hoffman, and E. L. Harden, "The Effect of Intelligence and Social Atmosphere on Group Problem-solving Behavior," Journal of Social Psychology, 1957, 45, pp. 61-74.

who are interacting with the teacher.[78] Similar results are found in studies related to values held by teachers. Findings suggest that in at least two of the value areas measured by such inventories (economic and social) teachers might, as a group, be distinguished from the general population. Even more important to the understanding of teacher performance are the differences between various teaching specialties. However, the usefulness of such findings, in isolation, in terms of teacher performance in the classroom has not been demonstrated.[79]

Another focus of studies of teacher characteristics is that area referred to in the literature as "personality" -- factors such as degree of introversion or extent of femininity. Such studies seem to fall into two major categories: studies attempting to discriminate between teachers and nonteachers with scales such as those of the Minnesota Multiphasic Personality Inventory;[80] and studies attempting to assess the relationship of scores on such scales to measures of teacher "effectiveness" in the classroom.[81] A question raised by many of these studies is whether the same teacher, no matter

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[78]Getzels and Jackson, op. cit., pp. 515-523.

[79]R. D. Mann, Interpersonal Styles and Group Development, (New York: Wiley, 1967), pp. 89-116.

[80]Allen L. Edwards, The Measurement of Personality Traits, (New York: Holt, Rinehart and Winston, Inc., 1970), pp. 167-190.

[81]Getzels and Jackson, op. cit., pp. 534-551.

what his personality, will affect all students the same way. The assumption is made that there is one ideal teacher equally effective with all students.

Studies of how intellectual ability contributes to teacher performance in the classroom have had limited success. Findings from the numerous studies in which intelligence tests have been administered to teachers in an attempt to assess its relation to performance are inconsistent. The role played by different types of cognitive functioning such as divergent thinking and by possible attitudinal correlates of such abilities in the performance of the teacher has not been explored in interaction with students in the classroom.[82]

The previous discussion of findings in the literature serves as an example of the basis upon which those looking for help to improve classroom instruction make charges that the results or implications of studies are often difficult to generalize into the classroom setting and fail to lead to actual procedural efforts to improve instructional results. However, it is evident that from whatever particular point of view the researcher has chosen to view the instructional complex (however narrowly defined), the difficulty in many cases is not inadequate conception or development in the study but that the results taken in isolation explain a very small portion of behavior when viewed within the entire instructional complex.

Accordingly, there have been some attempts to define conceptual frameworks for instructional research which are based on

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[82]Philip W. Jackson, Life in Classrooms, (New York: Holt, Rinehart and Winston, Inc., 1968), 146-155.

the assumption that factors comprising the instructional complex interact. An example of a study based upon such a framework is that of Siegel and Siegel, who have conceptualized what they refer to as the instructional gestalt -- the educational process as viewed in terms of broad frameworks which "give appropriate recognition to the variety of instructional settings, teaching procedures, simultaneously exposed learners, and multiple criteria of effectiveness without sacrificing either the essential flavor of the instructional process or specificity of its conditions."[83]

The Siegels' particular framework focused upon four clusters of independent variables, identified as instructor, learner, course, and classroom environment clusters. Specific variables within each of these four clusters, chosen on the basis of previous research findings, were specified as the most "potent determinants of what transpires within the instructional gestalt."[84] Alternative criteria for assessing instructional effectiveness were specified, as was the expectation that components of the gestalt probably would interact differently for the different criteria. Under these conditions there would be no one best instructional method. The best method would be a function of the educational objectives, the circumstances, and the participants. Interactions would occur between the variables within a given cluster and between variables across the

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[83]Laurence Siegel and Lila Corkland Siegel, "A Multivariate Paradigm for Educational Research," Psychological Bulletin, 1967, 68, 5, pp. 306-326.

[84]Laurence Siegel and Lila C. Siegel, The Instructional Gestalt in Televised University Courses, Number 609, United States Department of Health, Education, and Welfare, Office of Education, p. 27.

the four clusters. For example, the variable academic ability, from the learner cluster, supposedly would be in interaction with selected environmental, instructor, and course variables from the remaining clusters. Whereas specific aspects of the instructional complex may stimulate bright students, the very same elements may threaten or discourage students of less ability. Thus the model must focus on the interactive relationships between variables comprising the instructional complex, as well as upon the summary or main effects. The assumption underlying this framework is that effects of various kinds of instruction within a given course could be conceptualized and empirically studied in relation to variation in learning environments, learner characteristics, and the relevant activities of the instructor, with the hope of discovering combinations of learner, instructor, environmental, and course variables optimizing desired educational outcomes.

In making the transition from the generalized paradigm to the application of it in research in the classroom the difficulties encountered in the reported study raise again the problem discussed by Campbell and Stanley and Box in chapter one, the reconciliation of models. In the factorial design with analysis of variance the multivariate paradigm was of necessity simplified. Nine independent variables were used: two from the environmental, two from the instructoral, and five from the learner cluster. The three variables from the course cluster were eliminated from the analyses by developing separate analysis matrices for each course, preventing accumulation of data pertaining to the interactions between these variables and the

others explored. The learner variables though continuously distributed were dichotomized, excluding the middle forty per cent of each learner distribution. The complex analysis of variance model does identify when significant interaction is present, but unless the interactions are clearly hypothesized at the start, this approach does not provide a basis for empirical interpretation of the nature of these interactions. Rather, significance observed at one of the levels of interaction serves only to demonstrate that main effects are confounded. However, the design did serve as the investigators suggest, first, as a means for sensing interactive conditions probably present in the instructional setting, and second, if interactions are not present, to add strength to the generalization of main effects.

Background of Study Setting

The background of the setting for this study mirrored the problems discussed in relation to the studies reviewed in the literature -- namely, classes of undergraduate students with increasing numbers and increasing heterogeneity in characteristics, difficulty in assessment of the relative importance of variables in the instructional setting in a manner functional to improving instructional conditions, and difficulty in utilization of findings from research studies, for any combination of reasons examined by Campbell, Stanley, and Box in chapter one.

The setting of the study was the first course in the undergraduate teacher-preparation sequence, which can be categorized as a lecture-discussion group, multi-section, survey-type course. The instructional content of the course included, secondarily, an introduction to the teaching profession and to the program of teacher education, and primarily an introduction to the subject matter in the area of educational psychology. Anywhere from seven hundred to one thousand students were enrolled in the course in any given term.

The course itself was part of the curriculum offered in the College of Education at Michigan State University. Trow has outlined the predominant characteristics of large state-supported institutions (in which category this university falls) as being: first, a relatively high student to faculty ratio; second, a research-oriented faculty with a possibly genuine but limited interest in undergraduate teaching; third, a student body of great heterogeneous academic ability and motivation.[85]

The principle method of compensating for these characteristics has been to use senior faculty primarily in graduate instruction and research and in highly specialized upper-level undergraduate areas, while limiting the contribution of such faculty in the early educational phase of undergraduates to large lecture settings. The instructional gap thus created is typically filled by the teaching-assistant (usually a graduate student enroute to his doctorate) in a classroom structure of either the lecture-discussion section approach or the multi-section, independent-instructor approach with common curricular examinations.[86] The expected consequences of such instructional situations, if large numbers of students are enrolled and if there is failure to compensate for the heterogeneous

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[85]Martin Trow, "The Undergraduate Dilemma in Large State Universities," Universities Quarterly, December, 1966, pp. 17-18.

[86]Ibid., p. 30.

student population, would be:

> "the good students becoming lost, bored, and remaining unchallenged; the middle students -- and all of the students to some degree -- disassociating the material (theory and research) from their lives and their futures and from implications other than related to the discipline; the poor students becoming totally uninvolved because they cannot compete with the good students, and because within this setting, they cannot compensate in any way for the entering differential."[87]

Sources of suggestions for improvement of undergraduate instruction at Michigan State University parallel those sources for undergraduate education in general, mentioned in the introduction to the review of the literature in the previous section of this chapter. The generalized student comments on "relevant" education in the Carnegie Commission report are mirrored by comments in the editorials of the campus newspaper which in a discussion of the University's commitment to undergraduate education, referred to "undergrads getting 'inferior' education from graduate assistants."[88] The University Committee on Undergraduate Education based its recommendations for improvement of undergraduate education on the following stated principles: interaction between teacher and student as the primary consideration in implementing programs; programs would be judged on learning and scholarship; quality of instruction and the teacher as a model were to be the main concern of both individual faculty members and undergraduate programs; liberal education in terms of human development was to be enlarged as the foundation of

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[87] Ibid., p. 35.

[88] The State News, University campus newspaper, May, 1969.

the institution's approach; educational opportunity was to be a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact.[89] The College of Education, of which the course used in this study was a part, also provided suggestions for improvement of undergraduate education. The report of the College's Curriculum Review Committee stated,

> Providing quality programs to large numbers of students is one of the most challenging tasks faced by large universities.....In order to give undergraduate instruction the emphasis which we believe it deserves, the College of Teacher Education has designed a plan which will bring our undergraduate students in contact with outstanding senior faculty members and at the same time allow for student identification with a small group where his individual questions and comments can become meaningful.[90]

The actual physical representation of this plan to provide a "quality program to give undergraduate instruction the emphasis....it deserves," in terms of the course used in this study, was a lecture-discussion section format involving a number of composite parts: one course coordinator and evaluator, one teaching internship advisor for the teaching assistants, eight faculty lecturers, sixteen graduate teaching assistants, and seven hundred to one thousand-plus students (mainly sophomores, but some juniors and

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[89]Committee on Undergraduate Education, Improving Undergrad. Education: The Report of the Committee, (East Lansing, Michigan: Michigan State University, 1967).

[90]Curriculum Review Committee, "Organizational Plan For Foundation Courses," Report on Undergraduate Curriculum Revision, mimeograph, (East Lansing: College of Education, Michigan State University, April, 1965), p. 1.

a few seniors), plus two different hours during the day at which times the format was offered to the students, using the same instructional personnel. At whichever time chosen to take the course the student met on alternate days with other students for one large lecture section or in his discussion section of approximately twenty-five to thirty students.

Briefly, the role of the course coordinator was to "be the person responsible for bringing unity to the course....(and to) also be responsible for the coordination of the discussion sections." The role of the teaching internship advisor for the teaching assistants was to coordinate a content seminar for the teaching assistants and conduct a seminar in the methods and development of college teaching, in which the assistants were required to participate. The role of the course evaluator (in this instance also the course coordinator) was to construct examinations because "examinations in a course enrolling large numbers of students are doubly important. The construction of evaluation instruments which will properly measure the progress students make toward the predetermined goals of the course is a most important function."[91]

The role of the senior faculty can best be explained by the fact that the content of the course was to center around the main interests of the faculty, that is, their areas of specialization, in this instance, primarily areas within educational psychology.

> Senior faculty members who have a particular competence in some portion of the course content and who

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[91] *Ibid.*, p. 2.

> are known to be outstanding lecturers will be invited to give lectures on that portion of the course which falls within their particular area of interest and competence. Each senior faculty member thus will be involved with only from three to six lectures covering a particular unit of the course. Other times he will be free to pursue other research or instructional responsibilities.. ...We expect that it will become much easier to employ competent new staff whose responsibility it will be to only make specialized contributions to the instruction in the undergraduate basic courses.[92]

The role of the graduate teaching assistant under this format became the following:

> The students will meet in small (under thirty-five) discussion sections which will be conducted by graduate assistants (TA's) employed for this purpose. During these sessions it is expected that the student will have an opportunity to have his questions clarified and be identified as an individual within the total group. It is expected that the discussion sections will be related closely to the lectures and that here the student will be concerned with the application to classroom problems of the concepts covered during the lecture sessions.[93]

In chapter one Campbell advocated the implementation of research programs within already established instructional settings, on the premise that over time via replication a body of data would be developed to be used as the basis for additional testing of hypotheses about the nature of instructional variables. (The extension of this, of course, was that ideally cross-validation would be occurring by other such programs in similar situations.) Under such a program the initial purpose would be to discover the

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[92]<u>Ibid</u>.

[93]<u>Ibid</u>.

structure of relations among variables in a specified instructional setting, and under what conditions and through what intervening processes this relationship occurs. Under such research conditions not only would it be necessary to take into consideration the reconciliation of research and statistical models as stressed by Stanley and Box, but to take into consideration a less precisely delineated "model". This latter model is not the components of the physical setting but the set of assumptions about learner characteristics, environmental characteristics, and instructional process expressed (however implicitly) by the course designers and is a reflection of what they supposedly judge to be "important" factors. These assumptions are reflected in the criteria (goals, objectives, and so on) specified for the particular instructional situation. The instructional process and the outcomes as reflected in the learners during and by the end of the course are supposedly reconciled to the theoretical assumptions in the designers' model.

In the course used for this study the "implied" model, composed of a set of assumptions about the structure of relations among variables in the instructional setting, was reflected in the Review Committee's plan to implement the goals of the University and the College of Education to improve undergraduate education. The overall goal was to "provide quality programs for large numbers of students.....in order to give undergraduate instruction the emphasis....it deserves." Quality programs themselves would appear to be strategies -- an organization of planned interventions, sequences, and sets of standards to be used in the development of the students. Any given course within these programs would implicitly be providing a level of instruction which would guarantee the expected "quality". So, within the course setting used in this study these same goals would be reflected.[94]

One such goal provided that educational opportunity was to be a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact. This implies recognition of the heterogeneity of students. However, the role of senior faculty was confined to mass lecture sections. Therefore it would appear that the assumption was that the teaching assistant within the discussion section setting was able to make discriminations among students on the basis of this heterogeneity and to provide the opportunities for students to overcome barriers created by differential entering characteristics. The course also provided for common, multiple-choice exams, but the final grade was to be a weighted composite of sixty per cent exam grades, forty per cent instructor grade (determined on whatever basis the instructor considered important). So, a second assumption of this model was that the teaching assistants' grades made discriminations on important instructional setting variables that the common exams did not discriminate upon; a third assumption would appear to be that the the common exams themselves did not create an atmosphere based mainly on competition for the high exam score alone.

Another goal provided that a course be judged on the the basis of the learning and "scholarship" generated among students

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[94]The University and College of Education goals were specified by detailed quotations on pp. 53 - 56.

by it. The first assumption appears to be that the content provided by the faculty from diverse areas of specialization would be viewed by students as a sound basis for organizing their approach to the role of educational psychology in their own future teaching, and not be viewed as disparate entities. The second assumption about what the nature of the learning experience in this course should be is reflected in the list of competencies to be developed by this course specified by the Curriculum Review Committee and appearing in detail in Appendix A. With two exceptions the key word in each objective is either "understands" or "recognizes" or "distinguishes" which can be interpreted to mean the student is able to recall some piece of information for a multiple-choice exam or can apply a principle to a multiple-choice question. A third assumption about the nature of the learning experience in this course is that the more complex problem solving thought process was to take place in the discussion section where "the student will be concerned with the application to classroom problems of the concepts covered during the lecture sessions." Implicit here is the notion that the teaching assistants possessed the skills to help students to integrate disparate lectures and readings in a problem-solving approach to future teaching experiences.

An additional goal of the course was embodied in three aspects. First, interaction between teacher and student was to be a primary consideration in implementing a course of instruction. Second, not only quality instruction but also the teacher as a model were to be the main concern of faculty members. Three, a primary objective of any course in this sequence of teacher preparation was to contribute to the development of those "basic understandings, skills, and attitudes which characterize a teacher who can respond competently to all situations within which he must function."[95] The concept involved in this three-part goal was that over a sequence of courses the models represented by teachers would have meaning to students, due to the interaction of faculty with students. Students were to be exposed to eight senior faculty members in nine weeks via large lecture sections. The assumption would seem to be that any interaction which might result in students perceiving their teacher as model in some form would be within the discussion section.

A consideration underlying each assumption in the "implicit model" would appear to be that a decrease in faculty participation was possible on the basis of projected teaching-assistant performance. Trow has questioned the validity of this assumption, asserting that: teaching assistants are often poor instructors, less competent, less able in the content field, and poorly motivated to be an assistant; since the design of the course is established by the senior faculty, the formal content reflects their academic interests and any implications or relevance of the material to the students' lives is left to the TA; since the TA is generally weak in content, rarely does true integration take place, and examples, discussions, and activities within the TA's instruction are involved with his beliefs and experi-

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[95]Leland Dean, Associate Dean of the College of Education, Memorandum to the Educational Development Project, as Preface to the College of Education Curriculum Review Committee's Report on Undergraduate Curriculum Revision, mimeograph, (East Lansing, Michigan: Michigan State University, April, 1965).

ences rather than with content, skills as representative of the content, and the true implications or questions related to the material.[96] However, it would appear that the assumption was made that by providing a content seminar in which senior faculty discussed their projected lectures with the TA's, and by providing an additional seminar concerned with the methods and development of college teaching, the problems raised by Trow could be averted.

The above assumptions constitute the "model" underlying the instructional process in the natural setting chosen for the study. It is the set of assumptions which delineates the conditions under which the instructional process operates in that natural setting and cannot be ignored if the researcher plans to alter the structure of those relationships in any way. Neither those variables implied by the assumptions of the model nor those in operation in the ongoing situation are necessarily synonymous with those having actual "importance" to the improvement of instruction.

Summary

Many undergraduate college courses serve as exemplars of the failure to compensate in instructional procedures for the dimensions of any factors beyond the homogeneous descriptions of predominant characteristics in the instructional situation. However, recently a great deal of attention has been directed toward the subject of improving instruction at all levels of higher education, particularly the instruction of undergraduates.

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[96] Trow, *op. cit.*, pp. 19-23.

Suggestions for improvement often appear to have an amorphous quality because the factors discussed as relevant to improvement are expressed as generalities. Although some overgeneralities might be assumed away as showing lack of careful thought, the number of such examples in the literature suggests that this lack of specificity as to what dimensions of the factors in the instructional setting are of most relative importance in the improvement of instruction is partially a reflection of the criticisms of research on teaching and learning discussed in chapter one.

The first section of chapter two constituted a review of the literature. Since the setting for this study was at the college level, the review of the literature is confined to studies of instructional setting variables at that level. The studies chosen are examples of a number of studies reflecting the problems of methodology and application to ongoing instructional settings discussed in chapter one.

The criticisms by researchers of methodology related to such problems as failure in specificity of criterion, in maintaining homogeneity and independence, in analyzing interactions was illustrated from the literature by a series of studies which investigated factors in group behavior. The studies cited were chosen as examples of work over a time span of thirty years to illustrate how sequentially over time attempts have been made to increase the precision of the early Lewin model both in terms of theory and methodology, and to achieve more specific results, and that the degree of increase in stringent empiricism or more specific theoretical structures is difficult to asses. In addition, this group of studies was illustrative of groupings of studies that have occurred around many factors believed to be of some importance in classroom instruction. Further, the conceptual framework of the role of leader and group behavior is particularly germane to undergraduate college instruction where many such courses attempt to employ lecture-discussion formats.

The methodological problems associated with the statistical analysis of data involving many variables, presence of data in nominal form, and so on, was illustrated by the example of the number of studies, over time, attempting to identify and assess the relative importance of factors believed to be important in predicting college success of a student. Current studies reflect findings similar in level and precision to those made thirty years ago.

Criticisms by those trying to use research findings to improve instruction, to the effect that the results or implications are difficult to generalize into the classroom setting and fail to lead to actual procedural efforts to improve instructional results was illustrated by a series of studies from the literature conducted from the point of view of learning theorists, in the classical mold, from the point of view of learner characteristics specifically related to instruction, and from the point of view of instructor characteristics. Among all studies, inconsistent findings and lack of significant differences made forming any pattern difficult. For example, the studies related to characteristics of the learner suggest that: academic performance seems higher for students with more favorable attitudes toward school, greater interest in the subject area, and greater degree of achievement motivation; who have a more positive self-image, less anxiety in test-taking situations, have greater cognitive flexibility, are less defensive, and are more conforming. The difficulty is that the differences among the groups in the studies are very small and tentative. It is evident from the literature that from whatever particular point of view the instructional eomplex is chosen to be viewed by the researcher, the difficulty in many cases is not inadequate conception or development in the study but that the results taken in isolation explain a very small portion of behavior when viewed within the entire instructional complex.

Accordingly, there have been some attempts to define conceptual frameworks for instructional research which are based on the assumption that the factors comprising the instructional complex interact. As an example of such an approach, the paradigm of L. Siegel was discussed, which conceptualizes what Siegel refers to as "the instructional gestalt". This particular framework focused upon four clusters of independent variables, identified as instructor, learner, course, and classroom environment clusters. Specific variables within each of these four clusters were specified as the most "potent determinants of what transpires within the instructional gestalt". Interactions would occur between the variables within a given cluster and between variables across the four clusters. Thus the model must focus on the interactive relationships between variables comprising the instructional complex, as well as upon the summary of main effects. In making the transition from the generalized paradigm to the application of it in research in the instructional setting the difficulties encountered in the study raise again the problem discussed by Campbell and Stanley and Box in chapter one, the reconciliation of models. In the factorial design with analysis of variance the multivariate paradigm was of necessity simplified. In addition, the complex analysis of variance model does identify when significant interaction is present, but unless the interactions are clearly hypothesized at the start, this approach does not provide a basis for empirical interpretation of the nature of these interactions.

The second section of chapter two outlined the background for this study to be reported in the following chapters. The setting was the first course in the undergraduate teacher-preparation sequence, which can be categorized as a lecture-discussion group, multi-section, survey-type course. The instructional content of the course included, secondarily, an introduction to the teaching profession and to the program of teacher education, and primarily an introduction to the subject matter in the area of educational psychology.

The actual physical representation of this course involved a lecture-discussion section format made up of a number of composite parts: one course coordinator and evaluator, one teaching internship advisor for the teaching assistants, eight faculty lecturers, sixteen graduate teaching assistants, seven hundred to one thousand-plus students (mainly sophomores, but some juniors and a few seniors), plus two different hours during the day at which times the format was offered to the students, using the same instructional personnel.

In chapter one Campbell advocated the implementation of research programs within already established instructional settings. Under such a program the initial purpose would be to discover the structure of relations among variables in the specified instructional setting, and under what conditions and through what intervening processes this relationship occurs. Under such research conditions not only would it be necessary to take into consideration the reconciliation of research and statistical models as stressed by Box and Stanley, but to take into consideration the "model" underlying the instructional process in the natural setting chosen for the study. This model is the set of assumptions which delineates the conditions under which the instructional process operates in that natural setting.

In the course used for this study the "implied" model, composed of a set of assumptions about the structure of relations among variables in the instructional setting, was reflected in a plan to implement the goals of the University and those of the College of Education to improve undergraduate education. The overriding goal was to provide "quality" instruction to large numbers of students while at the same time decreasing the participation of senior faculty in providing this quality instruction. The assumption was made that this decrease in participation was justified on the basis of projected graduate teaching-assistant performance. Under these conditions, the teaching assistant would provide the only means for individualization of instruction or for participative instruction; due to the impersonality of lectures and exams, students would tend to identify the course with the discussion section; because of constantly shifting subject matter -- the result of changing faculty lecturers, the TA's would be responsible for clarification and continuity; a primary goal of the course was to act as a first step in the development of the students toward becoming "competent" teachers, and it rested with the teaching assistant to be a model of teaching competence broadly exhibiting the attitudes, skills, and understandings theoretically specified as necessary for this role.

The above comments summarize the assumptions which constituted the "model" underlying the instructional process in the natural setting chosen for this study. Neither those variables implied by the assumptions of the model nor those in operation in the ongoing situation are necessarily synonymous with those having actual "importance" to the improvement of instruction.

The following chapter, chapter three, is divided into three main sections, each section having subsections. The first section: develops a rationale upon which the choice of the factors included in the study was based; then presents a discussion of the factors themselves. The second section is a discussion of the instrumentation -- the various measures chosen to represent each of the factors in the study; the factors are grouped by two main categories -- outcome (reward and performance outcome factors) and predictor (student and instructor factors). The third section is an outline of the procedures for the study, including: the participants and the setting; the design of the study; the strategy of data analysis. An additional fourth section restates the questions raised in chapter one about the nature of instruction, in terms of this course.

CHAPTER III

RATIONALE FOR CHOICE OF FACTORS; INSTRUMENTATION; PROCEDURES

The review of the literature has served to show that there are a number of ways to view teaching and learning and, on the basis of whichever viewpoint chosen, to analyze any given component of the instructional situation. While difficulty in utilizing the results of some studies is due to methodological inadequacies in conception and development, in many other cases the difficulty is that the results taken in isolation explain a very small portion of behavior when viewed within the entire instructional complex. No one method, no one style, no one personality factor is more important than another, independent of the realities in the classroom. In this study the purpose is to attempt to unravel the components by discovering the structure of relations among potentially important variables in the instructional situation, and under what conditions and through what intervening processes this relationship occurs, in order to determine the relative importance of the variables to course criteria or outcomes in a manner functional to improving instructional conditions.

This method is a way of partitioning the diverse multi-faceted factors that constitute the relationships in the instructional situation and of providing a basis for going further into the analysis of the educational process. Since the structure of relations among the variables in this study is derived from the interaction process in a particular instructional situation, their impact upon a given student in another instructional situation would not necessarily be expected to be precisely the same. However, the underlying concern is the options which, as a result of the structure of relations among the variables, are open to students working their way through any given instructional situation. One question being asked is in what ways the structure of relations among variables seems to be related to the paths students choose to (or seem compelled to) pursue in the instructional situation when compared with other students, without inferring these choices are inevitable.

Theoretically, no matter what formal instructional situation is being viewed by the researcher, there is some overall "job" going on in the situation, and this "job" is a process of "doing what needs to be done" to get to some goal. That is, there is some overriding goal (which may be composed of a series of subgoals) to which all the variables in the instructional situation are supposedly geared. The form this "job" takes is defined by these variables, such as the characteristics of students, the content of the course, and so on.

This "job" cannot be understood without taking into account a number of considerations. One consideration which must be taken into account is the impact of different types of subgoals, that is, various phases of the overriding goal. For example, if a stated subgoal is "to develop values" (whether or not this is possible is a mute point in this discussion), its impact as a goal must be viewed in relation to the other subgoals for which the instructional situation was created and exists.

A second consideration which must be taken into account is that while the form of the "job" or "task" is defined by the variables,

certain variables, or more precisely specific dimensions of these variables, may carry more relative importance or weight in this definition.

Coming together in the instructional situation are various dimensions of a number of variables which form a structure of relations within this context. However, over time these various dimensions of the variables exert varying degrees of pressure on the "job" or "task" of reaching the specified "goal". For example, the students and teacher (or teachers) have entered the instructional situation with different conceptions of what the "job" or "process" should be like, and over time it is possible that interpersonal pressures created by these differences could interfere with the phase of the task which is goal-oriented. Therefore, at any given moment in the instructional situation the "job" actually has two components: the part which is goal-oriented (in many cases academically-oriented), and the part which deals with the pressures on the instructional situation at that moment. For example, if scores on a test have caused anxiety among students and this anxiety is interfering with the goal-oriented phase of the "job", the dissipation of this anxiety is at that moment a part of the "job". Thus, a third consideration which must be taken into account is how, over time, things are going in the instructional situation in relation to the goals.

A fourth consideration which must be taken into account is that among the many factors in the instructional situation the students are usually of particular interest. For example, even if the focus of interest in a study is the teacher, his role, his attitudes, and so on, inevitably the students (or learners or whatever label is

applied) become a focal point in terms of their role, or performance, or any number of other possibilities, in their relationship with the teacher. It is for them the instructional situation was created and exists. In the case of studies within the ongoing instructional situation the structure of relations among the variables creates circumstances with inherent violations of normalcy and homogeneity such that the focus of attention is not only what students have in common but also how students vary and what various subgroups exist.

There are a number of alternative explanations for what goes right, or wrong, in terms of the "job" or "process" taking place in the instructional situation, that is, for what happens instructionally, depending on one's viewpoint of teaching and learning. When the researcher enters the instructional situation there exist many factors with potential "importance" defining this "job", and depending upon his interests, the type of study he chooses to do, and so on, he selects, or introduces additionally, those variables relevant to his study. The question in this particular study is which factors in the instructional situation appear to make a real difference for the purpose of course development. This necessitates including not only potentially important entering-course characteristics but those which over time play a role.

The core of any investigative strategy is its set of restrictions. Eventually, some restrictions must be put on the strategy, such as limiting the number of factors or variables used, or limiting the freedom with which they are permitted to operate. In this study the problem becomes that of including those factors which not only have relevance but also potential importance to the improvement

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of instruction. Several considerations must be taken into account. Campbell cautions against initially rushing in after variables unrepresentative of the instructional situation and learning process but beloved of the researcher, although this does not preclude their later value and use.[97] A second consideration is that those who have designed the course or sequence of instruction in a given instructional situation supposedly do not operate in a vacuum independent of knowledge of teaching and learning, and factors they have chosen to emphasize may have potential importance. This necessitates taking into account the "model" or set of assumptions of the course designers in addition to the actual instructional process, since some of these factors may be emphasized in the "model" and may or may not be in actual operation. A third consideration which must be taken into account is the suggestions from research findings and from theory which support special attention to variables that seem indicative of critical instructional conditions.

Similar considerations are necessary in the choice of measures; these measures are proxies or stand-ins for the factors chosen for inclusion in the study as potentially important to critical instructional conditions. According to Campbell, one of the things necessary in such research is to use measures (to tap factors chosen for inclusion as outlined in the previous paragraph) which intrude as little as possible into the instructional situation.[98] Two sources of

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[97]Campbell, loc. cit., pp. 263-269.

[98]Ibid., p. 265.

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such nonreactive "proxies" are those derived from instructional measures which are already a part of the natural situation, such as past performance factors represented by grade-point average and scores from standardized tests of general ability, or course outcome factors represented by course test-scores. The remaining factors considered to have potential importance must be represented by new measures. Where a number of measures are available to represent a given factor, all else being equal, choice should include consideration of the degree of the measure's unobtrusiveness, and its possibilities for future use as a permanent part of the research situation based on a conception of its relationship to the instructional process, rather than being seen as introduced just because of a conspicuous new experiment.[99]

Table 1 (p. 74), lists the factors potentially important to relevant course criteria or outcomes chosen for inclusion in this study, based on the earlier discussion of considerations to be taken into account in choosing variables. Beginning at the left, each subsequent list contains those factors in the preceding list plus those included over time, divided into "classes" by headings, for the understanding of the reader and explanatory purposes.

Factors concerning students were chosen from the areas of performance (both past and in the context of the instructional situation in the study), attitudes, personality, and personal characteristics.

Studies in the review of the literature suggested that prior

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[99] Ibid., p. 266-267.

TABLE 1: SUMMARY OF COURSE PREDICTOR FACTORS

ENTERING-COURSE (AID I)	MID-COURSE (AID II)	END-OF-COURSE (AID III)
Personal	Personal	Personal
Sex	Sex	Sex
Age	Age	Age
Major	Major	Major
Past Performance	Credits earned	Credits earned
GPA	Current load	Current load
CQT	Past Performance	Past Performance
Personality	GPA	GPA
Extraversion	CQT	CQT
Neuroticism	Personality	Personality
Social acceptance	Extraversion	Extraversion
Test anxiety	Neuroticism	Neuroticism
Pretest anxiety	Social acceptance	Social acceptance
Attitudes	Test anxiety	Test anxiety
Learning set	Pretest anxiety	Pretest anxiety
Reason enrolled	Midterm anxiety	Midterm anxiety
Pre-attitude	Attitudes	Final exam anx.
Course-specific	Learning set	Attitudes
motivation	Reason enrolled	Learning set
at pretest	Pre-attitude	Reason enrolled
	Course-specific	Pre-attitude
	motivation	Post-attitude
	at pretest	Discussion att.
	Course Performance	Course-specific
	Pretest score	motivation
	Instructor	at pretest
	Extraversion	Course-specific
	Neuroticism	motivation
	Social acceptance	after midterm
	Defensiveness	Success expect.
	Rigidity	Accuracy judgment
	Authoritarianism	Course Performance
		Pretest score
		Midterm score
		Instructor
		Extraversion
		Neuroticism
		Social acceptance
		Defensiveness
		Rigidity
		Authoritarianism
		Risk
		Course load
		Teaching exper.

knowledge and ability of learners possibly play a role in explaining behavior in the instructional process. The possible role of past performance also happened to be an assumption of the instructional situation "model" (as discussed in chapter two to the effect that educational opportunity was to be a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact). Prior knowledge and ability are reflected by a number of factors: past academic performance in instructional situations with an underlying institutional similarity to that of the instructional situation under study, and represented by the institution as a gradepoint; past performance in situations ostensibly indicating potentiality of general intellectual ability, not only of verbal ability but also conceptual and problem-solving ability, and represented by test scores from standardized measures of such abilities; past performance on content (facts, concepts, and so on) with a possible underlying similarity to content which is a part of the instructional process in this situation, and reflected in the content of the pretest; past performance on content of the course as related to later performance in the course, and represented by the midterm test as related to end-of-course performance.

The review of the literature suggested that while the role of learner attitudes and values on broad, general categories is difficult to interpret in relation to classroom instruction, a number of specific aspects of attitudes possibly are important in explaining behavior in particular contexts. Two such points made were: no major changes in attitudes and values in broad categories could be expected over the short space of a given instructional situation although changes in attitudes related to specifics of that situation were possible; student indifference and docility are symptomatic of student attitudes of the irrelevance of educators to students' lives. The importance of student attitudes in relation to the learning process was also an assumption of the course "model" of which one objective was that the instructional process contribute to development of attitudes which characterize a teacher, and another was that course content provided by faculty would be viewed by students as a sound basis for organizing their approach to the role of educational psychology in their own future teaching. A third suggestion from the review of literature was that students differed in their preference for factual and conceptual learning experiences, not necessarily based on extent of ability to deal with conceptual learning tasks. The importance of providing opportunities for students to reflect these differences was also an assumption of the "model".

These various specific aspects of attitudes were reflected by a number of factors included in the study. One set of attitudes reflected qualitative judgments about the instructional process or "job" itself, of what students expected of the course and what they felt had occurred, of how they valued instructional activities and the course as part of their teacher training. A second set of attitudes pertained to the aspirations and expectations students hold for themselves in terms of their performance, how successful they feel they've been and how accurate their assessment. Such attitudes may serve as preconditioners of student attitudes toward future involvement with such content. A third set of attitudes pertained to academic "set" or preference for factual or conceptual learning, such attitudes possibly operating as selective tendencies under certain instructional conditions.

The review of the literature was not encouraging in suggestions of personality factors with potential importance to the instructional process. However, it would seem that certain facets of some variables which represent entering differences among students might operate as selective tendencies under certain instructional conditions. Furthermore, it would also seem more realistic to explore only factors with which, in interaction, students and teacher could logically be expected to come to grips in the instructional process. Factors reflecting both these conditions were chosen which seemed to have importance to the instructional process under both large group and small group conditions. The first set of factors reflects anxiety related to academic situations in general, and specifically to the "job" in the instructional situation in which evaluation is involved. The second set of factors was those considered to have the most potential relevance to performance in the discussion section. In a "discussion section" which really does not qualify as a small group, a person of more reticent nature may be at a disadvantage because of more recalcitrance to make themselves known and heard. Or possibly, those who experience a high degree of anxiety not necessarily related to test-taking may find it constraining if what is demanded of them involves personal commitment beyond that which they feel able to make.

The review of the literature suggested that while personal factors such as sex, age, degree of involvement in the content area, pressure from other activities and so on do not seem to have a significant impact in terms of the overall instructional process, they

are possibly related to specific aspects of the instructional process. The following such factors are represented in the study: sex, age, major field of interest, credits earned academically, and current academic course load.

After reviewing over eight hundred studies of teacher characteristics as factors in the instructional process, Getzels and Jackson expressed a general pessimism about the usefulness of such factors in explaining the instructional process in the classroom. Their suggestion was that a possible fruitful area of concern appeared to be different types of cognitive functioning in addition to those currently assessed by tests of general ability. In addition, the tentative proposal was made that attitudinal and behavioral correlates of cognitive ability might be more important in understanding teaching success than are the abilities per se.[100] The possible importance of such factors to the teacher's role in groups using "discussion method" as contrasted with "lecture method" was raised by McKeachie in his review of teaching methods in which he pointed out that a number of studies suggest the possibility that discussion in the classroom encourages and develops critical-thinking and problem-solving ability in students but the results are not apparent, since talking does not necessarily mean the talkers, including the teacher, are evidencing predisposition toward, or engaging in, critical thinking and problem solving.[101] In a study of teachers in classrooms, Jackson noted that such predispositions might not necessarily be in evidence in the teacher during

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[100] J. W. Getzels and P. W. Jackson, *loc. cit.*, pp. 574-576.

[101] W. J. McKeachie, in N. L. Gage (ed.), *loc. cit.*, p. 1122.

interaction with students, but it seemed to be important in what he called the "preactive phase" of teaching -- that is, during time spent contemplating what has or will take place in their instructional situations, among teachers considered superior by administrators and colleagues.[102] In a study of the components and process involved in inquiry behavior,[103] Shulman found that supervising teachers tended to rate more highly those student-teachers classed as dialectic (that is, those who focused on problems rather than solutions, interacted frequently with students through discussion, easily roamed widely over course materials, and always allowed for the unexpected) than those student-teachers classed as didactic (that is, those who strove for immediate, certain and unambiguous closure, avoiding unpredictability), irrespective of whether the supervising teacher himself (or herself) might be so classed.[104] These studies raise two suggestions: first, the possible importance to the instructional process in general of such factors as evidenced by teachers, and second, their importance in this study as evidenced in the

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[102] Philip W. Jackson, loc. cit., pp. 144-155.

[103] Rather than using a term such as problem solving, Shulman uses the term inquiry process, basing his concept of inquiry on Dewey's description of that process, and dividing the process of inquiry into four parts: problem sensing, problem formulation, search, and resolution.

[104] Lee S. Shulman, Michael J. Loupe, and Richard M. Piper, Studies of the Inquiry Process, United States Department of Health, Education, and Welfare, Final Report, Project 5-0597, (East Lansing: Educational Publication Services, Michigan State University, 1968), pp. 148-155.

instructors who interact with the students who themselves are eventually to assume the role of teacher in the instructional process.

This latter suggestion seems relevant on the basis of the goals and assumptions of the course "model" and the expected role of the graduate assistants as instructors, as described in chapter two. Briefly, the goals were: first, interaction between student and teacher was to be a primary consideration; second, one result of this interaction in the discussion section was that students were to be assisted in integrating materials from lectures and readings, and in applying these integrations in a problem-solving approach to future teaching roles; third, another result of this interaction was that students were to be assisted to integrate their course experience into not only basic skills but also attitudes and understandings which supposedly characterize the competent teacher; fourth, another result of this interaction was to be that opportunity be provided for heterogeneity among students in terms of differential characteristics; fifth, not only quality instruction for the students but also the teacher as model were to be the main concerns of faculty members. A consideration which seemed to underlie each of the above points was that a decrease in regular faculty participation was possible on the basis of projected teaching-assistant performance in relation to each of the goals. Thus the roles of the teaching-assistant instructor appeared to include: moderator, and where necessary, instigator of discussion; assistor in student integration of seeming disparate course content and in usage of such content in a problem-solving approach to issues of teaching and learning; contributor to development of attitudes of students toward their future role as teachers; discriminator of differential characteristics among students, and evaluator of their role in student performance; and lastly, the role of model. As was discussed in chapter two, under the time-span of the typical college course the effect of a single course of instruction upon long-held values of students is questionable. Further, what this role of model was supposed to entail for the faculty, let alone the teaching-assistant instructors, was not clear. However, two assumptions are tenable. Possibly the instructor was to be viewed as a model of the "attitudes, skills, and understandings which characterize a competent teacher" -- a goal discussed in chapter two. More realistically, the students might view the instructor as a model of a stance taken toward the activity in which the students themselves were being asked to engage -- a model of a stance, or predisposition toward, a critical-thinking, inquiry approach to issues raised through the course content and its application. The suggestions in the studies cited above and the assumptions of the course "model" seem to stress the importance of the teacher's ability to engage in inquiry, critical thinking, and so on, not only in the preactive phase of teaching as suggested by Jackson but in the interactive phase also -- that is, on the classroom firing line.

Getzels and Jackson pointed out the general paucity of studies which suggest possible characteristics relevant to such abilities in the instructional process.[105] In this study, the question is

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[105] J. W. Getzels and P. W. Jackson, in N. L. Gage (ed.), loc. cit., pp. 574-576.

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confined to which such factors or predispositions (rather than behaviors themselves) characteristic of teachers might most support students in their choice to use their competencies to engage in "problem-solving" activities.

In his discussion of inquiry learning Shulman points out the amount of current research focused on enhancing such processes in children and the results of such research suggesting the importance of such processes in the development of the cognitive functioning of children. He suggests that these processes are very likely to be dampened without adequate participation and modeling on the part of teachers, and that research on pupil inquiry may be of limited value without equal attention to teacher inquiry. In his study of inquiry behavior in student-teachers Shulman indicated certain factors which seemed important in such behavior. Those evidencing a high degree of inquiry predisposition also tended to evidence high associational fluency, high cognitive complexity (preference for ambiguity, assymetry, the unexpected, as opposed to preference for the regular, the predictable), high verbal problem-solving ability, low expressed test anxiety, willingness to risk on a test of logical thinking, and "liberalism" in political values.[106] The inquirer was: predisposed to balance the risk of inquiring against the risk of not so doing, and the greater the degree to which the individual was comfortable with complexity, the less the perceived risk involved; predisposed to become personally involved in problems and the process of resolution; pre-

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[106]L. Shulman, M. Loupe, and R. M. Piper, _loc_. _cit_., pp. 53-97.

disposed toward flexibility in thought and in usage of the individuality of students in the learning process.[107]

In a study of concepts not unrelated to those investigated by Shulman, the importance which Shulman attached to such processes in the development of the cognitive functioning of children is extended by Perry. He stresses the importance of similar processes, but in particular their cruciality during development taking place in late adolescence and young adulthood, and he tentatively posits such development as a "stage" of development, similar to the Piagetian sense of "stage". In his longitudinal study of a group of students throughout their college years, Perry postulated that the ultimate purpose of students in the period of late adolescence and young adulthood is "to find those forms through which they may best understand and confront the human condition". His study focused on how such young people "orient themselves in a relativistic world through the content and style of ongoing acts of commitment, and the forms of these options through which some students appeared to withdraw or retrench at various points in the development." The study results emphasized the interweaving of hierarchies of values with hierarchies of thought (what Perry termed interweaving meta-valuing with meta-thinking).[108] The developmental shheme depended heavily on Piaget's concepts of assimilation of an experience and accommodation of struc-

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[107] Ibid., pp. 154-155.

[108] William G. Perry, Jr., Forms of Intellectual and Ethical Development in the College Years: A Scheme, (New York: Holt, Rinehart and Winston, Inc., 1968), pp. 8-54.

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[109] Ibid.

structure through transformations and recombinations which can result in new and more differentiated structuring of experience, and the scheme also reflected processes ascribed to Piaget's stage of formal operations. Perry's postulated "stage" and the study results suggested that powers of detachment and objectivity consequent on the ability to "meta-think" make it possible for the individual to address the environment in such a way as to be able to move from the moral to the ethical, from the formal to the existential.

The study suggested that during this "stage" of development the most difficult moment for students in the instructional process seemed to occur "at the transition from the conception of knowledge as a quantitative accretion of discrete rightnesses to the conception of knowledge as the qualitative assessment of contextual observations and relationships".[109] In discussing those teachers from whom they felt the greatest sense of support in their attempts to make this transition, students inferred a number of predispositions characteristic of these teachers. One such predisposition was what might be classed as a type of "risk" -- that is, a willingness under ambiguous conditions to live with these ambiguities and based upon them, to express judgments which might deviate from the status quo, yet expressed with confidence, willingly exposing themselves to criticism rather than playing it cozy or equivocating. An associated predisposition was reflected in less need to make socially desirable responses (that is, those desired either by the "establishment" or the student

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[109] Ibid., p. 210.

population), less need for social acceptance. An additional predisposition was "an openness -- a visibility in their (the teachers') own thinking, groping, doubts, and styles of commitment".[110]

The previous theoretical considerations in relation to teacher traits led to the inclusion in this study of factors on the following continuums: extent of conservatism and uncertainty in judgments in ambiguous contexts; extent of conservatism in beliefs and extent of proneness to control events and to settle for the status quo; extent of rigidity in interaction with students; extent of need to respond in socially desirable ways and for social acceptance; extent of reticence or recalcitrance to initiate interaction with students; extent of anxiety created by demands for personal commitment beyond that which the individual feels able to make.

The focus of interest in this study was upon the relative importance of potentially important variables to relevant course criteria and outcomes in a manner functional to improving instructional conditions. The course criteria were defined by the course goals and objectives. The impact of the instructional process upon students in terms of certain of these goals (such as beginning development of attitudes toward the future role of teacher) was assessed indirectly by specific questions in attitudinal measures. The study was concerned with what, theoretically, was the relative importance of the "predictor" factors in terms of the assumptions underlying the course, and focused directly on what, in fact, was the relative importance of these factors to actual course outcomes -- the outcomes themselves

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[110]<u>Ibid</u>., pp. 209-215.

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defined in terms of assessed performance. The "outcome" factors thus defined were included in the study in the form of student scores and grades, derived from course tests and instructor assessments.

Reference must be made to two limitations on factors included in the study. The list of "predictor" factors indicates that the factors have been limited to those characteristic of students and instructors. McKeachie, after reviewing literature on environmental variables in the instructional situation such as books, films, and teaching machines, indicated that studies of the effects of such factors alone have not yielded definitive results, and suggested that their importance depends upon the objectives of a particular instructional situation, the characteristics of the particular students, and the excellence of the materials.[111] In the instructional situation used in this study such materials were standard and consistent across all classes. Consideration of such factors was confined to assessment of student reaction to their usefulness, reflected in the judgments made by students on specific questions in their evaluations of the course and the instructors. The second limitation was the exclusion of the senior faculty. Previous surveys of students in this course of instruction (under conditions of a new faculty lecturer approximately every week, seen three times) had indicated that students were unable, at the end of the course, to distinguish among the faculty without assistance in identifying the presentations, and that students identified the course experience with the discussion section. It was felt that useful assessment of the faculty contribution would be derived through the condensed means of end-of-course judgments of students

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[111] W. J. McKeachie, loc. cit., pp. 1173-1258.

concerning the faculty role in their course experience and indirectly reflected in exam performance on recall and applied portions. These limitations were imposed to avoid overloading the analytic model and were judgments based on the review of the literature in chapters two and three which suggested that the core of any given instructional situation is the interactive relationship between students and teacher.

The following section outlines measures (chosen via the criteria discussed previously) used as "proxies" for factors in the study.

II. INSTRUMENTATION

The term "outcome variables" referred to those factors considered to be tangible representations of the theoretical assumptions of the course "model". These outcomes were measured by course examinations and grades. Each outcome was analyzed on the basis of a set of predictor variables. The term "predictor variables" (themselves measured by tests and questionnaires) referred to those student and instructor characteristics considered important to the outcome variables.

OUTCOME VARIABLES

The outcome variables involved two forms: performance and reward. Course performance factors were represented by examination scores. Reward variables were represented by: grades assigned student scores on examinations; grades assigned by instructors; final grade assigned in the course, a weighted composite of all other course grades.

Reward Variables

The term "reward" was applied to the grades because they represented the value placed on student performance by a highly competitive system. Represented in student grade were components of student effort, student ability toward whatever criteria were being judged, and a

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a component of instructional bias in terms of what was chosen to be judged. For purposes of analysis, reward data was coded 1 - 5 (F = 1, A = 5), the "F" being assigned the real number value of "1" for analysis as it represents an actual range of performance scores at the lower tail of the curve. Reward variables included the final grade in the course, the midterm grade, the final exam grade, and the instructor grade.

Course grades as valid measures are always questionable. Judgments concerning their validity depend upon those elements of performance which are measured, and the reliability not only of this measurement but of the cut-off points upon which the grades are based. The reliability between the midterm grade and midterm exam ($r = .918$) and between the final exam grade and the final exam ($r = .932$) suggests the grade for examinations was representative of performance scores on the tests. There was a relatively low relationship between midterm grade and final exam grade ($r = .502$). The midterm grade and final exam grade were grade representations of the midterm exam and final exam scores. It was these grades rather than the scores themselves which were used in calculation of the final course grade, by means of a weighted transformation procedure in which the midterm grade counted twenty per cent, the final exam grade forty per cent, and the grade awarded by the discussion section instructor forty per cent. The mean final course grade was 3.633, with standard deviation .821. The instructor grade was even more difficult to assess. Weighted to account for forty per cent of the final course grade, it accounted for almost that much in a part-whole correlation with course grade

($r = .642$, $r^2 = .412$). Its correlation with midterm and final exam grades was not high ($r = .372$ and $r = .307$), and was .371 with student grade point average. Instructors were given virtually a free hand in the composition and assignment of this grade, and with the exception of three instructors, did not specify their various bases for judging student performance.

Course Performance Variables

The term "course performance variables" was applied to the actual results of student performance as measured by examination scores. These examinations took the form of multiple-choice tests over content and simple application of content from the readings and lectures in the course. Course performance variables included the pretest, the midterm examination, and the final examination including both recall and application sections.

The pretest consisted of forty items, supposedly the best performing items available to test student entering-course knowledge and ability in the course. Chosen as representative of the various test-item areas in an item-pool being developed to form a comprehensive exam for the course, the items had at least face validity in terms of their relationship to the course content. The internal reliability of the pretest was $r = .763$ (Kuder-Richardson Formula #20).[112] Mean performance was 22.205, with standard deviation 3.366, as indicated in Appendix B. Appendix C indicates that its relationship to the midterm

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[112] Robert L. Thorndike, "Reliability", Educational Measurement, E. F. Lindquist, ed., (Washington, D. C.: American Council on Education, 1963), pp. 586-597.

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examination and the final examination was low but consistent for each ($r = .290$ and $r = .297$).

The forty-item multiple-choice midterm examination had a mean of 30.716, with standard deviation 4.046. The items were directed to the readings and lectures included in the first half of the course, and was primarily a recall exercise. The internal reliability of the test was .847, using the formula cited in the previous paragraph. Appendix C indicates that the relationship between this exam and the final exam was .526.

The final examination was composed of eighty items divided into two sections. The first section dealt principally with content and lectures in a recall format. The second section consisted of series of questions related to simulated actual settings outlined in the test and to which the students were to apply the information and principles presented in the course in order to select the correct answer. The final exam mean performance was, for the total exam, 53.801 and standard deviation 7.157. Based on the Kuder-Richardson formula previously cited, the reliability for the total exam was .710. Appendix B indicates that the exam was negatively skewed (-.685) and also leptokurtic (Kurtosis = 5.183). However, this was attributable almost in its entirety to the extremely high kurtosis on the applied section of the exam (Kurtosis = 16.815). Since the first half of the final exam tapped student recall of course material, it was not unexpected that the relationship between this section and the midterm, also a recall exercise, was greater than that between the application section of the final and the midterm ($r = .503$ and .412 respectively).

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The applied section was more closely related to student entering ability and test-taking ability than was the recall section, as indicated by a much higher correlation between the former and the Qualifying Test-Total (r = .420 as compared to r = .302).

PREDICTOR VARIABLES

The term "predictor variables" was applied to those student and instructor characteristics considered to have importance to the course outcomes, and used in their analyses. The predictor variables were of two forms: those involving student characteristics and those involving instructor characteristics.

Student Characteristics

Previous research such as that discussed in Chapter II has indicated the relevance to classroom instruction of factors in such categories as past performance, attitudes, and personality. Student characteristics considered to have not only relevance but importance to the outcome variables were utilized from such categories.

Past Performance variables have importance not only as indicators of past accomplishment but in the sense that this past accomplishment is a partial determinant of future performance on the basis of ability, motivation, and the degree others judge student effort on this past basis. The past performance measures take two forms: the results of standardized tests of ability and background, and accumulated student gradepoint for previous academic work. Both are standard procedures in many universities. The standardized test of entering ability and background was the College Qualifying Test, university-administered, which provides both verbal and quantitative scores in addition to the total score. So that the range of scores met the requirements for a particular computer analysis, the results were divided by two such that a score indicated as twenty-five in the study results of the next chapter would actually be a standard score at the fiftieth percentile. Possible truncating effects in the analysis were not noticeable by inspection. The verbal, quantitative, and total scores are referred to in the analysis as CQT-V, -Q, or -T. The other measure, grade-point average, was self-reported by the students. A high relationship between self-reported GPA and university-calculated GPA was found on a randomly selected sample of sixty-three students in the study ($r = .945$). Previous research indicated students reliably report their GPA's.[113]

Course Performance variables involved the pretest and midterm exam scores, in some of the analyses of course outcomes. The pretest provided an indication of previous background in the content of the course. The midterm scores provided not only a measure of performance as judged by the course planners but has inherent in it a motivational component for outcomes late in the course. Statistics pertaining to these measures were discussed in a previous section of this chapter.

Attitude variables selected for inclusion were those relevant to the course outcomes as interpreted by the course designers. One set of attitudes reflected qualitative judgments about what students expected of the course and what they felt had occurred, about how they valued instructional activities, and the value placed on the course as part of their training. Such variables were represented by measures of pre- and post-course attitude and motivation, attitude toward the dis-

[113] O. M. Davidson, "Reliability of Self-reported High School Grades," unpublished research report, American College Testing Program, Iowa City, Iowa, 1963.

cussion section experience, and reason for enrolling in the course. A second set of attitudes pertained to the aspirations and expectations students hold for themselves in terms of their performance and eventual "reward" in the course, and have importance through the degree of congruence between these attitudes and actual performance. In a course which serves as an introduction to an area, such attitudes may serve as preconditioners of student behavior and of attitudes toward future involvement in the content. A third set of attitudes pertained to academic "set", and represented entering differences between students which might operate as selective tendencies under certain instructional conditions. For instance, in a course in which integration of ideas into a conceptual framework is stressed rather than recall of specifics, students oriented toward or with a preference for factual learning might find themselves at a disadvantage.

Three instruments were involved in the first set of attitudes. In indicating reason for enrolling in the course, students responded to one of five reasons on a one to five scale moving from negative to neutral to positive -- (#1. The course was required or I would not have enrolled, to #5. The course was not required but I wanted to take it.). The reliability of the scale was not established. Its relationship to to the other two instruments was low ($r = .394$ and $r = .174$ with pre- and post-course attitude, and $r = .091$ with discussion attitude). (Appendix C). Student pre- and post-course attitude and motivation toward the course itself were measured by instruments adapted from the instructional rsearch of Siegel and Siegel, and involved a series of statements related to the instructional setting and the conduct of instruction.[114] A yes or no response to each item indicated whether the student felt that item indicative of the course. Statements moved from very negative to very positive, with the students' score the median yes response. The developers of the instrument reported the procedures in its development and reported split-test reliability of .780. Neither the Siegel results nor those of this study showed significant relationship to past performance measures, suggesting that course-specific attitude rather than general academic motivation was being measured.[115] The original fifty-seven items were used in the past-sense in the post-course instrument. The test-retest estimate of this adapted version was .633. Student attitude toward specific discussion section experience was represented by the sum of positive responses on an instrument of 23 statements, related to procedures, qualities, and attitudes of the discussion section instructor. The items used were chosen from a series of items being developed at the University for an all-University student-attitude-toward-instruction scale. The items had undergone three administrations and analyses and were considered internally consistent with ability to discriminate. The split-half reliability of the instrument used in this study was r = .917.[116]

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[114] Laurence Siegel and Lila C. Siegel, <u>The Instructional Gestalt in Televised University Courses</u> (mimeographed research report, Miami University, Oxford, Ohio, 1966), p. 49

[115] <u>Ibid</u>., p. 52

[116] Linquist, <u>loc</u>. <u>cit</u>., pp. 586 - 597

The second type of attitudes, pertaining to the aspirations and expectations students hold for themselves in terms of performance, has only recently been incorporated into educational practice in any systematic way. Lewin, Festinger and Sears directed attention to this concept. Lewin described level of aspiration as a phenomenon operating in a situation involving choice of a future objective, and as a complex of three factors -- pursuance of sucess, avoidance of failure, and subjective probability judgment. The strength of these forces depends upon the particular way the individual sees his past experiences and cultural referents.[117] In this study, scores for high, actual, and low expectation for the first two administrations were determined by presenting students a scale of potential grades from F to A+ (numbered one to twelve) and asking them to circle the grade expected. The correlation between administrations one and two was .465 (Appendix C). In a study utilizing measures at the beginning, middle, and end of this course utilizing larger numbers of students, the correlations between one administration and the next of the same variable-type ranged from .500 to .757. The first two administrations were in the above form, in the third administration the student was presented the same grade list but asked to indicate the chances in one hundred he had of receiving each grade with the provision that the total chances indicated add to one hundred for all estimates. The score was determined using the same twelve-point scale and awarding the scale score for the grade showing

[117]K. Lewin, T. Dembo, L. Festinger, P. Sears, "Level of Aspiration," Personality and the Behavior Disorders, J. McVicker Hunt (ed.), (New York: Ronald Press, 1944), p. 376.

fifty per cent level of probability as determined additively. There was a constant, relatively high relationship between these measures and past performance, course examinations, and grades.[118]

The third form of attitudes, pertaining to student tendency to prefer factual or conceptual learning, involved the use of the Learning Set Scale developed by Siegel and Siegel.[119] This scale provides an index, moving from factual to conceptual, of student preference toward type of learning. The instrument was composed of thirty-one items each consisting of three statements -- one more conceptually oriented, one more factually oriented, and one judged a compromise. The student selected the condition most preferred and the condition least preferred in any item, and his score was determined by assigning a minus one to each factually-oriented choice, plus one to each conceptually-oriented choice, and no score to neutral items. Thus, for any given item if the student responded positively to the conceptual statement and negatively to the factual statement, the score was plus two; converse responses would be minus two. All statements were scaled for degree of factual or conceptual orientation, the weighting of the scale determining the score in any given item. Split-test reliability, r = .90, and test-retest reliability, r = .92 (using a five-day interval) was reported by the instrument authors. In developing scale validity, the authors report no relationship to standard measures of ability such as

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118J. T. Parmeter, "An Evaluation of an Introductory Course in Teacher Education," (unpublished doctoral thesis, Michigan State University, 1970), p. 78.

119Siegel, op. cit., p. 41.

college entrance examinations or a measure of creativity (Guilford's creativity tests).[120] In an earlier study the authors discussed validity in relation to performance and indicated that under classroom conditions controlled for such factors as teacher-student interaction and ability, set discriminates on performance between classes oriented either factually or conceptually.[121]

Personality variables, while a rather global group, have importance in that certain facets of some variable which represent entering differences between students might operate as selective tendencies under certain instructional conditions. Variables were chosen which seemed to have importance to classroom instruction under both large group and small group conditions, and to the questions raised in Chapter I. For example, a student with actually a good grasp of the subject matter but with high anxiety toward test-taking situations could be at a disadvantage under conditions of the highly competitive, large-group multiple-choice-test situation, or the student tending to be more introverted, less willing to commit himself verbally, could be at a disadvantage under conditions in which his grade depends upon class participation.

The first set of measures attempted to tap those factors associated with anxiety related to the academic situation. The first measure, the Alpert-Haber Test Anxiety Scale, was used to provide an indice of general test anxiety. The items pertain specifically to anxiety experienced

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[120] Ibid., p. 47.

[121] Laurence Siegel and Lila C. Siegel, "Educational Set: a Determinant of Acquisition," Journal of Educational Psychology, 56, 1966, p. 1-12.

during the taking of examinations, based on the concept that while some anxiety may be facilitative, debilitative anxiety can depress performance.[122] In this study the facilitating and debilitating scales were combined into a single index of debilitative anxiety. The scale authors indicate that general anxiety scales and scales of general test anxiety measure different attributes and that the latter are more useful in predicting academic performance. The test anxiety scales accounted for variance in academic performance over and above that accounted for by ability and aptitude measures. The reported test-retest reliability over a ten-week interval was .87 for the debilitative scale, .83 for the facilitative scale, and over an eight-month interval, .76 and .75 respectively. There were consistent negative correlations between the Albert-Haber and measures of performance in the study. (Appendix C) The second instrument used to assess academic anxiety was a measure of test anxiety to specific instances. Students were asked to indicate degree of anxiety before beginning the pretest, midterm and final exams by choosing one of five alternatives moving from very little to very much. There was almost no anxiety reported before the pretest and virtually no correlation with other variables, and anxiety increased over successive exams, the midterm and final exam anxiety scores correlating positively with the Albert-Haber Scale ($r = .314$ and $r = .322$), and low negative correlations with the examination scores. In addition, students were asked to indicate

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[122] Richard Alpert and Ralph Haber, "Anxiety in Academic Situations," Journal of Abnormal and Social Psychology, vol. 61, 2, 1960, pp. 207-15.

how successful they felt their performance had been, selecting one of five choices moving from very unsuccessful to very successful, and to indicate the degree to which they felt the exam reflected their knowledge of the course content, selecting one of five choices moving from very inaccurate to accurate.

The second set of personality variables were those considered to have the most possible relevance to performance in the discussion section. For example, among those students of lesser ability or those who, to the extent that GPA represents a degree of test-wiseness, have not mastered the skill, a more outgoing nature, more carefreeness, may be an advantage in a discussion section that really does not qualify as a small group. Or, possibly those who experience a higher degree of personal anxiety, not necessarily test anxiety, may find it constraining if what is expected of them is not made clear, or if what is demanded involves personal commitment beyond that which they feel able to make. In choosing the instrument, consideration was given to the fact that what was wanted was not detailed information on a great many personality variables for diagnosis, but an indicator of dimensions that seemed most important to actual differences between students in terms of course outcomes as specified by the course planners and the processes whereby these outcomes are supposedly attained. The measure chosen was the Eysenck Personality Inventory which is considered to measure two major personality dimensions, extraversion-intraversion and neuroticism-stability.[123] Consisting of two twenty-four item scales which provide

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[123]H. J. Eysenck and Sybil B. G. Eysenck, Eysenck Personality Inventory (San Diego, Cal.: Educational and Industrial Testing Service, 1963).

estimates of degree of individual outgoing, carefree, social inclinations and anxious, overresponsive, unstable predispositions, it also includes a nine-item "lie scale" to identify those subjects showing "desirability response set," this latter adapted from the MMPI. Test-retest reliability coefficients range from .80 to .94, split-half estimates of item intercorrelations for each scale range from .75 to .90. American college norms are based on data by Gideon, Gordon, Jensen and Knapp.[124] The concept of validity to a large measure rests on the particular criterion one uses in defining any given personality variable. The reader is referred to the discussion of this problem by Jensen, Lingoes, Stephenson, and Vernon in Buros, The Sixth Mental Measurement Yearbook,[125] and to the theoretical bases for these dimensions in Eysenck, Personality Structure and Measurement.[126]

Personal variables was the term applied to student characteristics such as sex, major, age, credits completed in university program, and current load. In certain instances because of space requirement, the factors are referred to by a code number in the display of the data in Chapter IV and the Appendix. For example, social science majors are referred to by the code number "5" where space necessitates. The code reference appears in Appendix A.

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[124] Eysenck and Eysenck, *op. cit.*, addendum

[125] Oscar Buros (ed), *The Sixth Mental Measurements Yearbook*, (Highland Park, N. J.; The Gryphow Press, 1965), pp. 286 - 295.

[126] Hans J. Eysenck and Sybil B. G. Eysenck, *Personality Structure and Measurement*, (San Diego, Cal.; R. R. Knapp, 1967).

Instructor Characteristics

The measures served as proxies or stand-ins for the factors specified for inclusion in the study, and therefore were chosen to approximate the theoretical considerations emphasized in the discussion of choice of instructor factors. Any measure is itself defined by those theoretical bases used in its development. In addition, the great demands upon the instructors' time both in terms of their teaching duties and their own studies were taken into account in restricting the extensiveness and time requirements of the measures.

Encouragement of problem-solving behavior (or inquiry, or however such processes are defined by their bases in various theories) was suggested in the literature as: an important consideration in teaching at all levels; particularly critical in late adolescence; an important consideration in the training of future teachers. It was also a critical explicit assumption of the "model" of the instructional situation used in this study. The discussion of teacher predispositions possibly relevant to encouragement of such behavior in students led to inclusion in the study certain factors previously specified.

One such factor suggested was a predisposition given by students the title of "risk"[127] and therefore so labelled in this study. However, the term as defined in the context of that suggestion did not pertain to the commonly used definition of actual decisions made under a "payoff" situation. Rather, it was defined in terms of cognitive

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[127] Perry, loc. cit., p. 211.

judgments involved in a problem-solving stance, and consisted of two aspects: first, the teacher exhibited tolerance of uncertainty, of inexactness, of ambiguity, avoiding the making of extreme and simplistic judgments to reduce his own uncertainty, and avoiding being insensitive to errors caused by such a simplistic approach; but in addition, where ambiguity and possible error were evident to all, the teacher seemed willing to make judgments which would be considered less conservative, less safe in terms of conforming to what the majority viewpoint might be, without fear of censure and with acceptance of being exposed as incorrect or unwise.

This predisposition has relevance for several reasons. First, Schwab has drawn attention to the reverse of the first of these aspects -- that is, the tendency to reduce ambiguity and uncertainty by simplistic and extreme judgments and positions -- as a common characteristic among undergraduate students.[128] Second, in his study of elementary teachers, Jackson drew attention to the reverse of both of these aspects, noting a not dissimilar simplistic tendency; that is, the teachers in their preactive phase of teaching tended to reduce ambiguity and uncertainty by extreme and simplistic positions of one to one causality, and where ambiguity and their own possible error must be considered, to be more conservative in their judgments and opinions, to preclude being exposed as wrong.[129] Third,

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[128]Joseph J. Schwab, College Curriculum and Student Protest, (Chicago: The University of Chicago Press, 1969), pp. 3 - 36.

[129]Jackson, loc. cit., pp. 143 - 147.

Shulman noted that those elementary student-teachers who were classed as dialectic (more likely to adopt a "problem" approach) evidenced greater willingness to take risks on a test of logical reasoning.[130]

The measure the underlying basis of which most closely approximated this factor as defined in the context of this study was the measure of judgment extremity and confidence developed by Brim and by Kogan and Wallach in their investigation of the degree of extremity exhibited in rendering probability judgments about ambiguous external events, subject to influence by the mechanism of tolerance for versus reduction of uncertainty. A basic point in the formulation of Kogan and Wallach is that cognitive-judgmental tasks ostensibly deal with problem-solving performance as opposed to decision-making procedures, and that the risk element is more or less covert, "emerging implicitly in terms of the strategy the subject employs". Since no one tells the subject he has been correct or incorrect, the risk element is based on the subject's assessment "of his own tolerance for error".[131] "When judgmental extremity serves as an expression of tendencies toward reducing general uncertainty in ambiguous situations, then the individual is not sensitive to the greater potential for error that lurks in extreme judgments. If judgment extremity does not serve uncertainty-reduction, then a person is more likely to respond as if aware of the greater chance for error that extremity entails. Under such conditions, greater judgmental extremity characterizes persons who

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[130] Shulman, loc. cit., p. 188.

[131] Nathan Kogan and Michael A. Wallach, Risk Taking: a Study in Cognition and Personality, (New York: Holt, Rinehart and Winston, 1964), pp. 2-7.

take greater risks than persons who are more conservative in pay-off situations."[132] The instrument consists of fifty items requiring judgments about the likelihood of various events, each so ambiguous as to prevent specification of a correct answer. After making each judgment the subject then specifies his level of confidence in his judgment. The theoretical basis for the development of the measure and its role in their investigations are found in Kogan and Wallach, Risk Taking: a Study in Cognition and Personality.[133]

A second predisposition with potential importance to the instructional process appeared to involve another conception of conservatism; that is, the extent of the teacher's conservatism relative to a number of attitudes held, which, while dissimilar in some aspects, seem to have an underlying common base in terms of the approach taken toward the "job" or learning process in the classroom. As with the previously discussed conception of extremity and of degree of conservatism in judgments, this conception of "conservatism" would seem to be important to an instructional process based on assumptions of the "problem" or "inquiry" approach -- in instructional situations in general, in particular in instructional situations involving young adults trying to make the transition from the conception of knowledge as the quantitative accretion of discrete rightnesses to the conception of knowledge as qualitative assessment of contextual relationships, and specifically in instructional situations involving future teachers who themselves eventually will be enmeshed in a relationship

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[132] Ibid., pp. 197-198.

[133] Ibid.

with students in the learning process.

In his study of elementary teachers on the job, Jackson has drawn attention to one aspect of this conservatism in what he calls "pedagogical conservatism" -- that is, "an accepting attitude toward educational conditions as they presently exist, with interest in educational change typically restricted to ideas about how to rearrange the room or regroup the students. This acceptance of the status quo appeared to be a part of the general myopia typifying the classroom teachers' intellectual vision."[134] Examples illustrative of how this "conservatism" or acceptance of the status quo operates in various areas of the "job" or learning process in the classroom can be derived from the literature. An example from one area is reflected in the attitude taken toward the entire concept of encouraging students to think not just convergently but divergently, of less rote memory for memory's sake. In discussing the failure of this concept to become a reality in the classroom the Panel on Educational Research and Development pointed out that while lip service is given to this by teachers, such teaching has to be "something more than (students) answering intelligent questions intelligently; it is creating the situations in which intelligent questions are likely to be asked (by students)," requiring an overhaul of the teacher's established patterns of teaching, a commitment most seem reticent to make.[135] An example from a second area is reflected in the attitude taken

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[134]Jackson, loc. cit., p. 148.

[135]Panel on Educational Research and Development, Innovation and Experiment in Education, (Washington, D. C.: U. S. Government Printing Office, 1964), p. 6.

toward the focus of "control" in the classroom. While teachers reject the stereotype of the teacher-autocrat and espouse a more egalitarian approach to control, nonetheless "control" in the majority of classrooms still appears to mean power and a teacher-centered learning process, ranging from authoritarian discipline to a less anti-democratic approach but one still reflecting reluctance to provide for variation in behavior which deviates from set routines.[136] An example from a third area is reflected in the attitude taken toward the importance of the educational process as a means of reflecting and preserving "those wishes and values that are to be found in the mainstream of the populace."[137] Any number of possible consequences of stressing preservation of the status quo in this regard can be listed. For instance, one such is that sometimes consciously but more often seemingly unconsciously there results in what might be termed an "ethnocentrism" in the designation of students as members of "ingroups" and "outgroups" on the basis of how visibly the particular individual manifests these desired values. Studies of such groups range from those investigating the effects of the seeming easier acclimatization of young girls than of young boys to life in the classroom, to studies of disadvantaged students about whom the teacher, in working with them with the best of intentions, nonetheless tends to have a set of negative expectancies about their behavior which

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[136] Herbert M. Kliebard, "The Observation of Classroom Behavior," in The Way Teaching Is, Association for Supervision and Curriculum Development and National Education Association, (Washington D. C., 1966).

[137] Michael A. Wallach and Nathan Kogan, Modes of Thinking in Young Children, (New York: Holt, Rinehart & Winston, 1965), p. 319.

often appears to act as a self-fufilling prophecy.[138] A second consequence of the tendency to stress preservation of the status quo in terms of attitudes, values, and behavior is that in the dilemma of whether "education will function as an arm of the majority in our society, reflecting those wishes and values that are found in the mainstream of the populace, or function as a minority voice, holding the general culture up to the mirror of constant appraisal," the former triumphs at the expense of the latter.[139]

This dilemma extends the concept of "pedagogical conservatism" -- that is, an accepting attitude toward educational conditions as they presently exist -- to a second aspect, that of a general conservatism in attitudes -- that is, as a component of the teacher's lifestyle. Such historians as Richard Hofstadter, in writing of the role of conservative beliefs in the lifestyle of individuals, have alluded to this predisposition in teachers' lifestyles spilling over into teaching stance, tending to result in teachers as a group being seen as followers rather than as in the vanguard, showing the way to "the mainstream of the populace."[140] Reports such as that by the Office of the United States Commissioner of Education on the state of

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[138]F. Riessman, "Teachers of the Poor: a Five-Point Plan," Proceedings of the 17th Annual State Conference on Educational Research, (Burlingame: California Teachers' Association, 1965), Mimeo.

[139]Wallach and Kogan, loc. cit., p. 319.

[140]Richard Hofstadter, Anti-Intellectualism in American Life, (New York: Alfred A. Knopf, Inc., 1963), and The Paranoid Style in American Politics and Other Essays, (New York: Alfred A. Knopf, Inc., 1967).

the education professions, under terms of the Education Professions Development Act, support this contention.[141] Such reports point to the general all-pervasiveness of these attitudes, extending into various aspects of the lifestyle such as an ideology of political conservatism -- at its most liberal, an ideology at the extreme conservative end of the liberal spectrum.

The study of the Carnegie Commission on the current status of education at all levels indicates that such predispositions are not confined to elementary teachers but are also a distinguishing feature at the secondary level.[142]

This conception of "conservatism" appears to have importance for a number of reasons. Initially, it has relevance at all educational levels. First, while exceptions can be cited as justifiable refutations of this conception, the literature suggests its existence as a common generalized predisposition. Second, an individual's predisposition to this "conservatism" should not necessarily be assigned a negative value. Rokeach points out the danger in placing a positive value on change and a negative value on non-change.[143] For example, there is positive value in preservation of

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[141] Office of the United States Commissioner of Education, report on the state of the education professions, authorized under the Education Professions Development Act, Annual Report, 1967, United States Office of Education.

[142] Study of the Carnegie Commission, discussed in Crisis in the Classroom, Charles E. Silberman, (New York: Random House, 1970). Results of the study suggest that such predispositions are characteristic of all levels of educational instruction.

[143] Milton Rokeach, The Open and Closed Mind, (New York: Basic Books, Inc., 1960), p. 10.

certain values and beliefs deemed important by society (although which ones should be so preserved is open to debate); the question centers on the emphasis placed on this as a goal. Further, review of the literature in chapter two indicated that to be predisposed to be more authoritarian or to be more teacher-centered does not necessarily infer lack of concern for student welfare, or that more student-centered approaches necessarily improve student performance or attitudes; however, the question is not the degree to which such an atmosphere may be repressive but the degree to which it may be oppressive and soporific. Third, the relevance of this conception of "conservatism" does not rest on what Levinson terms "reactionary conservatism" typified by assertions of the need for a drastic change to turn back the clock to the old verities;[144] rather, the relevance of this conception rests on what Dewey terms "teachers as students of teaching". The accepting attitude toward conditions as they presently exist suggests a tendency not to initiate change, but not necessarily to be adverse to change. Dewey's fear is that when a change is adopted, labels such as "progress" may mean only perfecting and refining skills at this new level, achieving a new plateau of acceptance of the status quo, devoid of initiative and a reflective approach about new ways to juxtapose seemingly dissimilar ideas about teaching.[145]

Second, this conception of "conservatism" seems to have

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[144] T. W. Adorno, E. Frenkel-Brunswick, D. J. Levinson, and R. Nevitt Sanford, The Authoritarian Personality, (New York: Harper and Bros., 1950, pp. 151-182.

[145] John Dewey, "The Relation of Theory to Practice in Education," in M. L. Borrowman (ed.), Teacher Education in America, (New York: Teachers' College, Columbia University, 1965).

particular relevance at the educational level of adolescence and young adulthood where, as Piaget suggests, the student is trying to make the transition from a world assessed in terms of discrete entities to a world assessed in terms of qualitative contexts, and is working at "injecting himself into adult society...by means of projects, life plans, theoretical systems, and ideas of political or social reform".[146] In his study of this period of development, Perry pointed out that in identifying those teachers from whom they felt the greatest sense of support in their attempts at this transition, students pointed to not only the predisposition to express judgments which might deviate from the status quo, willingly exposing the self to criticism rather than equivocate, but also the predisposition of "openness" --a visibility of the teacher's own doubts and gropings, and of his commitments in education and lifestyle.[147]

Third, this conception of "conservatism" appears to have special relevance at the educational level involving students who are themselves to be future teachers. The review of the literature in chapter two pointed out that differences in attitudes among undergraduates have been studied largely in terms of positions regarded as "liberal" or "conservative", and that with some consistency the most conservative groups are in applied rather than academic fields. Students in elementary and physical education tend to be among the most conservative groups. Those in secondary education reflect the

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[146]Jean Piaget, Six Psychological Studies, (New York: Vintage Books, 1968), pp. 60-73.

[147]Perry, loc. cit., p. 210.

attitudes of their academic subject fields, although as a group perhaps more conservative than those in their fields not working toward teacher certification.[148] Further, in his study of the inquiry process among elementary education majors, Shulman found that among the determinants of those predisposed to inquiry, one determinant was a tendency to be more politically liberal. The politics score was derived from three sources: political party preference of the student's parents, the student's own political identification on a scale from conservative to liberal, and student rank ordering of preference for four possible presidential candidates. Shulman pointed out that the results seem to lend support to "the notion that the same dynamics that underlie choice of political and social values predispose one to dialectical cognitive functioning[149] -- a finding congruent with the work of Harvey, Hunt, and Schroeder."[150]

Fourth, this conception of "conservatism" would seem to have particular importance to students in the teacher-education course involved in this study. One assumptions of the course "model" discussed in chapter two was that problem-solving thought process activities were to take place, and were specifically a goal of the discussion section. Among the teaching assistant's roles in the discussion section was not only the role of assisting students in

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[148]Bereiter and Freedman, loc. cit., p. 568.

[149]Shulman, loc. cit., pp. 86 - 88.

[150]O. J. Harvey, D. E. Hunt, and H. M. Schroeder, Conceptual Systems and Personality Organization, (New York: Holt, Rinehart, & Winston, 1963), as reported in Shulman, loc. cit., p. 88.

their attempts to engage in such activity, but also the role of teaching assistant as contributor to development of student attitudes toward their future as teachers, and also the role of teaching assistant as model -- presumably both as model of "attitudes, skills, and understandings which characterize a competent teacher," and as model of a stance taken toward the activity in which the students themselves were being asked to engage in the discussion section.

A number of considerations were taken into account in the choice of the measure to serve as a proxie for the conception of "conservatism" as discussed in the previous pages. One consideration, mentioned earlier, was a time factor, this measure being only one of several requiring the time of the teaching assistants, already hard-pressed. A second consideration was that since this measure was only one of several representing factors considered potentially important, this necessitated confining each proxie to a single measure to avoid overloading the analytic model. Third, as Rokeach points out, alternate ways of thinking about change, ingroups and outgroups, authoritarianism, and so on means that the particular way such factors are thought about involves implicit value judgments, influencing the operational definitions employed, and their interpretation.[151]

Of interest in this study was the conception of a set of attitudes forming a stance or predisposition reflected in a defined "conservatism" in lifestyle, an extension of which was reflected in various aspects of "pedagogical conservatism" in the classroom. The

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[151] Rokeach, *loc. cit.*, p. 11.

single measure which seemed most approximate as a proxy for the various aspects of the above defined conception of conservatism was the F-Scale.

Rokeach has criticized use of the scale in studies of authoritarianism outside those of the developers of the scale on grounds that "the F stands for fascism and the scale was designed (first) to be an indirect measure of prejudice without mentioning specific minority groups, and (second) to measure underlying personality predispositions toward a fascistic outlook on life."[152] However, although this had been the original point of inquiry, Adorno et al point out, in discussing the results of their studies,"....That we have achieved the second purpose underlying the F-scale -- to construct an instrument that would yield an estimate of fascist receptivity at the personality level -- has yet to be demonstrated."[153] Further, with regard to the first purpose, Adorno et al assert, "It seems that the F syndrome is actually more closely related to general ethnocentrism than to anti-Semitism," (which they used as an example of prejudice as differentiated from ethnocentrism), indicating statistical relationships to this effect.[154] In addition, in the discussion of the various related concepts in their body of work, the point is made that Fascism and Marxism as polarities on a right-left scale

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[152]Rokeach, loc. cit., p. 12.

[153]Adorno, Frenkel-Brunswick, Levinson, and Sanford, loc. cit., p. 279.

[154]Ibid., pp. 264-265.

"do not find active support on the American scene," and necessitated consideration of conservatism and liberalism as the prevalent right-wing left-wing ideologies.[155]

Rokeach is justified in contending that the concept of authoritarianism cuts across, and is possibly independent of, ideologies, and he posits the greater potential usefulness of the concept of dogmatism as a measure of general authoritarianism.[156] In this study, the conception of "conservatism" refers to an accepting attitude toward the status quo, defined in terms of "pedagogic conservatism" and lifestyle conservatism", involving aspects such as conventionality and a tendency to resist or at least show little iniative toward change, "authoritarianism" as reflected in the need for control in order to maintain this status quo, and an "ethnocentrism" as reflected in a provincialism toward those who do not reflect these aspects. The concept of dogmatism involves as a function those who are predisposed to demand change, across all ideological dimensions, and less closely approximates the various aspects of the defined concept in this study. In addition, in his study of concepts with potential usefulness as determinants of predisposition to inquiry, Shulman found that the concept of dogmatism as represented by Rokeach's scales did not serve as a determinant of teachers who might be less inclined to engage in inquiry.[157] To the extent that

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[155]Adorno et al, loc. cit., pp. 1-8, 150-180, 260-279.

[156]Rokeach, loc. cit., pp. 1-18, 121-131.

[157]Shulman, loc. cit., pp. 43-92.

Rokeach points out that the California F-scale measures "right authoritarianism (and is correlated with conservatism in ideology and politics),[158] the review of the literature indicates that teachers as a group have an over-all mean-item score below that of other adults of similar status.[159] However, the inference is not necessarily that teachers as a group are at the egalitarian end of an authoritarian-egalitarian continuum or at the liberal end of a liberal-conservative continuum, but possibly that as opposed to Levinson's "reactionary conservative" they more typify his conception of either "true conservatism" or of "passive liberalism".[160]

In discussing use of this scale in studies of teacher attitudes Getzels and Jackson criticize studies justifying the F-scale through correlations with other attitudinal measures, compounding any acquiescence set, but they give credence to McGee's study of the F-scale in relation to behavior observed in the classroom which indicated that teacher scores were consistent with their classroom behavior, and that a positive relationship existed between this "measure of anti-democratic potential and a measure of teacher's overt authoritarian behavior in the classroom"[161] Various modifications of the scale employing indirect nonideological

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[158]Rokeach, pp. 121-122, loc. cit.

[159]H. M. McGee, "Measurement of Authoritarianism and its Relation to Teachers' Classroom Behavior, Genetic Psychol. Monogr., 1955, 52, pp. 89-146.

[160]Adorno et al, loc. cit., pp. 152-180.

[161]Getzels & Jackson, in N. Gage (ed.), loc. cit., p. 523.

items have been used in studies, such as the Inventory of Beliefs developing out of the work of Stern, Stein, and Bloom.[162]

In discussing their entire body of work, Adorno et al point out that the work was guided by the following major hypothesis: "that the political, economic, and social convictions of an individual often form a broad, coherent pattern."[163] The F-scale developed as an extension of premises on which studies of ethnocentrism and conservatism were based. The relationship of the F-scale to the concept of ethnocentrism (defined as provincialism or rejection of the culturally unlike whereas prejudice involved feelings of dislike against individual groups)[164] was previously discussed. The concepts of conservatism and liberalism had been previously investigated with regard to trends such as support of the status quo and resistance to social change.[165] As contrasted with the dogmatism scale, Rokeach showed in this study the extent to which the F-scale correlated with liberal-conservative political measures.[166] Nine variables such as conventionalism, authoritarianism (submission and aggression), and power were derived and defined, and together were considered as a single F-syndrome. The theoretical basis for their derivations and definitions, the scale and its use in their studies are found in

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[162] G. G. Stern, M. I. Stein, and B. S. Bloom, Methods in Personality Assessment, (Glencoe: Free Press, 1956).

[163] Adorno et al, loc. cit., p. 1.

[164] Ibid., pp. 260-279.

[165] Ibid., pp. 153-207.

[166] Rokeach, loc. cit., pp. 119-122.

Adorno et al, The Authoritarian Personality.[167]

A third predisposition with potential importance to the instructional process was that of rigidity. Rokeach has drawn attention to the theoretical differences between concepts such as dogmatism and that of rigidity. While both refer to resistance to change, the latter more closely approximates the resistance to change of habits or sets. For example, a person is said to perform a task rigidly, not dogmatically or conservatively.[168] This predisposition would seem to have relevance to all educational levels involving even minimal interaction between student and teacher. For example, in his study of elementary education student teachers, Shulman noted that degree of flexibility in behaviors such as capitalizing on individual student characteristics as they arose during the instructional process characterized student-teachers classed as dialectic, as contrasted with those classed as didactic.[169] In addition, it would seem to have particular importance in instructional situations specifically created to insure interaction between student and teacher in a non-lecture approach to the instructional process. The measure the underlying basis of which most closely approximated this factor as defined in the context of this study was the measure of rigidity developed by Gough and Sanford. The scale is comprised of twenty-four items the referents of which appear to be specific tasks and habits,

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[167]Adorno et al, loc. cit. See also R. N. Sanford, "The Approach to the Authoritarian Personality," in J. L. McCary (ed.), Psychology of Personality, (New York: Logos Press, 1956).

[168]Rokeach, loc. cit., pp. 182-195.

[169]Shulman, loc. cit., pp. 53-148.

rather than attitudes as defined in the previous discussion. Balanced for rigidity-flexibility keying, it is now scale F_x in the California Psychological Inventory.[170]

A fourth predisposition with potential importance to the instructional process was that of defensiveness as reflected in the need for social approval. Kogan and Wallach in their studies of decision-making properties indicated the importance of this factor relative to the individual's image-maintenance, in which such a defensive concentration contributed toward the individual's adoption of pesture's consistent with this image relative to the nondefensive individual's more casual approach, allowing the latter to be more sensitive to the properties of the problem confronting him.[171] This predisposition would appear to have relevance at all educational levels in such instances as in decisions concerning the "fate" of individuals, for example, grades (particularly the subjective component of such), in the role of "authority" in a subject area and in supposed professional skills (as differentiated from the previous discussion of "authority"), and in the interactive relationship established with students. It would appear to have particular importance in instructional situations involving students attempting to alter their conceptions of learning in terms of "rightness" versus "qualitative assessment" and who identify teacher "openness" in his own doubts and commitments as supportive of their efforts (as earlier

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[170] O. K. Buros (ed.), The Sixth Mental Measurements Yearbook, (Highland Park, New Jersey,Gryphon Press, 1965).

[171] Kogan and Wallach, loc. cit., pp. 159-185.

discussed relative to Piaget and Perry), and especially in the instructional situation in this study, a situation specifically designed to give students opportunity to engage in this activity. The measure chosen to represent this concept was the scale developed by Crowne and Marlowe to measure degree of response set of self description in a socially favorable light, and conceptualized by the designers as a measure of "need for social approval". "Item style and content indicate the instrument has 'lie scale' properties, and is useful as an index of 'defensiveness' -- an index of the tendency to deny personal traits that, although moderately undesirable, are possessed by virtually everyone and to accept traits that are highly desirable but possessed by virtually no one."[172] The theoretical basis for development of the measure, the instrument, and statistics pertaining to it are found in Crowne and Marlowe, "A New Scale of Social Desirability Independent of Psychopathology."[173]

Additional predispositions which seemed to offer potential importance to the instructional process were extent of reticence to initiate interaction with students, and extent of anxiety created by demands for personal commitment beyond that which the individual feels able to make. These factors would appear to be important at all educational levels, but in particular at the level of instruction involving young adults engaged in thought processes discussed earlier in this

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[172] Kogan and Wallach, loc. cit., pp. 23-24.

[173] D. P. Crowne and D. Marlowe, "A New Scale of Social Desirability Independent of Psychopathology," Journal of Consulting Psychology, 1960, vol. 24, 4, pp. 349-354.

chapter (and summarized in the above discussion of social approval), who find teacher "openness" and "willingness to commit self" supportive of their own gropings. In addition, in instructional situations such as that in this study, where "discussion approach" is the specified format for the instructional process and especially where the discussion section fails to qualify on any criterion as a small group, the conceptions of a more reticent versus a more outgoing temperament, and of excessive anxiety and instability versus stability under pressure would seem to have particular relevance. The instrument which served as proxy for these conceptions was the Personality Inventory of Eysenck and Eysenck.[174] Its choice was based on two considerations: it is conceptualized to measure two major personality dimensions, extraversion-introversion and neuroticism-stability; and its use corresponded to its usage as a proxy for specified student characteristics. An extensive discussion of the rationale for use of this scale in this study and of information pertaining to the scale itself was outlined in the presentation of student characteristics.[175]

Two additional instructor factors, pertaining specifically to this instructional situation, were: first, the course load being carried -- that is, their academic load in pursuing their degrees; and second, previous teaching experience. In instructional situations at all levels, extent of involvement outside the specific instructional

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[174] H. J. Eysenck and Sybil B. G. Eysenck, loc. cit.

[175] See pp. 99-100 in this chapter.

situation and extent of teaching experience are two criteria emphasized by "evaluators" (such as principals) as important to the success of the instructional process. In the particular instructional situation in this study, a course "model" based on a set of assumptions existed; a number of these assumptions pertained to the various roles of the teaching assistant, and were themselves based on the assumption that a decrease in faculty participation was feasible on the basis of projected teaching-assistant performance. A review of the extensiveness of these roles (see chapter two) would seem to indicate that the first of the above factors, course load, would have relevance not only in the initial phase of the course, but increasing relevance over time. The factor of previous teaching experience would seem to have particular relevance on the same basis -- with roles such as model of attitudes, skills, and understandings possessed by competent teachers. Further, teaching experience had been an important criterion in the choice of teaching assistants.

In addition, an instructor questionnaire was constructed composed of two parts: first, a series of questions concerning such factors as the instructor's graduate studies, background in the subject area of the course, occupational aspirations, and some personal data (sex, age, marital status, and so on); second, a series of questions, open-ended, involving instructor value judgments concerning the instructional situation, relative to what the instructor perceived the course model to be (that is, the assumptions and objectives underlying the course), the degree of congruence between these assumptions and the "real thing", his own objectives for the discussion section, his methods and procedures for achieving these objectives, his perception of the nature of the behaviors students should be able to exhibit as a result of successful completion of the course, and perception of how the course could be improved, and specification of his procedures for determination of students' discussion section grades. The instructor questionnaire was not part of the analytic model. No instructor names were involved; a number code was used to match instructor and students, the matching being done by other than the individual conducting this study.

III. PROCEDURES

Setting and Subjects

The setting of the study was the first course in the undergraduate teacher-preparation sequence for future teachers, which can be categorized as a lecture-discussion group, multi-section, survey-type course. The instructional content of the course included, secondarily, an introduction to the teaching profession and to the program of teacher education, and primarily an introduction to the subject matter of educational psychology. Participants in the study included five hundred and thirty-two students enrolled in the course, fifteen graduate teaching-assistant instructors, and indirectly, eight faculty lecturers, one course coordinator and evaluator, and one teaching internship advisor for the teaching assistants. The course was conducted over a ten-week period, five days per week, fifty minutes at a time, at two different hours during the day at which time the same format was offered to the students using the same personnel. At whichever of the two hours designated at the beginning of the course, the student met with all other students in the course in one large lecture section by a faculty lecturer three days a week (Mondays, Wednesdays, Fridays), and two days a week (Tuesdays and Thursdays) met, along with the other twenty-five to thirty students in his discussion section, with his graduate-assistant instructor.

Design for the Study

From the discussion at the start of this chapter concerning the instructional situation, focusing on the instructional process or "job", it was possible to derive several premises about the instructional situation. First, students enter into the instructional situation with a set of characteristics which potentially may affect the instructional process and the instructional outcomes. Second, as the students continue in the course, certain events occur which may have importance to both the process and the outcomes. These events include a) contextual factors and b) reward and performance factors. Third, the course outcomes are various (and weighted), and contingent on a combination of entering factors and continuing factors.

The structure of the design was developed to approximate the course by extracting data at different points in time as the instructional process progressed. That is, the design structure approximated the instructional situation structure, of factors which had importance at a given time to students in the instructional process, as it developed. The extractions of data were made concerning two categories of factors: outcome factors and predictor factors.

Predictor-factor data was extracted at three points, each time recombining the new data with the previous data extracted. That is, predictor-factor data was extracted at the following three points: entering-course, mid-course, and end-of-course. Table 2 summarizes the predictor factors concerning which data was derived.

TABLE 2: SUMMARY OF STUDENT PREDICTOR FACTORS

ENTERING-COURSE		MID-COURSE		END-OF-COURSE
	recombine		recombine	
<u>Personal</u>		<u>Personality</u>		<u>Personality</u>
Sex		Midterm anxiety		Final exam anxiety
Age		<u>Attitudes</u>		<u>Attitudes</u>
Major		Course-specific motivation after midterm performance		Post-attitude
Credits earned		Success expectation after midterm perf.		Discussion section attitude
Course load		Accuracy judgment of final grade, after mid. perf.		
<u>Past Performance</u>		<u>Course Performance</u>		
GPA		Midterm score		
CQT				
<u>Personality</u>				
Extraversion				
Anxiety				
Social acceptance				
Test anxiety				
Pretest anxiety				
<u>Attitudes</u>				
Learning set				
Reason enrolled				
Pre-attitude				
Course-specific motivation at pretest				

The terms "entering-course, mid-course, and end-of-course" designating extraction points are relative. That is, the terms refer to just before, along with, or just after the day of a given test which was part of the course -- specifically, the pretest, the midterm, and the final. The measures concerning the instructor predictor factors (risk, "conservatism", rigidity, defensiveness and social approval, anxiety, extraversion, course load, and teaching experience) were given, along with the instructor questionnaire, between the entering-course and mid-course extraction points.

Chapter one presented Campbell's discussion of the difficulties in extracting data unobtrusively in the natural setting, and of the strategy of using data already available, data derived as an ongoing part of the instructional situation, and data obtained from intrusions as logically a part of the natural setting as possible. Certain data was obtained from sources already available, such as the CQT-scores, derived from the entering-university testing program. Student evaluation of the discussion section experience was derived from an all-university procedure of the natural setting, that of evaluating courses. A procedure not uncommon in various courses as part of professorial license was to ask for personal information concerning student major, sex, level (here represented by credits completed), and course load; in this instance, obtained along with GPA on the face-sheet of a measure in a battery discussed below. Some brief measures, one or two questions, not normally part of the course structure appeared along with measures normally part of the instructional process -- for example, data of anxiety relative to a given specific course exam was obtained as an addendum to that exam. Data from additional similar brief measures was obtained in lecture sessions -- materials handed to students entering, completed in the brief time prior to the lecturer's appearance, kept during lecture, tossed into barrels on departure. The course post-attitude measure followed the taking of the final exam; because of the scheduling of the exam in the evening with no other course exams to follow (a regular practice of the course), students were able to spend the extra few minutes necessary. The entering-course factors represented by the pretest, the learning set scale, the measure of general test anxiety, and of extraversion and anxiety were administered in what could be called a "battery" form in the initial phase of the course. The pretest was a normal part of the course setting, the others were not, requiring two periods of course time. Table 2 (p. 124) indicates that following this initial "battery", any additional continuing data was obtained by the means outlined above.

"Outcome" data was extracted at the same three points as was the predictor data discussed above. The first extraction included pretest-score data; the second extraction, data concerning the midterm exam scores and grades; the third, data concerning final exam scores and grades, discussion section grade, and final summary course grade. These were part of the instructional situation structure.

The purpose of the entire project, of which this study was a part, was outlined to students the first day of the course. Students were assured: no names would be involved, only student number (all measures bore this number); no work would be done with the data until after their completion of the course; student responses were privileged information and no one in instructional or administrative roles in the course would be allowed to examine the individual student responses. A question was included in the post-course assessment asking students to indicate the extent to which they felt the project had affected either the instructional process or their participation in it. Responses to this item indicated 43 per cent believed not at all, an additional 26 per cent believed very little if at all, 10 per cent did not know, 13 per cent felt perhaps somewhat, three per cent felt considerably, and five per cent were omits.[176] Other than handling those measures normally a part of the instructor role, no additional participation was expected of the teaching assistants.

All students enrolling in the course chose one of the two times at which the course was offered, as part of university procedures. Prior to the start of the course, students in either of the two time periods were randomly assigned (via a table of random numbers) to one of the discussion sections in that time period; on the same basis, teaching assistants were then assigned the sections. A second list of random numbers was generated to handle late additions to the course. Students dropping the course were replaced by late-enrolling students. No section changes were allowed. Later drops from the course could not be replaced; however, the discussion sections terminated with approximately the same number of students in each section.

Strategy of Data Analysis

The data analysis paralleled the research design, involving analyses represented by the three extraction points in the design. In chapter one the discussion of the purpose of the study indicated that the analysis questions revolved around two major categories: a) instructional process; b) instructional outcomes. Interest centered on what happens to the explanation of outcomes when data is added from the time perspective of the research model. That is,

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[176] J. T. Parmeter, loc. cit., pp. 101-102

given entering-course characteristics, the data appeares to be explained thus; given the addition of mid-course characteristics, then the addition of end-of-course characteristics, how does this appear to change? An extension of this point was the interest in the explanation of results as they occurred sequentially in the course. That is, what factors appeared to have the most importance to entering-, mid-, and final-course performance. Table 3 indicates the attempt to maximize explanation by looking at changes in structure as well as changes over time.

TABLE 3: MODEL OF COURSE STRUCTURE AND TIME SEQUENCE

Analysis	Extraction 1	Extraction 2	Extraction 3	
I (entering char.)	pretest			final course grade
II (mid-course)		midterm score midterm grade		final course grade
III (end-of-course)			final exam-1 final exam-2 final exam-T final ex. gr. disc. sec. gr.	final course grade

Each factor in Table 3 represents an "outcome" factor. With the exception of the pretest, each represents an "outcome" relative not only to course structure but also to course instructional process. "Pretest" is included as an "outcome" on one dimension; that is, it was not an outcome influenced by the instructional process per se. Its importance as an "outcome" in the analysis rests on its contrast with the "outcomes" involving instructional process, when examined in terms of the predictor factors.

Table 3 (p. 128) indicates that the first-stage analysis involved two separate analyses and one set of predictor factors -- analysis of entering-course characteristics first to the entering-performance indice, that is, to the pretest; then second, to the final summary course outcome, that is, to the final course grade. Of interest was not only what entering-course factors were of importance to pretest performance, but also what entering-course factors would appear to be of importance to final course grade without the contending contextual course factors developing from the instructional process. Table 4 lists the entering-course factors involved in the two analyses in this first stage.

TABLE 4: PREDICTOR FACTORS IN STAGE I ANALYSES

Personal	Personality	Attitudes
Sex	Extraversion	Learning set
Age	Anxiety	Reason enrolled
Major	Social acceptance	Pre-attitude
Past Performance	General test anx.	Course-specific motivation at pretest
GPA	Pretest anx.	
CQT's		

Table 3 (p. 128) indicates that the second-stage analysis involved three separate analyses and one set of predictor factors -- that is, analysis of all predictor factors extracted by mid-course (including a set of contextual factors recombined with those from the stage I analysis) first to midterm exam grade; second, to midterm exam score; third, to final course grade. Table 5 lists all factors to mid-course used in the analyses of the three outcome factors.

TABLE 5: PREDICTOR FACTORS IN STAGE II ANALYSES

Personal	Attitudes
Sex	Learning set
Age	Reason enrolled
Major	Pre-attitude
*Credits earned	Course-specific motivation at pretest
*Current load	*Course Performance
Past Performance	Pretest score
GPA	*Instructor
CQT's	Extraversion
Personality	Anxiety
Extraversion	Defensiveness
Anxiety	Social acceptance
Social acceptance	Rigidity
General test anxiety	"Conservatism"
Pretest anxiety	
*Midterm anxiety	

*Not involved in stage-I analysis

Table 3 (p. 128) indicates that the third-stage analysis involved six separate analyses. The six outcomes involved included: final examination score-part one; final examination score-part two; final examination score total; final examination grade; discussion section grade; final course grade. One set of predictor factors was used, composed of three parts: a set of factors which, following the midterm examination feedback, were considered to have potential importance to end-of-course outcomes (factors such as their reconsideration of expectations for their course performance, their adjusted level of motivation, specific additional instructor factors as course pressure increases in the instructional process, and so on) recombined with the factors considered to have importance initially in the course, and those developing potential importance by midterm examination time (that is, recombined with all previous predictor factors). Table 6 lists all factors to end-of-course used in the analyses of the six outcomes.

TABLE 6: PREDICTOR FACTORS IN STAGE III ANALYSES

Personal	Attitudes	Course Performance
Sex	Learning set	*Pretest score
Age	Reason enrolled	**Midterm score
Major	Pre-attitude	Instructor
*Credits earned	**Post-attitude	*Extraversion
*Current load	**Discussion att.	*Anxiety
Past Performance	Course-specific	*Social acceptance
GPA	motivation	*Defensiveness
CQT's	at pretest	*Rigidity
Personality	**Course-specific	*"Conservatism"
Extraversion	motivation	**Risk
Anxiety	after mid.	**Course load
Social acceptance	**Success expec.	**Teaching exper.
General test anxiety	after mid.	
Pretest anxiety	**Accuracy judg.	
*Midterm anxiety	after mid.	
**Final exam anxiety		

*Not part of stage I analysis
**Not part of stage II analysis

In summary, the research strategy was to try to approximate the theoretical course model through the design and analysis models -- that is, through the data gathered, the timing of the data gathering, and through the combinations of data used in the analysis stage.

That is, the purpose of the study was to identify and evaluate, in what could be considered the initial phase of research in a specific ongoing instructional situation, those instructional situation factors which seem most important to the specified instructional situation outcomes. Since the objective was confined to locating and evaluating factors and identifying problems in the structure and relations of these factors which would reduce the validity of studies in this situation under more stringent conditions, the research design outlined in the previous section was so structured as to extract from the instructional situation as many as possible of the factors which were judged to be "candidates for importance" to the instructional process on the basis of considerations derived from the literature and the assumptions of the instructional situation designers. That is, within the limitations of these considerations, an attempt was made, by inclusion of a considerable number of factors in the design, to maximize chances of including those with the most potential importance, on the assumption that it would probably be more difficult to correct problems arising from failure to see the importance of a factor than it would be to correct those arising from incorrectly including a factor. In addition, since interest was not in comparing instructional processes and their contingent factors but rather in maximizing the potentiality of the factors across the instructional situation, subjects were considered as a single group.

The assumptions of the study research design put both specifications and constraints on the analysis strategy that could be used. As indicated by the outline of the analysis design in the previous pages, the strategy for the analysis paralleled that of the study design. Therefore, the strategy of the analysis was in escence a first stage in an inductive "model" building in this particular instructional situation, as discussed in chapter one. That is, in the analysis of each specified outcome the question of interest is: what must be known most in order to reduce predictive error the most; given the results, what additional information would help reduce this more. (The ultimate aim, of course, as Campbell and Stanley suggest, would be that through a number of iterations the point of serendipity is reached in which the assumptions underlying the most stringent models become tenable in complex instructional settings.) In addition, through the strategy of analysis in this instance, estimates of the explanatory power of the model should be available relative not only to the total variation of a given outcome factor but also to the total explanatory power of given predictor factors. Moreover, the study design put a number of additional constraints on the potential analysis strategy. For example, the variables extracted appeared in a range from classification to continuous; application of statistical tests of significance under assumptions of a fully random sampling model was questionable at best; the probability of the presence of complex interactions could not possibly be assumed away (the presence of which, according to Stanley, should not only be revealed, but identified and located.)

Under the considerations in the previous paragraph, the analysis strategy adopted was an analysis process which accounted for variance in a specified outcome factor by optimal splits of a specified set of predictor variables. Paralleling the study design, the analysis strategy also, in the beginning, regarded subjects as a single group. This initial group of subjects was then divided, through a series of binary splits, into a mutually exclusive set of subgroups, the subgroups chosen so that their means accounted for more of the total sum of squares (that is, reduced the predicitive error more) than the means of any other set of subgroups. Briefly summarizing the entire strategy: the first decision is what single division of the initial single group into two groups (on the basis of the most important predictor at that point) will do the most good in reducing predictive error (that is, providing the largest reduction in the unexplained sum of squares; the next step is to determine which of the two groups of subjects thus created has the largest remaining error sum of squares and should be looked at next for possible further subdivision (the other group being a possible candidate for examination later in the analysis). Whenever a further subdivision of a group will not reduce the unexplained sum of squares in that group by a specified percentage of the total sum of squares (usually at least one per cent), the particular group splits no further and is regarded as a final group. If, however, the group does meet the criterion, and is still a candidate for subdivision, the group must be composed of at least a specified number of subjects (usually a minimum of twenty, to provide stability); if not, the subgroup is regarded as a final group. If both these criteria are met, the group is still a candidate and must meet the criterion of accounting for a specified percentage of the original sum of squares, (one-half per cent reduction in error before a split is allowed). If the criterion is not met, said group is regarded as a final group. When no groups exist to meet these criteria, the final set of subgroups exists, with each subject in the original group now a member of only one subgroup; that is, a final subgroup. The detailed theoretical considerations underlying the strategy, the statistical algorithm, the rationale for establishment of the parameter setting, its use in a number of studies, and its development over time have been documented by Sonquist and Morgan.[177]

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[177] J. A. Sonquist and James N. Morgan, The Detection of Interaction Effects, (Ann Arbor, Michigan: Institute for Social Research, 1964) pp. 5-140.

Sonquist points out that in an initial analysis where the purpose of the data is not only to locate and evaluate potentially important factors but also to produce information useful in determining the extent to which problems exist in the data and what variables are involved, parameter settings for the criteria are indicated which will insure that the maximum of information is extracted from the data.[178] Thus as few constraints as possible should be placed on the partitioning process, the parameters set to permit the creation of as many final groups as is feasible. "In addition to providing a maximum amount of information, the total explained[179] variation provided by this analysis estimates the amount that could be explained by a configuration model of the data being used."[180] For purposes of this analysis, stopping criteria were purposely relaxed slightly in order to provide as many leads as possible: the criterion relative to total sum of squares before a group is examined was set at .0001 (a specification used by the designers of this strategy); minimum group size was set at twenty, and the criterion relative to sum of squares before a group is examined was set at .006.

Each of the outcome factors was also examined on the basis of the specified set of predictor factors (as outlined in the design for analysis) using multiple linear regression analysis. These

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[178] J. A. Sonquist, "Multivariate Model Building," paper presented at the Conference on Multivariate Models for Data Analysis in the Social Sciences, Institute for Advanced Studies, Vienna, Austria, September 26/27, 1969, pp. 1-37.

[179] By "explained" is meant that the means of the two halves are used for predicting rather than the over-all mean.

[180] Sonquist and Morgan, loc. cit., pp.22-23.

analyses were performed to provide information relative to the points raised in chapter one concerning the use of this strategy with such data, and were not part of the design of the study. Therefore, results of these analyses appear only in summary form in the following chapter, and are referred to in the text only in regard to points raised in chapter one.

IV. EXPECTATIONS AND IMPLICATIONS

The supposition has been put forward that within any given instructional situation there is, at any given moment, an overall "job" going on, and this "job," represented by the instructional process, is to reach some objective or goal. That is, there is some overriding goal (which may be defined by subgoals) to which all factors in this given situation are geared. The particular form taken by the instructional process, therefore, is defined by these factors. A further supposition is that in order to understand this process it is necessary to take into account several considerations. First, underlying this instructional process is a "model" -- a set of assumptions (held by those creating the instructional situation) about the nature of the instructional process, and therefore about the nature of the factors defining the process. Second, while the form of the instructional process is defined by the factors, specific dimensions of these factors may carry more relative importance or weight in this definition. Third, at any given moment, the instructional process is a process of balancing two components -- that which is goal-oriented, and that which deals with pressures that have arisen in instructional situation at that moment. Fourth, different types of subgoals suggest that for each subgoal a different combination of factors involved in the instructional process will explain student performance in the achievement of that subgoal. Fifth, as the instructional process develops, the interest is not only on what students have in common but also on how they vary.

In this study, the purpose is to attempt to unravel the component parts of a given instructional situation by exploring the structure of relations among potentially important factors involved in the instructional process, and the conditions under which these relationships occur, in order to determine the relative importance of these factors to course criteria and outcomes. The concept of "importance" refers to the weight or usefulness of a given factor in this situation, defined by four characteristics: amount, location, time, and criterion.

The considerations underlying the concept of "the instructional process" and those underlying the concept of "importance" suggest a number of expectations about the structure of relations among the factors at any given moment and over time, in the particular instructional situation used in this study.

1. Coalescence will occur around certain classes of predictor variables in their description of a given outcome variable, the coalescence differing according to conditions surrounding the various outcome variables.

This first expectation relates to the contextual characteristics which surround a given outcome -- that is, the nature of the particular outcome, and the pressures upon the instructional process at a given time. The two predominant contextual characteristics in the instructional situation in this study which should result in coalescence of predictor factors, but differing in nature, are: first, the dimensions of competition versus non-competition; second, conditions relative to different points in time throughout the course. For example, the pretest as described by choice of items and means of administration is similar to the exams determining final course grade. However, the nature of the two outcomes (pretest and final course grade) on the dimension of competition leads to the expectation that coalescence would occur around different classes of predictors in explaining the outcomes. In the same sense, specific factors arising from the pressures within the context of the instructional process (for example, anxiety specifically toward the midterm exam) lead to the expectation that the structure of relations among factors present early in the course would be altered over time. Therefore, the specific questions to be considered in this study are:

1. Is the structure of relations among classes of entering-course variables similar for the pretest (noncompetitive) and the final course grade (competitive)?

2. Is the structure of relations between classes of predictors of the final course grade similar for different points in time -- entering-course, mid-course, and end-of-course?

2. <u>The results will show differences among the outcome variables (assessed student performance) in the type of predictor variables accounting for variance and in the extent of the explanation of variance</u>.

As compared to the previous expectation which was concerned with differences in explanation attributable to differences in contextual conditions, this expectation is primarily concerned with explanatory differences between outcomes in terms of the inherent tasks underlying the outcomes. First, it is expected that there will be overall differences in explanation among the outcomes because of the differing terms of each analysis (for example, the overall variance of the outcome variable, and the number of predictor variables included in the analysis), Second, it is expected that comparisons between analyses reasonably comparable in terms of overall variance in the outcome variables and identical in terms of the number of predictor variables, but different in terms of the underlying task, will result in different types of predictors emerging and in the extent of variance explainable by the different predictors. More specifically, it is expect that there will be broad differences in explanation between the final exam score-1, primarily a content-recall exercise, and the final exam score-2, an applied, problem-solving exercise. Another comparison which should illustrate differences attributable to underlying task is that between final exam grade, representing students' preparation for the exam in combination with other factors, and the instructor grade, representing the students' involvement and performance in the discussion section over the length of the term, in combination with other factors. Therefore, the specific questions to be considered are:

1. What accounts for the largest amounts of variance across the range of the different outcome variables?

2. Are there differences between the levels of the different outcome variables in:

    a. type of predictors accounting for variance?

    b. the extent of prediction by both number of splits and amount of variance explained?

3. Are there differences between outcome variables similar in analysis conditions, but different in underlying

task, specifically:

a. between the final exam score-1 (recall) and the final exam score-2 (applied)?

b. between the final exam grade and the instructor grade?

3. Measured factors may together represent a weighting of their underlying theoretical constructs in the form of an interaction.

Almost monotonously the literature reporting investigations of the instructional setting cite significantinteractions which were either uninterpretable or for which there was no provision allowed in the theoretical model. The reality of the instructional setting is such that interactions should be expected, and may, in fact, be the ideal result of an instructional strategy. If the instructional outcomes result in interactions which improve the performance of students off the expected, then those interactions are highly desirable. Given the number of students involved in the instructional situation under study, the highly heterogeneous nature of these students, the large number of instructional personnel, and the extensive number of objectives to which the course was directed, the likelihood of interactions occuring is even more probable. Thus for this study, a number of interactions would be expected and because of the lack of homogeneity and independence involved, it would be expected that of the interactions which emerge there would be variations of three dimensions: (1) interactions involving levels of student characteristics to course outcomes and interactions involving levels of instructor characteristics to course outcomes; (2) the interactions involving positive instructional effects (results greater than expected) and negative instructional effects (results less than expected); and (3) the interactions involving different degrees of interactiveness -- that is, interactions might emerge independently of multicollinearity. Because interactions were expected in the study and made a part of the analysis strategy, they will be used throughout the description of results, and therefore, the following questions will be directed only toward examples of the above dimensions:

1. Are there examples of interactions between instructor characteristics and course outcomes?

2. Are there examples of interactions between student characteristics and course outcomes?

3. Are there examples of positive interactive results (students performing above the expected) on course outcomes?

4. Are there examples of negative interactive results (students performing below the expected) on course outcomes?

5. Are there examples of interaction with no collinearity present?

6. Are there examples of interaction combined with collinearity?

4. <u>Certain instructional process variables operate differentially as facilitators or barriers to student performance in meeting course criteria and outcomes</u>.

From the preceding discussion of interactions, one of the dimensions developed was the quality of the effect of the interaction on student performance -- that is, positive interactions as the result of performance above the expected and negative interactions as the result of performance below the expected. That discussion was but part of a larger discussion directed solely to the nature of interactions, but the idea of facilitators and barriers is significant enough to merit a concern by itself. In terms of the instructional setting as a means to course goals, it is expected that there are a number of different factors which might act either as barriers or facilitators of student performance beyond those that just appear as interactions. Certain factors are obvious and consistent. For example, the nature of the overriding conditions to which the instructional setting was geared was strongly competitive. Therefore, the role of factors associated with competition in similar situations, such as the role of the grade-point average to course outcomes, would be expected to operate consistently across all levels of students over time. However, it is also possible that the idea of barriers and facilitators to performance is more selective than the obvious, consistent predictors. Instructor characteristics possibly operate as such in different ways. It is also possible that student characteristics may operate selectively across different ranges of past and present performance to increase or decrease outcome results. In addition, part of the rationale behind this study recognizes the importance of both time and type of outcome as important contributors to differences in student performance. As an extension of this rationale, it is possible that certain factors work selectively with respect to either time or type of outcome as facilitators or barriers. Therefore, the specific questions to be considered in relation to this expectation are:

1. What different factors operate consistently across all levels over time as facilitators or barriers to student performance?

2. Do instructor characteristics differentially operate as barriers or facilitators to student performance?

3. Are there differing sets of predictors that act as barriers or facilitators for the different ranges of student performance in the course?

4. Are there differing sets of predictors that act selectively as barriers or facilitators to student performance at different points in time?

5. Are there differing sets of predictors that act selectively as facilitators or barriers to student performance according to the type of course outcome?

5. The results will show isolated exceptions, normally relegated to measurement or statistical error, which represent either important exceptions to general prediction, or real instructional problems.

This expectation is an extension of the concept of characteristics as barriers/facilitators, discussed above. In this instance, the expectation is that there will be isolated exceptions of small groups of students on the barrier-facilitator dimension which, unlike other small groups that might be considered created by chance fluctuation, appear consistently. Therefore, the specific questions to be considered are:

1. Are there small groups which represent actual exceptions to general prediction when compared with other students on the same dimension of this characteristic?

2. Are there small groups which appear to represent real instructional problems?

6. To some degree the data will provide an estimate of congruence between course goals and conduct of the course.

The goals and the assumptions underlying the processes by which the goals were to be achieved were discussed in chapter two. Condensed here, there appear to have been three major goals. First, educational opportunity was to be a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact. The implementation of this goal was based on three assumptions: a) the capability of the teaching assistant to make discriminations on student heterogeneity and to provide opportunities for students to overcome barriers created by differential entering characteristics; b) common exams would not create an atmosphere based mainly on competition for the high exam score; c) TA grades would make discriminations on important variables that common exams did not discriminate upon. The second major goal was that the course was to be judged on the basis of the learning and "scholarship" generated among students by it. The implementation of this goal rested on the following assumptions: a) the content provided by the faculty from speciality areas could be used by students to organize an approach to educational psychology and problems in the classroom; b) the list of competencies to be developed by this instructional process and expressed as a set of objectives operationalized this major goal; c) teaching assistants possessed the skills to help students to integrate disparate lectures and readings in a problem-solving approach to future teaching experiences. The third major goal embodied three aspects: a) student-teacher interaction was to be a main consideration; b) not only quality instruction but also the teacher as a model were of primary importance; c) an objective of the course was to contribute to development of attitudes characterizing a "competent" teacher. The implementation of this goal rested on the assumption that a decrease in faculty participation was possible on the basis of projected TA performance in these areas. To get at course congruence necessitates both a reintegration of the results corresponding to the previous questions and a further examination of the data, as applied to the following questions.

1. Was educational opportunity a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact (performance outcomes)?

2. To what degree did the course prepare the students to use disparate information in an integrated approach to

solving classroom problems?

3. To what extent did the course provide models of the instructional behavior suggested as goals for students?

Summary

Within any given instructional situation there is a "job" being performed, represented by the instructional process. That is, there is some overriding goal to which all factors in this situation are geared; therefore, the particular form taken by the instructional process is defined by these factors. In order to understand this process it is necessary to take into account several considerations. First, there is a "model" -- a set of assumptions -- underlying the instructional process. Second, while the form of the instructional process is defined by the factors, specific dimensions of these factors carry more weight in this definition. Third, the instructional process involves the balancing of two parts -- one part specifically goal-oriented, the other part dealing with pressures that have arisen in the instructional situation at a given moment, affecting goal progress. Fourth, the impact of various subgoals must be taken into account. Fifth, as the instructional process develops, the interest is not only on what students have in common but also on how they vary.

In this study, the purpose is to attempt to unravel the component parts of a given instructional situation by exploring the structure of relations among potentially important factors involved in the instructional process, and the conditions under which these relationships occur, in order to determine the relative importance of these factors to course criteria and outcomes. The concept of "importance" refers to the weight or usefulness of a given factor in this situation, defined by four characteristics: amount, location, time, and criterion.

The above considerations necessitated including in the analytic model not only potentially important entering-course factors but also those which over time play a role. In choosing those factors to be included from the total potential set of factors in the instructional situation, it was necessary to consider not only recommendations from previous findings and theory but also the "model" of the instructional situation. The review of the literature also suggested that the core of any given instructional situation is the interactive relationship between student and teacher. Therefore, factors in the analytic model were confined to those from the discussion section which reflect potentially important student characteristics, and potentially important instructor characteristics relative to their assumed roles in this particular instructional situation.

Factors concerning students were chosen from the areas of performance, attitudes, personality, and personal characteristics.

Prior knowledge and ability were reflected by a number of factors: past academic performance in instructional situations with an underlying institutional similarity to that of the instructional situation under study, represented by student gradepoint average; past performance in situations ostensibly indicating potentiality of general intellectual ability, not only verbal but also conceptual ability, measured by CQT-scores; past performance on content with a possibly underlying similarity to content which is a part of the instructional process in this study, and measured by the pretest score; performance on content covered early in the course as related to later performance in the instructional situation, and measured by score on the midterm.

Various specific aspects of attitudes were reflected by a number of factors included in the study. One set of attitudes reflected qualitative judgments of students about the instructional process itself; this set of attitudes was represented by three factors -- reason for enrolling for the instruction, student pre- and post-course attitude and motivation toward the instructional situation, and student attitude toward the discussion experience specifically. A second set of attitudes pertained to the aspirations and expectations students hold for themselves in terms of their performance. A third set of attitudes pertained to academic "set" or preference for factual or conceptual learning.

Specific personality factors were explored with which, in interaction, students and teacher could logically be expected to come to grips in the instructional process. The first set of factors reflected anxiety related to academic situations, both in general test-taking situations and those specifically connected with test-taking in this instructional situation. The second set of factors was chosen on the basis of potential relevance to performance specifically in the discussion section. In a "discussion" section which really does not qualify as a small group, reticence or recalcitrance to make oneself known and heard was considered a factor with potential importance, as was a high degree of anxiety, generated by demands for personal commitment beyond that which the individual feels able to make.

Additional factors included were the personal factors of sex, age, major field of interest, credits earned academically, and current academic course load.

Instructor characteristics were chosen on the basis of the assumptions of the teaching assistant's role in the course, and associated suggestions from the literature. The various instructor roles stressed the importance of the instructor as a model of predispositions toward a critical-thinking, inquiry approach to issues raised through the course content and its application. Results of studies cited in chapter three suggested the importance of such thought processes in the development of cognitive functioning in children; the cruciality of similar processes during development taking place in late adolescence and young adulthood; the importance of such predispositions in students who themselves are eventually to assume the role of teacher in the instructional process (such as the particular students in this study); suggestions pertaining to certain predispositions characteristic of those teachers who offered the greatest sense of support to students attempting to engage in an "inquiry" approach to learning. This led to the inclusion in this study of factors on the following continuums: extent of conservatism and uncertainty in judgment in ambiguous contexts; the extent of conservatism in beliefs, extent of proneness to control events, and to settle for the status quo; extent of rigidity in interaction with students; extent of need for social acceptance and defensiveness; extent of reticence in interaction with students, and degree of anxiety created by demands for personal commitment beyond that which the individual feels able to make; course load; teaching experience. An open-ended questionnaire of instructor perceptions and judgments of the course was also included.

For both student characteristics and those of instructors, rationales were presented in chapter three for the choices not only of each factor but also for each measure used as a proxy for a specified factor.

This study was concerned with the relative importance of "predictor" factors in terms of the assumptions underlying the specific instructional situation in this study, and focused directly on what, in fact, was the relative importance of these factors to actual course outcomes -- the outcomes themselves defined in terms of assessed performance. That is, the term "outcome" referred to those factors considered to be tangible representations of the theoretical assumptions of the course "model". The outcome variables involved two forms: performance variables and reward variables. Course performance factors were represented by examination scores. Reward variables were represented by: grades assigned student scores on the examinations; grades assigned by instructors; final grade assigned in the course. (The term "reward" was applied to the grades because they represented the value placed on student performance by a highly competitive system.)

Subjects included five hundred and thirty-two students enrolled in the instructional situation, and fifteen graduate teaching-assistant instructors. The course was conducted over a ten-week period, five days per week, in fifty-minute sessions. Students met as a group for lecture three sessions per week, and in a given discussion section of approximately twenty-five fellow students two sessions per week.

The structure of the research design approximated the instructional process over time, by extracting data at different points in time as the instructional process progressed. Extractions were made on two categories of factors: outcome and predictor. Both types were extracted at the following three points: entering-course, mid-course, end-of-course. Table 2 (p. 124) summarizes the predictor factors concerning which data were derived. As for outcome data extracted -- the first extraction included pretest-score data, the second extraction included midterm exam scores and grades; the third extraction included final exam scores and grades, discussion section grade, and final course grade.

The data analysis paralleled the research design, involving analyses represented by the three extraction points in the design. In chapter one the discussion of the purpose of the study indicated that the analysis questions revolved around two major categories: instructional process and instructional outcomes. Interest centered on what happens to the explanation of outcomes when data are added from the time perspective of the research model. An extension of this was interest in the explanation of results as they occurred sequentially in the course. Table 3 (p. 128) indicates the attempt to maximize explanation by looking at changes in structure as well as changes over time.

The first-stage analysis (labelled "I") involved two separate analyses of two outcome factors and one set of predictor factors -- that is, analysis of entering-course characteristics first to the pretest, then to the final course grade. Entering-course predictor factors involved in the analysis of the two outcomes included: sex, age, major, GPA, CQT-scores, extraversion, anxiety, social acceptance, general test anxiety, pretest anxiety, learning set, reason for enrolling, pre-attitude toward the instructional situation, and course-specific motivation at pretest time.

The second-stage analysis involved three separate analyses and one set of predictor factors. Separate analyses were made of the following three outcomes: midterm score, midterm grade, and final course grade. The predictor factors involved in the second-stage analysis (labelled II) were: credits earned, current load, midterm anxiety, pretest score, and the following instructor factors (extraversion, anxiety, defensiveness, social acceptance, rigidity, "conservatism"), combined with the predictors used in the stage-one analysis.

The third-stage analysis involved six separate analyses and one set of predictor factors. The six outcomes, each part of a separate analysis, included: final exam-recall section; final exam-applied section; final exam-total; final exam grade; discussion section grade; final course grade. The set of predictor factors used in the analyses included: final exam anxiety, post-attitude, attitude toward discussion section, course-specific motivation after midterm, success expecation after midterm, and accuracy of this judgment, midterm score, instructor risk, instructor course load, instructor teaching experience, combined with the set of predictor factors in the stage-two analysis.

In summary, the research strategy was to try to approximate the theoretical course model through the design and analysis models -- that is, through the data gathered, the timing of the data gathering, and through the combinations of data used in the analysis stage. A total of eleven analyses of nine course outcomes were made on the basis of three sets of predictor factors. Under such a strategy, assumptions of absence of interactions, nonclassifactory data, nonrandomness, and so forth, were not tenable, necessitating an analysis strategy the assumptions of which met the requirements of the model used. Therefore, the strategy adopted was an anlysis process which accounted for variance in a specfied outcome factor by optimal splits of a specified set of predictor factors. Paralleling the study design, the analysis strategy also, in the beginning, regarded subjects as a single group. This initial group of subjects was then divided, through a series of binary splits, into a mutually exclusive set of subgroups, the subgroups chosen so that their means accounted for more of the total sum of squares than the means of any other subgroups.

The considerations underlying the concept of "the instructional process" and those underlying the concept of "importance" as discussed at the beginning of this summary suggested a number of expectations about the structure of relations among the factors at any given moment and over time, in the particular instructional situation used in this study, to be revealed by the analyses. Briefly summarized, they are:

1. Coalescence will occur around certain classes of predictor variables in their description of a given outcome variable, the coalescence differing according to conditions surrounding the various outcome variables.

2. The results will show differences among the outcome variables (assessed student performance) in the type of predictor variables accounting for variance and in the extent of the explanation of variance.

3. Measured factors may together represent a weighting of their underlying theoretical constructs in the form of an interaction.

4. Certain instructional process variables operate differentially as facilitators or barriers to student performance in meeting course criteria and outcomes.

5. The results will show isolated exceptions, normally relegated to measurement or statistical error, which represent either important exceptions to general prediction, or real instructional problems.

6. To some degree the data will provide an estimate of congruence between course goals and conduct of the course.

In chapter four the data are summarized and displayed to illustrate the analysis strategy used in interpreting the data, and the data are discussed in terms of the concept of "importance".

CHAPTER IV

DATA DISPLAY AND DISCUSSION OF "IMPORTANCE"

This chapter has two purposes. First, the data is summarized and displayed to illustrate the analysis strategy to be used in interpreting the data derived from the analysis of each set of predictor factors to an outcome factor. Second, the presentation is a discussion of the relative importance of the predictor factors to the course outcomes, on the basis of the four characteristics of importance which together provided the basis for the evaluation of the predictor factors -- that is, amount, location, time, and criterion, as delineated in chapter one.

I. DATA DISPLAY FORM

Complete display of the data is found in the appendices. Appendix B provides, for all analyses, a summary of the variables, including number, mean, standard deviation, skewness and kurtosis; Appendix C provides an intercorrelation matrix of the variables. For each outcome factor used, the following are provided:

Appendix D Each tree provides a visual representation of the groups formed on the basis of predictor variables. When two groups are formed as the result of a split, the group with the higher mean appears above the other. A group is represented by a box which lists:

a) the predictor classes of the predictor variable used in that particular split

b) group mean and standard deviation on the outcome

c) the per cent of sample included in the group

d) for a final group, the group size, and an asterisk designating it as final.

Figure 1, p. 157 is an example of the form of data in Appendix D. Box number two (2) summarizes the fact that students appear in this group on the basis of grade point averages of 1.1 to 2.7, the mean final course grade is 3.376 with standard deviation .730, 72.1 per cent of the students in the study appear in the group, and it is not a final group.

Appendix E The statistic $(BSS/TSS)_i$ is examined for each predictor over each group created during the partitioning process, showing the proportion of variation in each group explainable for each predictor. The group numbers in the column headings correspond to the group numbers in the trees of the figures in Appendix D. Indicators mark the predictor used in a split, the next best choice, the split-fail attempts, and the final groups. Table 7, p. 158 is an example of the tables in Appendix E. The proportion of variation in group three (3) explainable for each predictor appears in the second column. The arrow from group (3) to groups (12) and (13) indicates that predictor (50-50-1) was used in the reduction of variation. That is, differentiation among students with higher grade point averages represented by group (3) in the tree and table (Figure 1, p. 157 and Table 7 , p. 158)

FIGURE 1

Explanation of Final Course Grade by Entering Course Variables

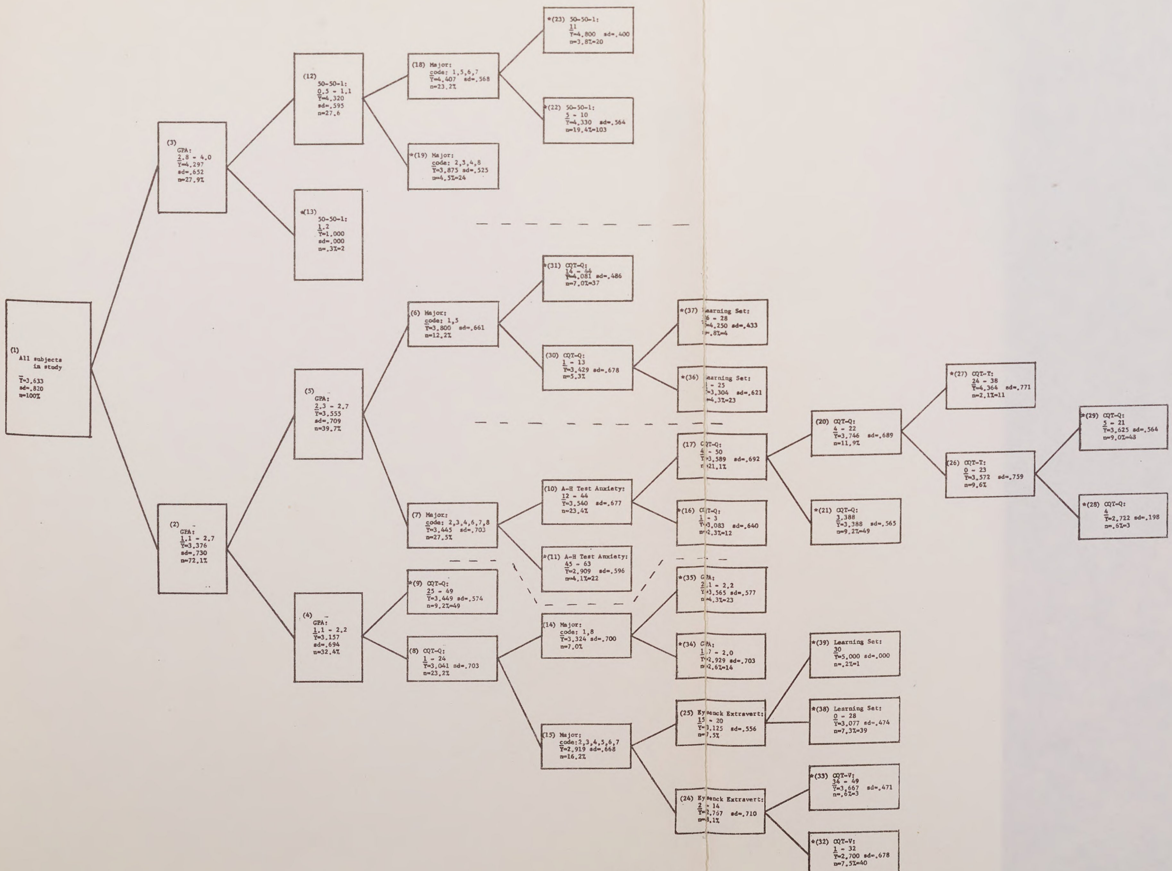
(1) All subjects in study Ȳ=3.633 sd=.820 n=100%
(3) GPA: 2.8 - 4.0 Ȳ=4.297 sd=.652 n=27.9%
(2) GPA: 1.1 - 2.7 Ȳ=3.376 sd=.730 n=72.1%
(12) 50-50-1: 0.5 - 1.1 Ȳ=4.320 sd=.595 n=27.6
*(13) 50-50-1: 1.2 Ȳ=1.000 sd=.000 n=.3%=2
(5) GPA: 2.3 - 2.7 Ȳ=3.555 sd=.709 n=39.7%
(4) GPA: 1.1 - 2.2 Ȳ=3.157 sd=.694 n=32.4%
(18) Major: code: 1,5,6,7 Ȳ=4.407 sd=.568 n=23.2%
*(19) Major: code: 2,3,4,8 Ȳ=3.875 sd=.525 n=4.5%=24
(6) Major: code: 1,5 Ȳ=3.800 sd=.661 n=12.2%
(7) Major: code: 2,3,4,6,7,8 Ȳ=3.445 sd=.703 n=27.5%
*(9) CQT-Q: 25 - 49 Ȳ=3.449 sd=.574 n=9.2%=49
(8) CQT-Q: 1 - 24 Ȳ=3.041 sd=.703 n=23.2%
*(23) 50-50-1: 11 Ȳ=4.800 sd=.400 n=3.8%=20
*(22) 50-50-1: 5 - 10 Ȳ=4.330 sd=.564 n=19.4%=103
*(31) CQT-Q: 14 - 44 Ȳ=4.081 sd=.486 n=7.0%=37
(30) CQT-Q: 1 - 13 Ȳ=3.429 sd=.678 n=5.3%
(10) A-H Test Anxiety: 12 - 44 Ȳ=3.540 sd=.677 n=23.4%
*(11) A-H Test Anxiety: 45 - 63 Ȳ=2.909 sd=.596 n=4.1%=22
(14) Major: code: 1,8 Ȳ=3.324 sd=.700 n=7.0%
(15) Major: code:2,3,4,5,6,7 Ȳ=2.919 sd=.668 n=16.2%
*(37) earning Set: 6 - 28 4.250 sd=.433 .8%=4
*(36) earning Set: - 25 3.304 sd=.621 4.3%=23
(17) - 50 3.589 sd=.692 21.1%
*(16) 3 3.083 sd=.640 2.3%=12
*(35) 1 - 2.2 3.565 sd=.577 4.3%=23
*(34) 7 - 2.0 2.929 sd=.703 2.6%=14
(25) Extravert: 20 3.125 sd=.556 7.5%
(24) Extravert: 14 2.757 sd=.710 3.1%
(20) CQT-Q: 4 - 22 Ȳ=3.746 sd=.689 n=11.9%
*(21) CQT-Q: 3.388 Ȳ=3.388 sd=.565 n=9.2%=49
*(39) Learning Set: 30 Ȳ=5.000 sd=.000 n=.2%=1
*(38) Learning Set: 0 - 28 Ȳ=3.077 sd=.474 n=7.3%=39
*(33) CQT-V: 34 - 49 Ȳ=3.667 sd=.471 n=.6%=3
*(32) CQT-V: 1 - 32 Ȳ=2.700 sd=.678 n=7.5%=40
*(27) CQT-T: 24 - 38 Ȳ=4.364 sd=.771 n=2.1%=11
(26) CQT-T: 0 - 23 Ȳ=3.572 sd=.759 n=9.6%
*(29) CQT-Q: 5 - 21 Ȳ=3.625 sd=.564 n=9.0%=43
*(28) CQT-Q: 4 Ȳ=2.722 sd=.198 n=.6%=3

FIGURE 1

TABLE 7

AID I: Proportion of Variation in Final Course Grade by Group within Branch Explainable for Each Entering-Course Variable

Predictor	Group Number							
	1	3	12	13*	18	19*	22*	23*
Sex	.004	.022	.019		.016	.019	.016	.011
Age	.002	.003	.003		.007	.129	.002	.211
Major	.043	.081	.109		.011	.022	.028	.063
GPA	.254	.080	.084		.068	.198	.055	.083
CQT-V	.087	.065	.056		.038	.079	.021	.204
CQT-Q	.070	.103	.102		.079	.157	.045	.063
CQT-T	.088	.091	.086		.064	.121	.026	.210
Eysenck Ext.	.025	.031	.029	NA	.016	.129	.040	.306
Eysenck Neu.	.003	.008	.018		.021	.170	.016	.211
Eysenck Lie	.012	.020	.026		.018	.222	.014	.167
A-H Test Anx.	.055	.018	.017		.023	.120	.037	.209
Text Anx.-1	.001	.001	.001		.000	Cons.	.003	.013
Learning Set	.041	.048	.054		.052	.152	.057	.063
Reason Enrol	.004	.010	.009		.009	.015	.009	.141
Pre-attitude	.005	.015	.008		.018	.072	.049	.062
50-50-1	.085	.174	.103		.093	.199	.021	Cons.
N	532	149	147	2	123	24	103	20
TSS_i/TSS_T	1.000	.176	.145	.000	.111	.019	.092	.009
MEAN	3.633	4.297	4.320	1.000	4.407	3.875	4.330	4.800

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE 7 (cont'd.)

Predictor	Group Number							
	1	2	5	6	30	31*	36*	37*
Sex	.004	.015	.008	.006	.012	.000	Cons.	
Age	.002	.001	.009	.023	.015	.067	"	
Major	.043	.031	.053	.011	.009	.033	"	
GPA	.254	.073	.032	.044	.059	.046	"	
CQT-V	.087	.028	.030	.107	.036	.233	"	
CQT-Q	.070	.038	.039	.240	.034	.090	"	
CQT-T	.088	.027	.033	.161	.064	.082	"	
Eysenck Ext.	.025	.008	.007	.025	.037	.091	"	NA
Eysenck Neu.	.003	.009	.009	.036	.043	.051	"	
Eysenck Lie	.012	.027	.020	.048	.152	.060	"	
A-H Test Anx.	.055	.035	.045	.046	.065	.042	"	
Test Anx.-1	.001	.002	.006	.023	.015	Cons.	"	
Learning Set	.041	.029	.028	.104	.241	.074	"	
Reason Enrol	.004	.002	.005	.015	.037	.040	"	
Pre-attitude	.005	.006	.011	.013	.026	.006	"	
50-50-1 (Asp.-Exp.)	.085	.009	.007	.036	.036	.053	"	
N	532	383	211	65	28	37	23	4
TSS_i/TSS_T	1.000	.570	.297	.079	.036	.025	.025	.002
MEAN	3.633	3.376	3.555	3.800	3.429	4.081	3.304	4.250

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE 7. (cont'd.)

Predictor	Group Number													
	1	2	5	7	10	11*	16*	17	20	21*	26	27*	28*	29*
Sex	.004	.015	.008	.015	.021	Cons.		.031	.051	.015	.015			.062
Age	.002	.001	.009	.006	.010	"		.007	.012	.050	.013			.014
Major	.043	.031	.053	.025	.044	"		.057	.067	.080	.046			.118
GPA	.254	.073	.032	.032	.043	"		.023	.060	.033	.027			.009
CQT-V	.087	.028	.030	.030	.024	"		.025	.106	.054	.039			.027
CQT-Q	.070	.038	.039	.045	.049	"		.072	.083	.067	.078			.026
CQT-T	.088	.027	.033	.024	.025	"		.017	.136	.047	.063			.026
Eysenck Extraversion	.025	.008	.007	.025	.016	"	NA	.012	.014	.077	.028	NA	NA	.117
Eysenck Neuroticism	.003	.009	.009	.017	.026	"		.027	.021	.092	.041			.068
Eysenck Lie	.012	.027	.020	.021	.041	"		.036	.117	.047	.053			.051
A-H Test Anxiety	.055	.035	.045	.103	.017	"		.008	.021	.050	.015			.040
Text Anxiety-1	.001	.002	.006	.003	.005	"		.007	Cons.	.010	Cons.			Cons.
Learning Set	.041	.029	.028	.011	.013	"		.018	.072	.038	.027			.040
Reason Enrolled	.004	.002	.005	.009	.006	"		.002	.005	.015	.033			.017
Pre-attitude	.005	.006	.011	.013	.013	"		.011	.031	.066	.064			.019
50-50-1 (Asp.-Exp.)	.085	.009	.007	.023	.016	"		.10	.006	.031	.038			.044
N	532	383	211	146	124	206	12	112	63	49	51	11	3	48
TSS_i/TSS_T	1.000	.570	.297	.202	.159	.022	.014	.137	.084	.044	.082	.018	.033	.043
MEAN	3.633	3.376	3.555	3.445	3.540	2.909	3.083	3.589	3.746	3.388	3.572	4.364	2.722	3.625

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

= Split made on this variable.
.xxx = Next best BSS/TSS.
* = Final group.
= Split attempted but not made.
NA = Split not attempted.

TABLE 7 (cont'd.)

Predictor	Group Number														
	1	2	4	8	9*	14	15	24	25	32*	33*	34*	35*	38*	39*
Sex	.004	.015	.027	.057	.028	.019	.035	.069	.041	.047			.001	.023	
Age	.002	.001	.014	.018	.082	.028	.011	.021	.062	.008			.091	.034	
Major	.043	.031	.051	.070	.096	.001	.024	.067	.116	.116			.005	.128	
GPA	.254	.073	.033	.031	.060	.195	.028	.026	.105	.050			.042	.136	
CQT-V	.087	.028	.036	.027	.019	.116	.062	.120	.104	.050			.091	.135	
CQT-Q	.070	.038	.071	.020	.077	.108	.037	.084	.051	.073			.166	.091	
CQT-T	.088	.027	.039	.019	.039	.103	.036	.095	.063	.090			.091	.100	
Eysenck Ext.	.025	.008	.032	.026	.120	.026	.072	.066	.017	.073	NA	NA	.029	.119	NA
Eysenck Neu.	.003	.009	.009	.009	.067	.058	.032	.117	.067	.115			.159	.100	
Eysenck Lie	.012	.027	.026	.010	.008	.026	.054	.060	.024	.053			.085	.043	
A-H Text Anx.	.055	.035	.010	.016	.062	.088	.031	.057	.063	.109			.091	.102	
Test Anx.-1	.001	.002	.000	.000	Cons.	.006	Cons.	Cons.	Cons.	Cons.			.043	Cons.	
Learning Set	.041	.029	.032	.033	.074	.103	.038	.034	.291	.036			.227	.205	
Reason Enrol	.004	.002	.002	.004	.009	.042	.001	.003	.011	.005			.103	.024	
Pre-attitude	.005	.006	.010	.009	.043	.030	.038	.077	.057	.084			.176	.054	
50-50-1	.085	.009	.009	.015	.018	.062	.011	.024	.034	.028			.104	.004	
N	532	383	172	123	49	37	86	43	40	40	3	14	23	39	1
TSS_i/TSS_T	1.000	.570	.232	.170	.045	.051	.108	.061	.035	.051	.002	.019	.021	.002	.000
MEAN	3.633	3.376	3.157	3.041	3.449	3.324	2.919	2.767	3.125	2.700	3.667	2.929	3.565	3.077	5.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

= Split made on this variable.

.xxx = Nest best BSS/TSS.

* = Final group.

= Split attempted but not made.

NA = Split not attempted.

is made on the basis of their aspirations and expectations for the course (50-50-1), and the students are now represented by groups (12) and (13). Because of the number of groups represented in any given tree, to aid the reader the groups are placed together in the $(BSS/TSS)_i$ table in the natural groupings represented in the tree. For example, in Table 7, (pp. 158-161) each of the four pages represents one of the four major branches in the tree of Figure 1, (p. 157). The groups appearing on page 158 of the table are the same groups appearing in the main branch in the upper part of the tree in Figure 1.

All other figures and tables appear within the text of the discussion.

A number of analyses were made involving outcome variables (dependent variables) and different sets of predictor variables. In the figures and tables, any analysis involving entering-course predictor variables is referred to as AID I; involving mid-course predictor variables, AID II; involving end-of-course predictor variables, AID III. For example, analysis of the final course grade involving entering-course characteristics is labelled AID I - Final Course Grade; analysis of the final course grade involving mid-course characteristics, AID II - Final Course Grade; analysis of the final course grade involving end-of-course characteristics, AID III - Final Course Grade.

II. FINAL COURSE GRADE BASED ON ENTERING-COURSE CHARACTERISTICS DISCUSSED AS AN ILLUSTRATION REPRESENTATIVE OF ALL OUTCOME VARIABLES

In this chapter the data results are summarized, displayed, and discussed to illustrate the analysis strategy to be used in interpreting the data. The data from one analysis, final course grade based on entering-course characteristics, is presented and discussed in detail: first, to show a series of characteristic patterns useful in examining the data of each of the outcome variables; second, to illustrate the analysis strategy in interpretation. The figures and tables identify the data of "final course grade based on entering-course characteristics" as "AID I - Final Course Grade". Data of each of the other outcome variables is discussed in summary presentations, with appropriate references to complete data and documentation location, following the discussion of AID I - Final Course Grade.

Characteristic Data Patterns

The tree in Figure 1, (p. 157), represents for the final course grade a pattern of groups formed using the student entering-course characteristics as the basis for discriminations. This tree illustrates a general pattern of two configurations common to all the trees. For the first few groups, each group produced by a split is further subdivided. For example, groups (2) and (3) branch from group (1), groups (4) and (5) from group (2), groups (6) and (7) from group (5). A second configuration occurs when groups are split from the main branch and not split again, constituting final groups. For example, in the lower branch of Figure 1, groups (8) and (9) are formed from group (4), but group (9) is split from the main branch which continues via the series of groups formed from group eight.

The combination of the two configurations results in a patterning of the boxes into several branches. For example, there are four main branches (separated by dotted lines) in Figure 1, each involving a different combination of student characteristics useful in discussion of student final course grade. These four branches appear in Table 7, (pp. 158-161), the $(BSS/TSS)_i$ table for AID I - Final Course Grade. The first page of the table contains data pertaining to the upper tree branch composed of groups (3), (12), (13), (18), (19), (22), and (23); the remaining pages of the table each pertain to one of the remaining main branches in Figure 1. This table expands the discussion of the characteristics of the predictor variables by showing, in addition to the characteristic utilized in any given split in the tree, the relative power of the other predictors to reduce unexplained variation. For example, in branch three of the tree, "major" was almost as effective as "CQT-Q" in the split of group (10) into groups (16) and (17), as shown in Table 7, (p. 158). Learning set is used in several splits in the tree, but also would have been used to split several large final groups had the split reducibility criterion been lowered, and this is evident throughout the table pages.

Each main branch contains a number of final groups which are not split further. Either the number of students is too small to warrant the split of the group, the proportion of variation in the group compared to the variation in the total sample is too small, or no predictor in the analysis can reduce the unexplained variation in the group the required amount. The theoretical and statistical procedures resulting in formation of final groups and application of this procedure in this study are discussed in Chapter III. Groups twenty-eight and twenty-nine at the far right of Figure 1 are representative of final groups in all trees. Group twenty-eight is too small to attempt a split. Although group twenty-nine has sufficient internal variation to warrant an attempt to split (.043 with TSS_I=15.250 and TSS_T=357.390, compared with the split eligibility criterion of .0001), group twenty-nine cannot be split further (.005 with BSS=1.797 and TSS_T=357.390, compared with the split reducibility criterion of .006). Predictor variable "major" comes closest, but does not reduce the unexplained variation enough for the split actually to take place. Additional variables appear needed in the analysis.

Discussion of the Data for AID I - Final Course Grade

The final course grade is a weighted composite of twenty per cent midterm grade, forty per cent final exam grade, and forty per cent instructor grade, with a range of one to five representing grades F to A. The specific components of the final course grade and the rationale for a range of one to five rather than zero to four are discussed in Chapter III. Only entering-course variables are used in this analysis of final course grade. These are discussed in Chapter III and summarized in Table 4, (p. 129). The mean final course grade of the original total number of students in the study is 3.633, with standard deviation .821. Nine of the fifteen entering-course variables were used to form twenty final groups. The nine variables accounted for fifty-one per cent of the total sum of squares. (Table 8, p. 166)

TABLE 8: PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES BY ENTERING-COURSE, MID-COURSE, AND END-OF-COURSE VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)											Squared Beta Coefficients From Deletion Regression Analysis										
	AID I		AID II			AID III						Del. Reg. I		Del. Reg. II			Del. Reg. III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade
Sex	.011		.008									.002	.005	.007		.003	.003	.002			.001	
Age			.009	.006	.008		.010		.018		.008	.004	.003	.005	.007		.002	.003			.002	.001
Major	.086	.042	.049	.045	.051	.036	.029	.028	.023		.014		.002		.001	.002	.003	.003	.004	.005	.004	.002
Credits	** ---	---								.023	.009	---	---	.006	.007	.009	.004		.001		.004	.003
Current Load	---	---					.010					---	---	.001	.001			.001			.001	
GPA	.018	.306	.208	.194	.295	.040	.201	.222	.230	.077	.088	.007	.227	.123	.144	.213	.027	.059	.054	.040	106	.081
CQT-V	.111	.008	.032	.026	.009				.007			.021	.018	.012	.001	.008	.002	.002				
CQT-Q	.053	.061	.041	.025	.017	.024	.010		.046	.018			.029	.004	.003	.022	.004	.011	.010	.013	.003	.009
CQT-T	.022	-.016	.013	.018	.010	.037	.084	.173	.030			.005	.004	.004	.002	.002	.006	.015	.009	.012	.009	
Extraversion	.006	.012	.007		.007		.018	.004	.019	.010	.030	.003			.001		.001	.002				
Neuroticism	.023		.007	.036	.024		.018	.022	.006	.029		.001		.003	.006						.005	.001
Eysenck Lie	.009			.015	.022	.008	.018	.014		.015		.012	.007	.002		.005	.001	.009	.005	.006	.005	.002
A-H Test Anxiety	.096	.021	.031	.018	.036					.053	.007	.002		.004	.005						.008	.002
Test Anxiety-1							.011					.002	.003			.006		.006	.003	.005	.002	.005
Test Anxiety-2	---	---			.006							---	---	.001		.003	.008	.002	.005	.003	.003	.004
Test Anxiety-3	---	---	---	---	---	.008				.008		---	---	---	---	---	.003	.007	.005	.001	.001	.002
Accuracy	---	---	---	---	---		.010			.020		---	---	---	---	---	.003	.001			.001	.001
Success	---	---	---	---	---					.007		---	---	---	---	---	.001					
Learning Set	.059	.042	.013	.009	.024	.026	.021		.041	.009		.011	.007	.007	.006	.005	.001	.009	.005	.005	.002	.001
Reason Enrolled	.049			.007								.006		.001		.001		.001			.008	.001
Pre-attitude	-.015		.009	.019	.012		.020			.009	.009	.002		.006	.002	.001		.001	.001	.001	.003	.002
Post-attitude	---	---	---	---	---			.007				---	---	---	---	---		.001		.001	.002	.002
Discussion Attitude	---	---	---	---	---	.015	.006			.046		---	---	---	---	---	.001			.001	.007	
50-50-1(Asp.-Exp.-1)	.009	.041	.010	.015	.031	.031	.052	.069			.024	.006	.001			.002	.004	.002	.003	.001	.001	.006
50-50-2(Asp.-Exp.-2)	---	---	---	---	---		.021	.030		.007		---	---	---	---	---	.012	.007	.012	.014	.009	.025
Pretest	---	---	.076	.079	.019	.020	.014	.008	.012			---	---	.019	.029	.022	.007	.001	.004	.009	.001	.004
Midterm	---	---	---	---	---	.268	.049	.130	.139	.141	.539	---	---	---	---	---	.089	.022	.071	.069	.053	.172
Inst. Extraversion	---	---	.024		.014							---	---	.001	.006	.005					.004	.005
Inst. Neuroticism	---	---							.026	.015	.008	---	---	.002	.002	.026	.001	.014	.007	.008	.065	.025
Inst. Eysenck Lie	---	---				.014				.015		---	---	.004	.003	.002				.002	.030	.008
Inst. Marlowe-Crowne	---	---	.008	.007				.006		.040		---	---	.002	.003	.031		.013	.002		.041	.025
Inst. Sanford-Gough	---	---		.013	.009	.013				.021		---	---	.008	.003	.012		.001	.001	.001		.003
Inst. California-F	---	---		.007			.028	.009	.006	.013		---	---		.001	.004	.005	.009	.009	.005	.036	.004
Inst. Risk	---	---	---	---	---			.027				---	---	---	---	---		.016	.007	.005	.003	
Inst. Course Load	---	---	---	---	---		.010	.007		.029		---	---	---	---	---	.002	.002	.001		.003	.005
Inst. Teaching Exp.	---	---	---	---	---						.010	---	---	---	---	---	.001	.011	.001		.001	
Total proportion of variation explained(R^2)	.537	.517	.545	.539	.594	.540	.640	.782	.577	.605	.746	*.318	.354	.308	.287	.399	.356	.370	.436	.450	.298	.589

*Beta coefficients do not add. This is an adjusted R^2.

** --- Variable not included in this stage of analysis.

The analysis shows the powerful effects of past performance variables, particularly grade point average and to a lesser extent the quantitative portion of the College Qualification Test (CQT-Q) in determining the final course grade. The total group is divided first into three groups (3, 4, and 5, Figure 1, p. 157) on the basis of grade point average. These major splits on GPA are not unexpected. Numerous studies have indicated that grade point average is the single best predictor of potential student grade in a college course. The tree indicates that on the basis of grade point average, students with a GPA in the range of B-minus to A-plus have a mean on the dependent variable of 4.297, those in the C to C-plus range have a final course grade mean of 3.555, and those in the range below C-minus have a mean of 3.157. While not all high final course grades are among the high GPA's, the high GPA's as a group (with one exception discussed below) do have high mean final course grades, and GPA does maintain strata in that with isolated exceptions the high mean final course grades among middle GPA groups do not reach the highest means of the high GPA groups, nor do the high means among low GPA groups reach the highest means of the middle GPA's.

However, among groups without the advantage of high grade point average there are entering-course advantages which cumulate into final course grades higher than grades of those who are at a disadvantage on the characteristic, and in some cases are competitive with those characterized by high GPA. These advantages appear associated with skills in conceptual learning. The lower branches in the tree each present splits on the variable CQT-Q. Middle and low GPA groups with higher CQT-Q scores have higher mean final exam grades than their respective counterparts with lower CQT-Q scores, with one exception. (See groups 31, 30; 8, 9; 16, 17; 28, 29.) In the case of the reversal, those among the low CQT-Q who achieved a high mean final course grade also were characterized by high CQT-T's. The importance of CQT-Q is illustrated not only in the splits in Figure 1 but in Table 7 where it is second choice not only in a number of splits throughout the lower branches but in the upper branch of high GPA's also. In addition, among low CQT-Q's, those indicating a preference for conceptual learning have higher mean final course grades than those who do not share this preference, and, in fact, the mean for the former is competitive with that of their higher CQT-Q counterparts. (See groups 36, 37; 38, 39.) Why should these variables be more highly correlated with the dependent variable than any other one in the analysis for these particular groups? The CQT-Q attempts to tap the ability to analyze, to break set, as opposed to the vocabulary-analogy orientation of the CQT-V. The learning set instrument attempts to tap preference for conceptual rather than factual learning. The second half of the final exam was composed of items involving problem-solving rather than straight recall skill. In addition, it is possible that this preference and ability was applied in discussion of material in discussion section, and noted by instructors as part of their evaluation.

There appear to be for high, middle, and low GPA's different sets of barriers to high final course grade. In the middle branch of the tree the most important subsequent split is one involving test anxiety. The group of students in the middle GPA range who are not elementary or social science majors is split by test anxiety. (See groups 10 and 11.) It is possible that the split has isolated a group of students with middle GPA who are handicapped not only by not being elementary or social science majors, but by high test anxiety. Perhaps elementary majors have already taken some required courses in child development or child psychology, and the social science majors have background in sociology and psychology courses. The importance of test anxiety extends beyond the isolation of the group on this variable. First, the group handicapped by high test anxiety has a mean depressed a letter grade below that of those not handicapped by high test anxiety, a mean nearly as low as low scores in the course. In addition, Table 7 indicates that test anxiety was almost as useful as was major in the split of the entire group of middle GPA scores (group 5 into 6 and 7). In many splits in any given tree, one factor is often clearly superior to any other for a given group. However, in this particular case, while test anxiety was not used to split the entire group of middle grade point students (group 5 into 6 and 7), its relationship to the dependent variable was almost as strong as that of major, and in fact its relationship to final course grade was not reduced enough by the first split to prevent its being used in the immediate subsequent split of group 7 (Table7 , p.160). It is possible that in the middle grade point range test anxiety has a more pervasive effect than is indicated in the tree, and that its effect as a depressent of final exam grade is considerable.

In the lower branch of the tree, the most important subsequent split involves the personality variable extraversion. It is an interesting sequence for several reasons. First, it involves 16.2 per cent of the original total group in the study (groups 24 and 25). Secondly, it involves about two-thirds of those at a disadvantage on GPA and CQT-Q. Third, Table 7 indicates that for the group who also had low GPA but had the advantage of high CQT-Q, a large group isolated early in the branch (group 9), extraversion was the choice to split the group, had the reducibility criterion been met. Why should a higher degree of extraversion be an advantage particularly among students of low GPA? Forty per cent of the final exam grade is instructor grade, and perhaps this extraversion is reflected in participation in discussion, in the contacts with the instructor. And indeed the group with low GPA and low conceptual skills coupled with lower extraversion appears as low-man-on-the-totem-pole in terms of course grade distribution (group 32).

In the upper branch of the tree containing groups characterized by high GPA the most important subsequent split involves course-specific motivation reflected in the level of aspiration and expectation of course performance (50-50-1). It is of interest for several reasons. First, two of the three splits of the upper branch involve this variable. In addition, Table 7 shows that this characteristic was the second choice to make the split of group two, the only other split in the branch (Figure 1). Having important weight in every split in the upper branch of the tree, course-specific motivation does not appear in the branches nor show any strength as second choice among those groups characterized by middle and low grade point averages. For these groups, other factors such as test anxiety and extraversion bear more weight in determining course performance. It is among those groups characterized by high GPA that course-specific motivation appears to have importance. A second reason why this variable is of interest is that it is used to isolate extreme cases of high specific-course motivation. In the case of groups 23 and 22, group 23 isolates twenty students for whom course-specific motivation is very high, the level of aspiration for course performance set at a minimum of "A". The mean on the final course grade for this group is predicted at 4.800. An earlier split in the same branch involves isolation of an extreme case of high specific-course motivation also. The split of group three into twelve and thirteen occurs early in the branch, involves 27.9 per cent of the sample, and isolates one individual with course-specific motivation of A-plus and a predicted final course grade of F. When a small group is isolated so early in the branch, one interpretation is that this is due to chance. However, the groups appear in the data of final course grade based on mid-course variables, and that of the final exam application section and final exam total score, and also in the data of the final exam recall section and final course grade based on end-of-course variables, associated with lower midterm scores. All other instances of the use of course-specific motivation follow the pattern of groups 22 and 23 -- higher course-specific motivation associated with higher score or grade.

A third reason why the variable (50-50-1) is of interest is that it illustrates the importance of identification of interactions if meaningful questions are to be asked of the data. In the tree of Figure 1, course-specific motivation is asymmetrically distributed in the tree. It is also apparent in the $(BSS/TSS)_i$ table for Figure 1

(Table 7 , pp. 158-161) that the variable gains in explanatory power in this branch while this does not occur in the other branches. On the other hand, examination of the correlation matrix indicates a correlation between entering level of course-specific motivation as to course grade, and actual course grade, of .260. (Appendix C) In Figure 1, (p. 173) observation of the plotted points of aspiration-expectation on course grade for the entire study group indicates that there is a regression. However, the regression rather sharply changes its slope at approximately the mean values of both indices, suggesting an interaction in addition. The evidence supporting regression plus interaction is further exemplified by examining the plotted points for the three levels of GPA occurring in the three initial splits of the data. Again, as shown in Figure 1, (p. 173) the points for high GPA involving more than ten cases follow a positive accelerating path; the points for middle GPA follow a horizontal path; the points for low GPA follow a negatively accelerating path. Table 9 , (p. 154) shows the means, standard deviations and number for each of the plotted points by category. It appears that course-specific motivation interacts with GPA in a positively accelerating manner.

In summarizing the discussion of final course grade based on entering-course characteristics it can be said that grade point average exhibits a powerful effect. It appears that higher conceptual ability and preference for conceptual learning are advantages associated with higher final course grades among all GPA levels. There are, for high, middle, and low GPA's, different sets of barriers to high

FIGURE 2

MEAN EXPECTED COURSE GRADE PLOTTED FOR VARIOUS GPA GROUPS BY ENTERING-COURSE ASPIRATION-EXPECTATION FOR COURSE GRADE

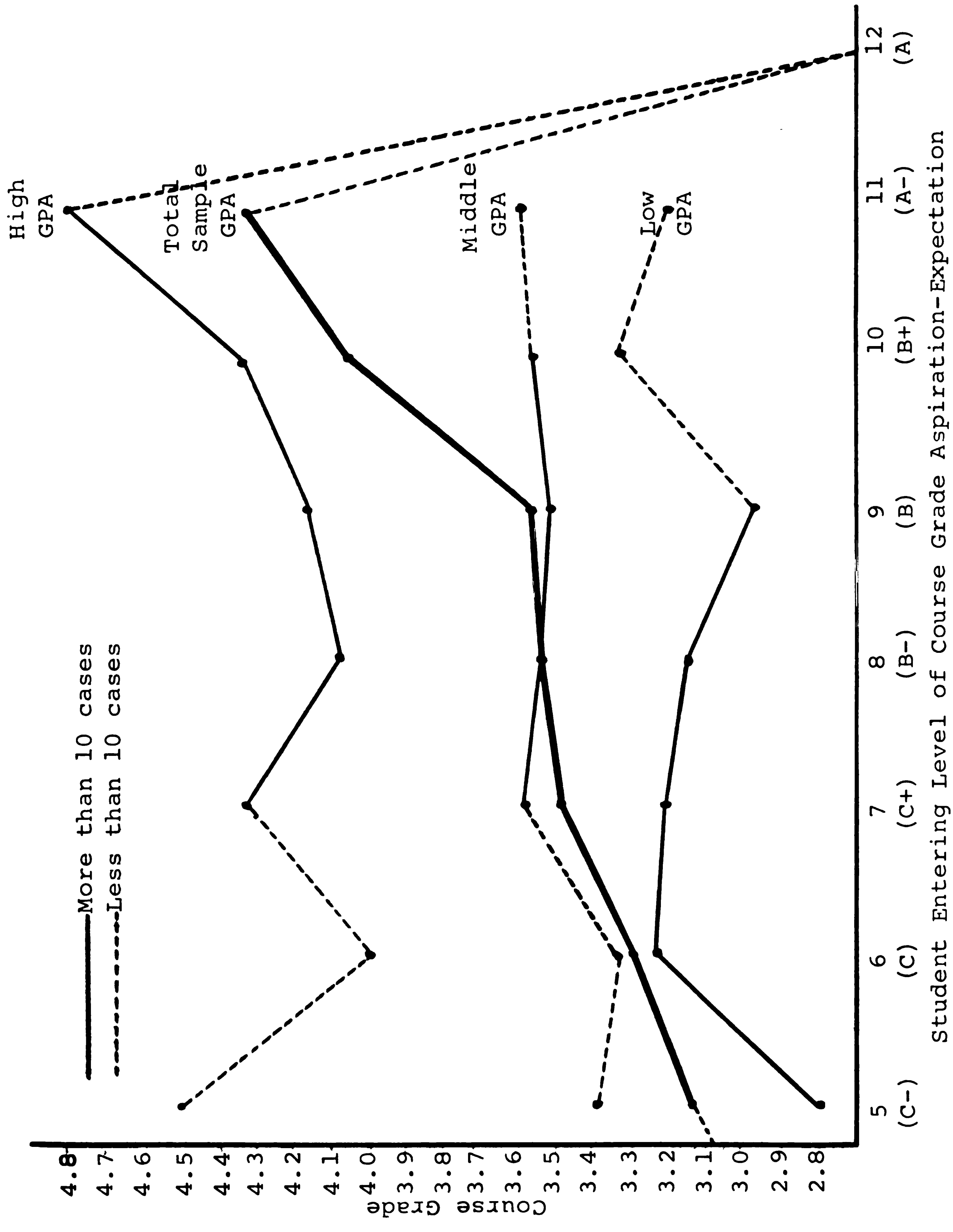

TABLE 9

MEAN EXPECTED FINAL COURSE GRADE, BY ENTERING-COURSE ASPIRATION-EXPECTATION FOR FINAL COURSE GRADE

Entering-Course Aspiration for Final Course Grade		Total			Group 3			Group 4			Group 5		
		$\bar{Y}$	σ	N	$\bar{Y}$	σ	N	$\bar{Y}$	σ	N	$\bar{Y}$	σ	N
5	C-	3.176	.785	17	4.500	.500	2	2.800	.600	10	3.400	.490	5
6	C	3.310	.670	29	4.000	.000	1	3.263	.636	19	3.333	.816	9
7	C+	3.500	.756	112	4.333	.624	12	3.222	.737	54	3.608	.607	46
8	B-	3.560	.756	166	4.091	.570	33	3.188	.697	48	3.564	.727	85
9	B	3.885	.823	106	4.182	.575	33	2.964	.680	28	3.533	.748	45
10	B+	4.088	.702	68	4.369	.566	46	3.333	.471	6	3.562	.609	16
11	A-	4.333	.869	30	4.800	.400	20	3.200	.400	5	3.600	.102	5
12	A	1.000	.000	1	1.000	.000	1						

Group 3 High grade point average

Group 5 Middle range grade point average

Group 4 Low grade point average

final course grade. For students with lower grade point averages degree of extraversion is an important consideration in predicted final course grade; for those in the middle GPA range general test anxiety has a strong effect on final course grade; for those in the higher range of GPA entering level of course-grade aspiration in association with GPA appears important.

III. SUMMARY PRESENTATION OF DATA ANALYSIS OF OUTCOME VARIABLES

Data of each of the remaining outcome variables is summarized and discussed with appropriate references to complete data and documentation location. The analysis of final course grade based on mid-course variables and the analysis of final course grade based on end-of-course variables are presented first. This is followed by the analysis of the pretest score based on entering-course variables. Mid-course variables are then discussed in the analyses of the midterm test score and the midterm grade. End-of-course variables are finally discussed in the analyses of the final exam score -- part one, part two, and total score, the final exam grade, and the instructor grade. The variables used in each analysis are discussed in Chapter III and summarized in Table 4, (p. 129,), Table 5, (p. 130), and Table 6, (p. 131).

Analysis of Final Course Grade Based on Mid-course Variables

AID II - Final Course Grade involved in its analysis mid-course variables, a portion of which was entering-course variables. The mean final course grade of the original total number of students in the study is 3.633, with standard deviation .821. Table 8, (p. 166) indicates the proportion of variation in the final course grade explained by the variables. (See column five.) Seventeen of twenty-six mid-course variables accounted for fifty-nine per cent of the total sum of squares. The tree in Appendix D5 (p. 327), indicates that the final course grade based on variables involved to mid-course depends mostly upon past performance, conceptual skills, test anxiety, and personality factors.

No variable in the early portion of the course is as powerful as GPA in the prediction of final course grade. Higher course grades are associated with higher GPA, middle grades with the middle range of GPA, and lower grades with the lower GPA, with minimal exceptions, in terms of overlap. (Table E5 , p. 370) At every level of GPA a preference for conceptual learning is an advantage to higher course grade, a particular advantage for those with low GPA. (Appendix E5, p.370) Those with low GPA are also at an advantage with higher CQT-Q scores.

Following up the lower branch, it appears that among those of lower GPA and lower conceptual skills a combination of personality variables cumulate into lower course grades. Lower social extraversion, less emotional stability, greater tendency to respond in socially acceptable ways tend to depress the final grade. (There is one exception, in a final group in which one individual is isolated. This may be chance fluctuation, since the majority of cases indicate a reverse effect.) In addition, the effect of personality variables is concentrated among those of lower GPA. The variables show secondary strength among middle GPA ranges, as indicated in the $(BSS/TSS)_i$ table, (Appendix, p. 370) and make one split on the basis of tendency to respond in terms of socially desirable patterns. Such factors show no strength among the high GPA groups.

Among these groups in the middle range of GPA, the majority of splits involve separating off a group inhibited from obtaining a higher course grade by some barrier, none of the groups being split again. The inference is that such barriers are alternatives, any one being sufficient to keep a student from a higher course grade. The first split among those in the middle range of GPA involves 39.7 per cent of the sample and is made on the basis of general test anxiety. This factor also occurs later in the branches of those in the mid-GPA range. The $(BSS/TSS)_i$ table also indicates this variable as second choice in several splits in this range of GPA. A higher level of test anxiety among those in the middle range of GPA appears associated with depressed course grade. However, there is a final split among those of high GPA and high pretest score which isolates a group of eight for whom higher general test anxiety is associated with extremely high final course grade. Why should this be? Perhaps for them this is unfounded anxiety, perhaps they always say to themselves that they won't do well. The explanation is not apparent. While a degree of anxiety may be facilitative in test taking, a high degree would be expected to depress the peformance. Unlike middle GPA, the effect is isolated rather than generalized across students in the grade range. This generalized anxiety does not appear in the branch of lower GPA. However, anxiety related specifically to the midterm exam with some students who are also low in conceptual ability, does appear, higher anxiety depressing grades. The effect is not common among all low GPA's, however.

With the exception of the isolation of eight extreme cases on the basis of general test anxiety, the variables in the branch of the higher GPA's deal principally with factors associated with "doing well" in school -- course-specific motivation, conceptual ability, CQT-T and test performance. It is among high GPA's that the pretest score is associated with course grade. Not only does this variable make the third split, it is second choice to make the first split of the higher GPA's, although less strong a force than entering-course aspiration. The deletion regression analysis attributes approximately the same amount of variation to the pretest, but the tree adds the impression that the force of this variable is centered among those of higher GPA. (Table 8 , p. 166)

Analysis of Final Course Grade Based on End-of-Course Variables

AID III - Final course Grade involved in its analysis the end-of-course variables, portions of which were entering and mid-course variables. The mean final course grade of the original total number of students in the study is 3.633, standard deviation .821. Eleven variables were used to form twenty final groups, accounting for seventy-four per cent of the total sum of squares. (Table,8 p.166) The variables are discussed in Chapter III and summarized in Table 6, (p. 161).

The analysis indicates the powerful effect in the latter part of the course of the midterm test score, the total proportion of variation explained by the midterm being .539. The interpretation of the powerful effect of this variable is complex. We may hypothesize that the effect on the final course grade is strong because although its weight in the final course grade is only half that of the final exam grade and instructor grade (20 per cent versus 40 per cent for the latter two), the midterm score may have an excessive amount of weight assigned to it. It would appear to be a strong motivational factor. The deletion regression analysis using the same set of variables also indicates the midterm as far more powerful than any other variable in the analysis. The increased effect in the AID analysis may be due to the fact that the use of the variable in the first split does not prohibit its later use again. However, it is used in early splits involving large numbers of the study group. (TableD11, p.339) (Appendix D11, p.339)

Among those in the upper branch of the tree there is an interesting differentiation between those with very high midterm scores. For those characterized by very high midterm scores and higher GPA, course-specific motivation related to entering-course level of aspiration appears important in relation to performance. For those with very high midterm scores and GPA's in the C to C+ range, there is no variable which meets the reducibility criterion for a split of the group. (Appendix 11, p. 339) However, the BSS/TSS table (Appendix E , p. 423) suggests that test anxiety related specifically to the final exam is related to final course grade. Among those students with grade point averages of B or better who score in the B-range on the midterm pre-attitude toward the course is associated with final course grade--those with high pre-attitude having lesser mean final course grades than those expressing less positive pre-attitude. However, the difference in mean scores is less than a letter-grade, and the inference is not that those with lower pre-attitudes were necessarily negative toward the course, but rather were more indifferent. (groups 30 and 31, Appendix 11, p.339)

Among those with very low midterm scores (11.1 per cent of the original group) all splits involve the personality variable extraversion. However, the results are unstable in that the first large split suggests a higher level of extraversion is an advantage in terms of final course grade, while the second split isolates a group of seven for whom quite low extraversion is an advantage.

If the teaching assistant's importance is as pervasive in the course as was intended by the course designers, why does it not appear in the tree? With the exception of one final split among those who scored at the mean on the midterm the variables do not appear. Perhaps their absence signals a conceptualization problem. Perhaps the powerful effect of the midterm involves a component of instructor influence in exam preparation. Perhaps their influence in terms of final course grade is far less important than the student variables themselves.

Analysis of Pretest Score Based on Entering-course Variables

The forty-item pretest is composed of questions chosen from an item pool being developed to form a comprehensive course exam. The items chosen are representative of the different test item areas in the pool, supposedly the best items available to test student entering knowledge and ability. The pretest is discussed in Chapter III. Entering-course variables are used in this analysis. The mean pretest score of the original total number of students in the study is 22.205, with standard deviation 3.366. Fourteen of sixteen variables accounted for fifty-three per cent of the total sum of squares. (Table 8 , p. 166)

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Fourteen of sixteen predictors are used to make at least one split in the pretest. This may suggest that there really are many forces at work which are not so highly correlated with one another that the division of the total group on one makes the other unnecessary. The pretest has no reward value in terms of counting toward grade in the course; the same set of variables is used in the analysis of final course grade, an outcome to which students attach considerable reward value in a competitive system. In the latter case there appears to be a tendency for coalescence to occur around certain variables which are advantages in the attainment of the grade. (Figure D1, p. 319)

The use of fourteen of sixteen entering-course variables is reflected in the tree which appears extremely complex, and also asymmetric, in that the complexity occurs mainly in the branches in the center of the tree. One inference may be that chance fluctuation has created a highly unstable pattern. On the other hand, it is apparent that CQT-V has split the original group into 3 (groups 3, 5, and 4, Appendix 1, p. 319), isolating those with quite high verbal scores and those with very low verbal scores from the majority of the group who fall across a wide distribution in high average to average to low average range. As a group those with high CQT-V's have a higher mean pretest score than either of the other two groups, and as a group those in the middle range of CQT-V have a mean value on the pretest higher than those in the lowest CQT-V range. This does not mean that there will not be groups among the middle range of CQT-V's who have mean scores competitive with those with high CQT-V. What is inferred from examination of the top branch containing high CQT-V's is that high verbal ability is an advantage such that in general being at a disadvantage on some variable such as CQT-Q (groups 57 and 56) does not result in performance that is noncompetitive, whereas among those in the middle range of CQT-V it requires a series of advantages to overcome the deficit. The initial split on the basis of CQT-V is not unexpected. The pretest supposedly was designed to obtain a measure of student knowledge of factual material in the area of educational psychology, many times involving terminology in which vocabulary and reading skills would be important.

The heavy weight in the center of the tree is not unexpected. Seventy-eight per cent of the students appear in the wide range of low-average to high-average CQT-V ability, only those at either extreme of CQT-V score being removed. Further, the test, of no weight in determination of course grade, would hold varying degrees of personal worth to students in terms of putting forth an effort. Thus there are many alternative barriers, any one of which is sufficient to depress the pretest score. Among this large group of middle-range CQT-V's, the first division occurs on the variable GPA -- the group with GPA's of B to A having a pretest mean above the mean for all students in the study, those in the group with GPA of D- to C+ having a mean slightly below that of the total group. For those with average CQT-V scores but high GPA, a strong CQT-T score and the tendency not to make socially accepted or expected responses are advantages to obtaining pretest scores competitive with the high CQT-V's. However, for those with average CQT-V scores but GPA's in the D- to C+ range differentiate on the basis of reason for enrolling in the course, as the most important subsequent split. Both those who would not have enrolled in the course had it not been a requirement and those who are not working toward teaching certificates nor required to take the course have higher mean pretest scores than those who were required to enrol but stated that in all probability they would have anyway. (See groups 8, 9; 37, 36; Appendix E1 , p. 319) Why should those students in this grade point range who took the course only because it was a requirement have higher mean pretest scores than those who were required to take it but had positive orientation toward the experience? Those in this latter group with CQT-Q scores below the seventy-fifth percentile also are differentiated on the variable of general test anxiety. In addition, the groups are differentiated on the basis of aspiration level for course grade. The students with GPA D- to C+ whose grade aspiration in this course fell in the same range and who had lower test anxiety had higher mean pretest scores than those students who were similar but with high test anxiety, and also higher mean pretest scores than those students in the same GPA range who set course grade aspiration at B or higher, regardless of level of general test anxiety. Perhaps the latter students find level of test anxiety a disadvantage. The variable test anxiety also appears in the upper branch of the tree among those with high CQT-V scores, but undifferentiated by GPA, (group 64 vs groups 65, 21 and 20).

The complexity of the tree is increased by the fact that while a variable may be used throughout all branches and have its maximum effect in one direction, it may isolate a small group which does not follow the pattern for the majority of students. For example, both learning set and CQT-Q appear throughout the entire tree, and the general pattern in both instances is that groups with higher CQT-Q scores or groups more oriented toward conceptual thinking have higher mean scores on the pretest than do groups at a disadvantage on these variables. However, toward the end of a branch the variable may differentiate an extreme instance of the opposite effect. (See groups 66 and 67, 54 and 55.)

Analysis of Midterm Score Based on Mid-course Variables

The forty-item multiple choice midterm was primarily a recall-type exam directed to the readings and lectures included in the first half of the course. Statistics pertaining to the midterm examination are discussed in Chapter III. AID II - Midterm Score involved in its analysis mid-course variables a portion of which were entering-course variables. The mean midterm score for all students was 30.716 with standard deviation 4.046. Sixteen of twenty-six mid-course variables accounted for fifty-four per cent of the total sum of squares. (See Table 8 , p. 166.)

The tree for midterm score (Appendix D3, p. 323) suggests the importance of performance variables, both past and in the course. GPA, the CQT's and the pretest score accounted for thirty-six per cent of the total sum of squares and appear throughout all levels of the tree. (See Table 3 , pp. 353-360.) In addition, GPA and pretest score are used in initial splits of the tree.

The initial splits on GPA and pretest score indicate that those with GPA's above C+ and scores above the mean on the pretest have, as a group, a higher mean midterm exam score than do those of comparable GPA but with midterm exam scores below the mean. Similarly, those in the GPA range D- to C+ and pretest scores at the mean or above had, as a group, higher midterm exam scores than those of comparable GPA but pretest scores below the mean.

In addition, those students with high grade point average but with pretest scores below the mean still had higher mean midterm scores than groups with lower GPA regardless of the pretest scores of the latter. Furthermore, the tree indicates that while not all high scores were among the high GPA's, the groups characterized by high GPA did have, in general, mean midterm exam scores at the top or within a point or two of the top scores, regardless of pretest score. Except for a final split on the variable major, the remaining splits of high GPA groups involved the CQT's, those with either lower verbal or lower quantitative scores being at a disadvantage. However, these disadvantages did not depress the mean scores on the midterm sufficiently to make them noncompetitive. That is, the students' midterm performance counted twenty per cent of the final course grade, and for those in the high GPA range no factor depressed their twenty per cent to the point where it was not an advantage. For those with lower pretest score and lower CQT-Q it was an advantage to be either an elementary major or to be a major outside the field of teacher education; perhaps this is indicative of previous course work in a related field such as child psychology. However, the group involved a small number and the factor of stability in the group must be considered. With the exception of these four individuals, the variables appearing in the branch with higher GPA involved performance, either past as in the case of the CQT's, or within the course, in the case of the pretest. No other variable included in the analysis reduced the unexplained variation sufficiently to warrant a split. Perhaps other variables were needed in the analysis. GPA is itself a complex indice. On the other hand, this may indicate that for those with higher GPA's, high midterm exam scores were associated not only with advantages on performance criteria but by the absence of disadvantages on personal factors such as test anxiety or relations with their instructor. This does not infer that these factors were not present. The $(BSS/TSS)_i$ table indicates they were. But for those with higher GPA's, such variables did not seem to "get in the way" of performance.

Those in the GPA range D- to C+ were also characterized by performance variables. The initial split of this group was on the basis of pretest score, those with scores at the mean or above having higher midterm exam scores. The CQT's also appear throughout these branches of the tree, but characterize smaller groups than the groups among the high GPA's. It is among this group of GPA's, the D- to C+ range, that variables associated with attitudes and personality factors appear in the branches of the tree. General test anxiety made the initial split of those students characterized by lower GPA but with pretest scores above the mean. Those students with a high degree of general test anxiety were at a disadvantage on the midterm exam. The same variable differentiated a smaller group among those with lower GPA and low pretest scores. Student preattitude toward the course, if the attitude was negative, or a strong preference for factual learning rather than conceptual learning, or the tendency to respond in socially acceptable ways rather than on a more concrete basis each were variables which were alternative disadvantages for groups of students with lower GPA's. Among students with lower GPA, low pretest scores and low CQT-Q's, scores on the midterm were depressed by instructors who tended to be more rigid in behavior or by instructors who were highly extroverted.

Analysis of Midterm Grade Based on Mid-course Variables

A student's performance on the midterm exam accounted for twenty per cent of his final course grade. In the calculation of the final course grade this percentage was expressed in terms of a letter-grade (A through F) rather than the midterm point-score itself. For this reason an analysis of the midterm grade was included. Statistics pertaining to the midterm grade are discussed in Chapter III. AID II - Midterm Grade involved in its analysis the same mid-course variables used in the analysis of AID II - Midterm Score. The mean midterm grade for all students in the study was 3.662.

Since the midterm grade was based solely on the midterm score it would be expected that there would be a strong resemblance between the trees of the midterm grade and midterm score. However, since two individuals with scores quite similar can, through arbitrary cut-off scores appear in different grade categories the trees would not be carbon copies but rather show variations in arriving at overall similar groupings. There was a strong relationship between the midterm grade and midterm score, with r=.918. In both the analysis of midterm grade and midterm score sixteen of twenty-six variables were used in the analysis to account for fifty-four per cent of the total sum of squares in the case of the midterm score, fifty-three per cent in the case of midterm grade. (See Table 8 , p. 166.) Table also indicates that the same groups of variables account for much the same weight of unexplained variation. The importance of past performance, represented by GPA, the CQT's and pretest scores appears throughout the midterm grade tree as in the tree of the midterm score. The initial splits of the tree on the basis of GPA and pretest occurred in the same pattern and accounted for approximately the same amount of variation. As among the high GPA's in the analysis of midterm score, the high GPA's as a group had high midterm grades characterized by performance factors rather than personal factors. An orientation toward conceptual learning was an advantage, but a high total CQT score offset being at a disadvantage on this factor for some students. Among those with high GPA and high pretest scores, being over twenty-one was a disadvantage. However, the variable isolated a small group and did not depress the letter-grade sufficiently to drop the grade a letter-grade.

As in the analysis of midterm score it was among those in the D- to C+ range that variables associated with attitudes and personality factors appeared. A less positive preattitude toward the course, a tendency to make socially acceptable responses, a higher degree of test anxiety depressed the midterm grade as it did the midterm score, in general. Depressed grades were also associated with instructors who tended to be quite authoritarian or extremely flexible. That is, depressed grades were associated with extremes. The initial split of those with lower GPA but pretest scores above the mean occurred on the basis of the neuroticism scale, and following a split on major, to split again on the basis of the scale. Although the initial split implied that those with higher scores on the scale had slightly higher mean midterm grade, the differences in midterm grade appear in the second split which isolates a group with extremely low neuroticism scores having a low mean midterm grade. Rather than isolating those with high scores on the neuroticism scale, the splits isolated a group for whom very low scores on the scale depressed the midterm grade. The initial split of the group with lower GPA but higher pretest in the tree of the midterm score was on the basis of general test anxiety. In the tree of the midterm grade general test anxiety was the second choice to make the split which was, in fact, made on the basis of the neuroticism scale. General test anxiety is used in a subsequent split in the same branch. The two may, in fact, suggest the importance of anxiety as a factor affecting the performance of students in the GPA range of C and below, who under pressure of course examinations suffer depressed grades.

One difficulty in interpretation of the tree is the isolation of extremely small groups, particularly in the final splits of the tree. (See Appendix D5, p. 327.) The stability of these groups is susceptible to question, and perhaps the split eligibility criterion set at a higher level or an increase in final group size would correct the problem.

Analysis of Final-1, the Recall Section of the Final Exam, Based on End-of-Course Variables

The final exam was composed of eighty items divided into essentially two different parts, the first being primarily recall of the course content and lectures with emphasis on the second half of the course. Statistics pertaining to the first section of the examination are discussed in Chapter III. Involved in the analysis of this section referred to as AID III - Final-1, were the end-of-course variables, which are summarized in Table 8 , p. 166. This set of variables, which includes both entering and mid-course variables, is discussed in Chapter III. The mean score for the entire group in the study on Final-1 was 29.524, with standard deviation 4.101. Twelve variables accounted for fifty-four per cent of the total sum of squares.

The analysis indicated the importance of the midterm performance to performance on the final examination part one. Both contained primarily recall items from readings and lectures, although from different sections of the course. The total group was divided first on the basis of midterm score; those with extremely high midterm scores and a group with low midterm scores were isolated from those with midterm scores clustering at the mean midterm score. The mean Final-1 score for the group with high midterm scores was higher than that of the other two groups, and the mean Final-1 score for the group with low midterm scores was the lowest.

For those students characterized by very high midterm scores, they, as a group had high Final-1 scores. Slight advantages accrued if in addition the instructor himself did not have a high need for social acceptance and if anxiety related to the final exam was low. However, being at a disadvantage on these latter factors did not depress Final-1 scores below the mean.

The students who scored at or just above the mean on the midterm had, as a group, a Final-1 score at the mean for the entire group. However, there were a series of advantages and disadvantages which resulted in raising or depressing the Final-1 score. Those with GPA's in the B to A range had higher Final-1 mean scores than those with GPA's in the C to D range. However, those in the lower

GPA range who had high pretest scores, were oriented toward conceptual learning and had a more negative attitude toward their discussion section had scores comparable with those of the high GPA's on Final-1, and competitive with those characterized by high midterm scores. For those with lower GPA's and also low pretest scores it was an advantage to have an instructor who as not at extremes of authoritarianism nor nonauthoritarianism. That is, splits in this branch tended to isolate extremes, and also to isolate small groups.

With one exception scores of those with low midterm scores were not competitive with those who were characterized by high midterm scores, in terms of Final-1 performance. For this group advantages accrued to those characterized by higher CQT- scores, and for some students, higher Final-1 scores were attached to students with a more negative attitude toward their discussion section experience. The split on the basis of the variable 50-50-1 was discussed in the analysis of AID I - Final Course Grade. It served to isolate one extreme case.

Analysis of Final-2, the Applied Section of the Final Exam, Based on End-of-Course Variables

AID III - Final-2 involved in its analysis the end-of-course variables, sixteen of which accounted for sixty-four per cent of the total sum of squares. The mean Final-2 score for the entire group of students in the study was 24.688, with standard deviation 4.333. The last thirty-eight items of the final exam were organized into a series of groups, each group of questions relating to a given situational perspective which was outlined for the students. In this part of the exam the students were to apply the knowledge they had supposedly accumulated in the course in terms of its implication to an instructional situation, in order to determine the best alternative answer. Performance on this section was to involve the ability to transfer learning experiences in addition to accumulated information and test-taking abilities. Preparation within the course for this part of the exam would primarily be a part of discussion section activities in which application of content and ideas to educational situations should provide the students with both experience in transfer and strategies for interrelating materials. Therefore the expectation would be that student characteristics which would seem most important to this performance should include general test-taking abilities, motivational and general ability components (as represented in the GPA), effort extended to course and discussion section, and interactions between student characteristics and instructor characteristics. As shown in Appendix B , (p. 314) the overall results were slightly skewed negatively and quite leptokurtic. This would suggest that while there would be a number of descriptive predictors characterizing student performance, descriptions would be expected to include isolating extreme exceptions to general descriptive predictor variables (on the basis of skewness) and expecting the description surrounding the mean score to be relatively interchangeable (on the basis of kurtosis).

Each of these expectations about the nature of the data is born out by the analysis. There are a number of groups which isolate a very small number of cases. Group 26 isolates one extreme case of a low score on the variable 50-50-2, group 45 isolates 4 cases of extremely high score on the same variable. Two splits involving the variable major isolate groups of two and three (groups 55 and 68, Appendix D7 , p. 331). Group 14 isolates a small number of cases from a large group on the variable "current load" as does group 66 on the variable "accuracy-2". In addition there is a large difference between the amount of variance accounted for by the AID-III analysis (.640) as compared to the multiple linear regression analysis (.370). While the level at which the split eligibility criterion and split reducibility criterion were set would lead to the expectation that there would be a a larger amount of the variance accounted for by the AID-III, the isolation of extremes would suggest the importance of skewness in the dependent variable. In addition, the tree indicates that after the initial split on GPA, the second split for all students occurred on the basis of CQT-T. (The split among high GPA's on the variable 50-50-1 isolating one extreme case early in the branch was discussed in AID I - Final Course Grade.) The tree for Final-2 indicates that students with high average to high GPA's and average to high CQT-T had a mean Final-2 score of 27.533. Those with low GPA and low CQT-T's had a mean Final-2 score of 22.528. The group characterized by high average to high GPA but low CQT-T had a mean score (24.933) slightly lower than the group with low GPA but higher CQT-T's (25.096). Both these latter groups had mean Final-2 scores close to the Final-2 mean for the entire group in the study. Thus the middle range of scores on the Final-2 is composed of either students with a high GPA or a high CQT-T score initially.

Given the general tendency of the analysis to split the groups by major predictors (GPA, test scores) and then isolate extreme exceptions to the general descriptions, there are additionally some descriptive splits which seem to have relevance to explaining student performance on this type of exam both in terms of student characteristics and course-related characteristics. As shown in the tree (Figure 7 , Appendix D7 , p. 331), the best initial split in reducing error variance was on the GPA which channelled performance into groups with above a 2.5 GPA and students at or below this GPA. In both branches this is followed by splits on the CQT-T score which, in both cases, split the low CQT-T's from the high's. However, as was discussed in the preceding paragraph the middle range is composed of students with either a high GPA or a high CQT-T, thus leaving the tree composed of three primary branches.

Although the middle branch is characterized by groups with either high GPA or average to high CQT-T's, with similar mean Final-2 scores (groups 8 and 5), there are characteristics distinguishing the two groups, in both cases characteristics which acted as inhibiting factors, any one of which depressed the Final-2 scores. For those with lower GPA but high CQT-T's, a preference or orientation toward factual learning was inhibiting perhaps expected, on this application section of the test. Among those more oriented toward conceptual problems, a lower midterm score was inhibiting, perhaps indicative of lack of preparation. However, among those with higher GPA's but low CQT-T's, (group 8), the factors characterizing performance were related to variables which would seem associated with valuing the GPA, namely attitudes and level of aspiration primarily. A positive pre-attitude toward the course, anxiety related to the pretest, a test with no "counting" value in the course, kept to a minimum, mid-course aspiration level in terms of final grade set at least at the level of their present GPA, characterized groups of higher GPA but low CQT-T who scored above the mean of Final-2 and competitive with the higher scores on the test. (Interpretation must take into consideration the earlier discussion of skewness and kurtosis.) However, the branch is differentiated at this point by the attitude of the students toward their discussion section instructor, and involves a significant number of students in each group. These students had lower entering-course abilities as measured by the CQT-T, but GPA's above 2.5 plus high preattitude toward the course, little anxiety toward the pretest and strong motivation to do well in the course. Among these students, those with a lower-than-average attitude toward the discussion section instructor performed noticeably better than those with a high discussion section instructor attitude (27.080 vs 24.955, groups 50 and 51). This may imply a relationship between student perception of discussion section and the ability of the discussion section instructor to provide examples and practice for application tasks, as represented in this section of the exam. These students were not isolated extremes on any variable, had what would be considered "good" GPA's; it is possible that their feelings toward the instructor's ability to clarify the course material was inversely related to their ability to apply the course material to situations.

The upper branch of the tree describes the students with the best performance on Final-2, and is initially described by both high GPA and CQT-Total scores. At this point the data is split isolating those students whose instructor was very low in authoritarianism from students whose instructor was characterized by normal to high authoritarianism, the lower test performance associated with those students having the instructors characterized by very low authoritarianism. This may indicate that success for these students on this type of performance was related to differentiating between acceptable and unacceptable applications through the direct intervention of the instructor, or it could imply that instructor authoritarianism was reflected by more enforced student involvement in application-type tasks. Students were then differentiated by performance on the midterm exam (higher mean Final-2 associated with high midterm scores), indicating to that point degree of knowledge accumulated and degree of effort extended in the course. For those with lower midterm scores the disadvantage was offset by very high CQT-Q scores. For those with with high midterm scores it was a disadvantage to have a low level of drive (in terms of the neuroticism scale), and to be older than the majority of students in the course.

Among the groups in the lower branch of the tree are those with the lower scores on Final-2, as a group. Students with lower GPA's (below 2.6) and CQT-T's below the fiftieth percentile were first differentiated on the basis of midterm exam performance, indicating preparation effort. The split occurred at the midterm mean. Among those with lower GPA and lower CQT-T but who scored above the mean on the midterm, the group split almost equally on the size of the course load carried by the instructor, higher mean scores associated with instructors with heavier course loads. The general expectation would probably be that this split should be the inverse, but in combination with other instructor-related splits it may represent the possibility that less instructor intervention in the discussion section actually aided student performance on this task. Previous evidence based upon the item analysis of the students' attitude toward discussion section instructors indicated that students felt that the instructors were weakest in interrelating course materials and providing adequate practical examples of application.[181] Following this split, performance again follows expected patterns with the upper group splitting on learning set -- the more conceptually-oriented having higher mean scores, and with the lower group, less extroverted students performing better on the test. In the case of students low on GPA, low on CQT-T and low on midterm, important descriptions were based on personal characteristics. Those who indicated less need to make socially desirable responses performed better on this section of the exam which required applying information, than did those indicating a greater need. Among the latter, those with a higher degree of extroversion were at even more disadvantage, their mean performance scores being at the lowest range for all students.

Analysis of Final Exam Total Score

AID III - Final Exam Total Score involved the addition of the Final-1 and Final-2 scores. Statistics for the total are discussed in Chapter III. The mean was 53.801, standard deviation 7.157. Fifteen

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[181] J. T. Parmeter, loc. cit., pp. 164-178.

predictor variables accounted for seventy-eight per cent of the total sum of squares. Since the total score was a compilation of the recall and applied sections of the test, the expectation would be that the majority of the splits would be accounted for on the basis of the major predictors which appeared in the two sections of the exam, and that the branches would reflect the same trends as in the trees of both exam sections.

The tree for AID III - Final Total Exam Score (Figure 8 , Appendix D8 , p. 333) indicates the importance of the midterm score in the prediction of performance on the recall section as did the analysis of Final-1, the importance of GPA and the CQT-T in the prediction of performance on the application section as did the analysis of Final-2, and the same kinds of variables characterizing the different branches of the tree -- for example the absence of personal factors in the prediction of performance of students with high GPA.

The tree first split on the variable GPA, isolating the twenty-seven per cent of the students with GPA's of 2.8 or better. As a group their mean final exam total score was 58.959, compared with 51.839 for those with GPA's below 2.8. The high scores for the entire students in the study were found among these students. With the exception of seven individuals, all groups had means of 56.600 or better, exceeding the mean for the entire groups of students (53.840). Except for one split on an instructor variable involving those with strong GPA's who scored at the mean or below on the midterm, (discussed below) the variables characterizing those with high GPA involved performance variables -- GPA, CQT's, midterm performance, and motivation related specifically to this course. In all instances those with higher scores on the predictor variable had a slight advantage in terms of the final total exam score. The split on the variable 50-50-1 (groups 10 and 11) was discussed in AID I - Final Course Grade.

Among those students with GPA's below 2.8, different characteristics describe those with midterm scores below the mean and those with midterm scores at or above the mean. For those with lower GPA, low midterm performance and also very low CQT's, even lower final exam total scores were found among those with more authoritarian instructors. For those with low GPA but scores near the midterm mean, higher final total exam scores were found among those who did not tend to respond in socially acceptable or expected patterns. Among those students with lower GPA and midterm scores at the mean or just above, higher scores on the total final exam occurred among students with higher CQT-T scores, and instructors carrying higher course loads. The significance of this latter variable was discussed in the analysis of Final-2. The split on the variable extraversion and instructor need for social acceptance reflect the problem of isolation of small groups. The isolation of extreme scores is also reflected in the splits on the instructor level of risk-taking. This split occurred among those with high GPA or those with lower GPA but very high midterm scores. The splits isolate small groups with extremely low or extremely high scores on the measure, with the majority of students falling in a wide middle range.

Analysis of Final Exam Grade

Student scores from the total final exam were converted into a range of letter grades A to F. An analysis of the final exam grade was included because it was this grade rather than the final exam total score which was used in the calculation of the final course grade. Statistics pertaining to the final exam grade are discussed in Chapter III. The mean for all students in the study on AID III - Final Exam Grade was 3.327, with standard deviation 1.017. Since the final exam grade was the representation in grade form of the final exam performance the expectation would be that the tree for final exam grade would not be unlike that of final exam score in that the same major predictors would appear in the various branches of the tree.

As did the tree of final exam total score the tree for final exam grade indicates that students were first differentiated on the basis of GPA, isolating those with GPA's above 2.7, and then differentiated among the students below 2.8 on the basis of midterm score, isolating those with very low performance scores. Among those students with GPA's above 2.7, the characteristics which best describe the groups are performance criteria -- the CQT's and the midterm, with higher scores on the predictor variables associated with higher mean performance grades on the final exam. The high grades in the course were found among these students, and with the exception of one group of ten with lower CQT-Q's and midterm scores below the mean, the final exam grades of the higher GPA's were were equaled by few others in the lower branches. For those students with GPA's below 2.8 and very low midterm scores it was an added disadvantage to be more introverted and to be among the youngest in the class. The mean grade for these students, 1.926, contrasted sharply with that of the students with high GPA's, 4.074. Those with GPA's below 2.8 but with midterm scores close to or above the mean were at a disadvantage on the final exam grade if characterized also by low pretest scores, low CQT-T and CQT-Q scores, strong orientation toward factual learning.

Analysis of Instructor Grade

The instructor grade was weighted to account for forty per cent of the final course grade. The analysis of AID III - Instructor Grade indicated that twenty-one of thirty-six end-of-course variables accounted for sixty per cent of the total sum of squares. The mean instructor grade for all subjects in the study was 3.793. The composition of the instructor grade and statistics pertaining to it are discussed in Chapter III.

Several characteristics of the instructor grade which were discussed in Chapter III are reflected in the tree for instructor grade (Figure 10, Appendix E10, p. 337). First, the criterion used by each instructor to determine a student's instructor grade was largely an unkown quantity. Second, the instructors as a group were inconsistent in the grades assigned in that the mean grade assigned by any given instructor for his students varied from a high of 4.291 to a low of 3.102, a difference greater than one letter grade. Third, any given instructor was consistent in grading across his particular discussion sections, some instructors grading uniformly high across all students, and some low.[182] An examination of the instructor grade tree reflects these factors. First, after the initial splits of the tree the majority of splits serve to isolate groups either low or high

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[182] J. T. Parmeter, loc. cit., pp. 164-178

on the dependent variable, and these groups are not themselves split again, creating numerous "twigs" in the tree rather than branches with a generalized trend involving a considerable number of students. Second, the majority of these splits involve isolation of small groups on the basis of extreme scores on any given predictor characteristic. Third, high grades appear throughout all branches of the tree.

The initial splits of the entire study group occurred on the variables midterm score and GPA. As a group those with midterm scores above the mean had higher mean instructor grades than those with midterm scores below the mean. When examining any given split the question, "What are the reasons why the split was made on this variable rather than on one of the other predictors?" should be kept in mind. A study of the bivariate relationships between the instructor grade and all other variables for each instructor indicated that the only consistent predictor of instructor grade in addition to the GPA was the midterm examination. There was considerably less correlation between the instructor grade and the final exam scores.[183] The instructors kept track of student performance in the course. It is possible that to a certain degree the exam acted as a predetermining agent in the awarding of the instructor grade. The relative importance of GPA is not unexpected. While the term GPA represents a numerical value, it has underlying associations not only with mental ability, academic skills, and motivation but associations with understanding "the name of the game" in competitive situations. Perhaps higher grade point averages also reflect an awareness of "what sells". Among those with

[183] _Ibid._, pp. 164-178.

very high midterm scores, those with GPA's of C+ or better had, as a group, significantly higher mean instructor grades than the group with lower GPA. In addition, those students with GPA's in a range approximately comparable to that of the high GPA's with high midterm scores but who themselves obtained midterm scores at or only slightly above the mean, had as a group slightly higher mean instructor grades than those with very high midterm scores but lower GPA's. (See Figure 10, Appendix D , p. 337, groups 3, 7, 6, 5, 9.) GPA was also a strong second choice in the initial split of the group. (See BSS/TSS_i table, Appendix E10 , p. 412 .)

While these general trends appeared in the tree, it is evident that instructor grading practices and instructor and student characteristics acted as alternatives, any one of which caused deviations from these trends. However, there are also certain predictor variables which appear in various combinations in different branches, characteristic of different student groups.

For example, all students with GPA's in the range of C+ and above and midterm scores just at the mean, thirty-six per cent of all students, (with the exception of six students previously isolated), were differentiated on the basis of their attitude toward the discussion section. Students with quite positive attitudes toward their discussion section experience had significantly higher mean instructor grades than those with less positive attitudes toward the experience. One interpretation could be that in some cases their midterm performances fell short of their current grade point and some responsibility for this was directed at the instructor. However, this same split appeared among some of the students characterized by the same range of GPA but very high midterm scores, although involving fewer cases. In this instance, too, those with less positive opinions of the discussion instructor had a mean instructor grade greater than one letter grade lower than those with more positive attitudes toward the instructor. Students expressed their attitudes toward the instructor prior to assignment of the instructor grade. The importance of attitudes appears in a different form among those students with lower GPA but very high midterm scores (with exception of one small group isolated on extreme scores on another variable). For the majority of students with lower GPA but very high midterm scores, higher instructor grades were associated with those students who at midcourse indicated high course motivation in terms of their own performance, and those who felt they had not been successful in terms of their performance on the midterm exam. For these students of lower GPA, their high midterm performance appears associated with their re-evaluation of their possibilities in the course and resulted in greater effort in discussion section performance.

Among the lower branches of the tree the student characteristic which showed the greatest strength was generalized test anxiety. Among those students with GPA's of approximately C+ and above with midterm scores below the mean and carrying normal or heavy course loads, those characterized by high general test anxiety had higher mean instructor grades than those in the normal or low general test anxiety range. Those with low general test anxiety had higher mean instructor grades than those in the middle range. Among students with very low GPA and midterm scores at or below the mean, the advantage in terms of instructor grade went to those with high anxiety. However, the group isolated was small. It is possible that those with very high anxiety sought out the instructor for help and became known to him. For students with low GPA and lower midterm scores with instructors who themselves did not tend to prefer socially acceptable responses, advantages in instructor grade accrued to those who were more extroverted.

Instructor variables also appear in various combinations in different branches, characteristic of different student groups. The variable "instructor course load" appears in different branches of the tree, involving groups of students with GPA's of C+ or better whose midterm scores ran the entire range of low to high. In the upper branch of the tree the first split of the group of students with high midterms and the GPA's of C+ and above was made on instructor course load, those students with instructors carrying heavy course loads receiving a higher mean instructor grade than students with instructors carrying lighter course loads. The group characterized by instructor heavy course load then split on attitude toward discussion section instructor, with those students expressing more negative attitudes having a significantly lower mean instructor grade. This latter split was discussed earlier in this section, and the group involved was small. However, among students with comparable GPA's but who did not do well on the midterm, the split on instructor course load also appears, in this case among students carrying less than normal credit loads. As in the upper branch, the group characterized by instructors with heavy course loads had significantly higher mean instructor grade. It is among students with this range of GPA but midterm scores just at the mean that a split on attitude toward discussion section instructor appears, involving twelve per cent of all the students in the study, with those students who evidence less positive opinions of the discussion section receiving a lower mean instructor grade. (See groups 13, 12, 39, 38, 31, 30, 59, 58, Figure 10, Appendix D10, p. 337.)

Variables involving more personal characteristics of instructors appear throughout the lower branches of the tree. Instructors characterized by more rigid behavior and more authoritarianism in beliefs were associated with groups of students having higher mean instructor grades than were instructors less rigid, less authoritarian. The student characteristics associated with these groups involved students with lower GPA who had very high midterm scores or higher GPA's but midterm scores at or below the mean. The group of students with lower GPA but very high midterm scores was also characterized by viewing their performance on the midterm as successful and at mid-course setting their aspiration for course grade at least at C+ to B+. The students with higher GPA were characterized by midterm scores just at the mean or by midterm scores below the mean, normal to heavy credit loads and high general test anxiety. Among students with low GPA and also lower midterm scores, the instructor variables associated with groups involved instructor tendency to respond in socially acceptable ways and instructor need for social acceptance. Among these students, those whose instructors tended themselves to respond in socially acceptable ways had a higher mean instructor grade than those whose instructors did not. Among students who also tended to be introverted and whose instructor did not tend to respond in socially acceptable ways it was an advantage if the instructor was characterized by a higher need for social acceptance.

Summary

In chapter four the data was summarized and displayed to illustrate the analysis strategy to be used in interpreting the data of each set of predictors to course outcomes, and was also discussed in terms of the concept of "importance". A number of analyses were made involving eleven outcome factors and three sets of predictor factors. The data from one analysis, final course grade based on entering-course characteristics, was presented and discussed in detail. Data of each of the other outcome factors was then discussed in summary presentations in the following order: final course grade based on mid-course variables and then based on end-of-course variables; the pretest, based on entering-course factors; the final exam scores (recall section, application section, and total), the final exam grade, and the instructor grade, based on end-of-course factors.

The data from the analysis of final course grade based on entering-course characteristics was presented and discussed in detail to show a series of characteristic patterns useful in examining the data of each of the outcome variables, and to illustrate the analysis strategy in interpretation. The discriminations among students on the basis of entering-course characteristics and their association to final course grade were represented visually in a figure referred to as a "tree," in which various "branches" each represented a number of student groups with varying combinations of personal, attitudinal, and performance characteristics associated with different values of final course grade. For example, Figure 1 , (p.157), indicates that discrimination among students was first made on the basis of GPA, the first two splits creating three groups -- those with GPA's of B- or better having a mean final course grade of 4.297 (on a five-point scale), the GPA's of C to C+ a mean of 3.555, and the lower GPA's a mean of 3.157. (See groups 3, 5, 4, p. 157.) Discriminations in the upper "branch" of the tree containing the GPA's of B- or better are then made on the basis of major and of specific motivation related to performance in this particular course, resulting in four final groups in the upper "branch". The importance of these factors to high final course grade is indicated by examining the relative power of the other entering-course characteristics to reduce the unexplained sum of squares. Table 8 , (p. 168), indicates that in the initial discrimination of all students, no entering-course variable approached the strength of GPA to reduce unexplained variation (See column one.) Column twelve indicates that among the group with high GPA course-specific motivation was almost as important a factor as was major. Its strength as second choice, its use as the most important factor among all other groups in the upper branch, and its lack of strength to reduce variation among other groups in the tree suggests the importance of this factor coupled with high GPA to high final course grade as judged on entering-course characteristics.

Utilizing the above strategies, the final course grade based on entering-course characteristics was then discussed in detail. Nine of fifteen entering-course variables were used to account for fifty-one per cent of the total sum of squares. The mean final course grade was 3.633, standard deviation .821. A summary of the findings indicates the importance of grade point average to assigned final course grade across all students. Higher conceptual ability and preference for conceptual learning were advantages associated with higher final course grade among all levels of GPA. There appeared to be for high, middle, and low GPA's different sets of barriers to high final course grade. For students with lower grade point averages, degree of extraversion was an important consideration in predicted final course grade; for those in the middle GPA range, general test anxiety was an important consideration; for those in the higher range of GPA, entering level of motivation related specifically to their performance in the course appeared important.

The second analysis of final course grade, based upon variables involved to mid-course, indicated that final course grade depended mostly upon past performance, conceptual skills, test anxiety, and personality factors. Higher course grades were associated with higher GPA, and at every level of GPA a preference for conceptual learning was an advantage to higher course grade, and a particular advantage to those with low GPA, as were higher CQT-Q scores. Among those of lower GPA and lower conceptual skills a combination of personality variables cumulate into lower course grades, with lower social extraversion, less emotional stability, greater tendency to respond in socially acceptable ways tending to depress the final grade. Personality variables were concentrated among those of lower GPA, showed secondary strength among the middle GPA ranges, and no strength among the high GPA groups. Among groups in the middle range of GPA the majority of splits involved separating off a group inhibited from obtaining a higher course grade by some barrier, none of the groups being split again, inferring that such barriers are alternatives, any one being sufficient to keep a student from a higher course grade. A higher level of test anxiety among those in the middle range of GPA appeared associated with depressed course grade. In general the variables in the branch of higher GPA's dealt principally with factors associated with doing well in school -- higher course-specific motivation, higher conceptual ability, higher pretest performance all associated with higher final course grade. The deletion regression analysis attributed approximately the same amount of variation to the pretest, but the "tree" added the impression that the force of this variable was centered among those of higher GPA.

In the third analysis of final course grade the end-of-course variables accounted for seventy-four per cent of the total sum of squares. The interpretation of the importance of the midterm performance to a student's final course grade was complex. The deletion regression analysis also indicated the midterm to be far more powerful than any other variable. Midterm performance as a motivational factor in the last half of the course was an important consideration, as was the indication that midterm scores served as a preconditioner to instructors in assignment of instructor grade, itself a forty per cent component of final course grade. The relative importance of the other variables was similar to that in the analyses of final course grade previously discussed.

The entering-course variables used in the analysis of the pretest accounted for fifty-three per cent of the total sum of squares. Fourteen of sixteen predictors made at least one split, suggesting there were many forces at work which were not so highly correlated with one another that the division of the total group on one made the other unnecessary. Further, the test, of no weight in determination of course grade, would hold varying degrees of personal worth to students in terms of putting forth an effort. Thus there are many alternative barriers, any one of which is sufficient to depress the pretest score. The complexity of the tree is increased by the fact that while a variable may be used throughout all branches and have its maximum effect in one direction, it may isolate a small group which does not follow the pattern for the majority of students. The importance of the verbal CQT-score was not unexpected since the pretest was designed to obtain a measure of student knowledge of factual material in the area of educational psychology, many questions involving terminology in which vocabulary and reading skills were important.

In the analysis of midterm score, sixteen mid-course variables accounted for fifty-four per cent of the total sum of squares, and indicated the importance of performance variables both pre-course and course. GPA, the CQT's, and the pretest score appeared throughout the tree. The variables appearing in the branch with higher GPA's involved some performance criteria of an academic nature --CQT's or pretest. However, the mean midterm scores of those at a disadvantage on these factors were not depressed sufficiently to make them noncompetitive, in that midterm performance counted twenty per cent of the final course grade, and no factor depressed the weight of their score to the point where it was not an advantage in determination of final course grade. In addition, for those with higher GPA, high midterm scores were associated not only with advantages on performance criteria but by absence of disadvantages on personal factors such as test anxiety or relations with instructor. Variables associated with attitudes and personality factors appeared among those groups of students with GPA's in the D- to C+ range. Those students who had done well on the pretest but were characterized by high general test anxiety were at a disadvantage on the midterm. Negative preattitude toward the course, strong preference for factual learning, or the tendency to respond in socially acceptable ways were alternative disadvantages.

Since the midterm grade was based solely on the midterm score there was a strong resemblance between the trees of the midterm grade and midterm score. However, since two individuals with scores quite similar can, through arbitrary cut-off scores appear in different grade categories, the trees would not be carbon copies but rather show variations in arriving at overall similar groupings. The same group of variables accounted for much the same weight of unexplained variation.

In the analysis of the first part of the final exam, twelve end-of-course variables accounted for fifty-four per cent of the variation. The analysis indicated the importance of the midterm performance to student performance on the final exam, part one. Both contained primarily recall items from readings and lectures. Those students characterized by very high midterm scores had, as a group, high scores on the recall section of the final exam. Among students with GPA's in the C to D range, lower midterm scores, but who had scored well on the pretest and were oriented toward conceptual thinking, scores on this section of the final exam competitive with the highest scores among all students were associated with a less positive attitude toward their discussion section experience.

The end-of-course variables used in the analysis of the "application" section of the final exam, the last half of the test, accounted for sixty-four per cent of the total sum of squares. Those students who as a group had the best performance on this section of the exam were those initially characterized by both high GPA and high CQT-total scores. Those students whose Final-2 scores approximated the mean for all students were described by one of the characteristics of those with the best overall test performance, but not both -- namely, high GPA or average to high CQT-total scores. Different characteristics distinguished these latter two groups. For those with lower GPA but high CQT-T's an orientation toward conceptual learning was an advantage -- not unexpected on this section of the exam. Among these students a lower midterm score depressed the final exam score, perhaps indicative of lack of preparation. Among those with higher GPA but low CQT-T the factors characterizing performance were related to valuing the GPA, namely attitudes and level of aspiration. Among these students, those with high preattitude toward the course, little anxiety toward the pretest, and strong motivation to do well in the course had Final-2 scores competitive with the highest on the section of the exam. In addition, among these students with competitive scores, those with a lower-than-average attitude toward the discussion section instructor performed noticeably better than those with a high discussion section instructor attitude. Among those who did not do well on Final-2, and who were characterized by low GPA, low CQT-T and low midterm scores, those who indicated a tendency to respond in socially acceptable ways and those with a higher degree of extraversion were at a further disadvantage in terms of their score on this application section of the exam.

The total examination final score was a compilation of the recall and the applied sections of the test. The expectation would be that the majority of the splits would be accounted for on the basis of the major predictors which appeared in the two sections of the exam, and that the branches would reflect the same trends as in the trees of both exam sections. The analysis supported this expectation, indicating the importance of the midterm score in the prediction of performance on the recall section as did the analysis of Final-1, the importance of GPA and the CQT-T in the prediction of performance on the application section as did the analysis of Final-2, and the same kinds of variables characterizing the different branches of the tree -- for example, the absence of personal factors in the prediction of performance of students with high GPA.

Student scores from the total final exam were converted into a range of letter grades. An analysis of the final exam grade was included because it was this grade rather than the final exam total score which was used in the calculation of the final course grade. Since the final exam grade was the representation in grade form of the final exam performance, the tree for final exam grade was not unlike that of final exam total score in that the same major predictors appeared in the various branches of the tree.

Twenty-one end-of-course variables accounted for sixty per cent of the total sum of squares in the analysis of the instructor grade. The importance of grade point average and midterm score were not unexpected, with higher instructor grades associated with higher scores on the predictor variables. While the term GPA represents a numberical value, it has underlying associations with understanding the name of the game in competitive situations involving more than a test score. In addition to being a motivating factor for some students in the latter half of the course, the midterm exam scores acted as a predetermining agent to instructors in the awarding of grades. While these general trends appeared in the tree, it was evident that instructor grading practices (inconsistencies in criteria and assignment), and instructor and student characteristics acted as alternatives, any one of which caused deviations from these trends by isolating small groups on the basis of extreme scores on any given predictor. However, there were also certain predictor variables which appeared in various combinations in different branches, characteristic of different student groups.

For example, student characteristics related to attitudes and personality were associated with different groups. All students with GPA's of C+ and above and midterm scores at the mean, and some students with comparable GPA's but high midterm scores were differentiated on the basis of attitude toward discussion section --more positive attitudes associated with higher instructor grade. The importance of attitudes appeared in a different form among students of lower GPA but who did well on the midterm, in terms of a re-evaluation of their possibilities for doing well in the course after their midterm success, with higher instructor grades associated with higher course specific motivation for the last half of the course. Higher instructor grades were associated with very high general test anxiety among students of higher GPA but who had not done well on the midterm, and were carrying full course loads.

Instructor variables also appeared in various combinations in different student groups. The factor "instructor course load" appeared in different branches, involving groups of students with GPA's of C+ or better whose midterm scores ran the range of high to low. Heavy instructor course load was associated with higher instructor grade. Instructors characterized by more rigid behavior and more conservatism in beliefs were associated with groups of students' higher mean instructor grades. These student groups were those with higher GPA, lower midterm performance and high general test anxiety, or those with lower GPA but high midterm performance whose motivation in the latter part of the course was high. Among students with low GPA and low midterm scores, higher instructor grade was associated with students whose instructors tended to respond in socially acceptable ways or had higher need for social acceptance.

This presentation of the data findings is integrated and interpreted in chapter five in a discussion of the issues and questions raised in chapters 1 and 3 about the nature of instruction in the instructional situation in this study.

CHAPTER V

DISCUSSION OF THE FINDINGS

The considerations underlying the concept of the "instructional process" and those underlying the concept of "importance" suggested a number of expectations about the structure of relations among the factors involved in the instructional process. In this chapter, the data which were presented in chapter four are integrated in a discussion of the questions raised in chapter three in relation to the suggested expectations.

1. Coalescence will occur around certain classes of predictor variables in their description of a given outcome variable, the coalescence differing according to conditions surrounding the various outcome variables.

    i. Is the structure of relations among classes of entering-course variables similar for the pretest (noncompetitive) and the final course grade (competitive)?

The extent of coalescence is based upon the contextual characteristics which surround a given outcome -- that is, based upon the nature of the particular outcome and the pressures upon the instructional process at a given time. The discussion of the contextual characteristics surrounding two particular outcome variables -- pretest and final course grade -- was presented in chapter three and again in chapter four, and can be summarized here as noncompetitive versus competitive.

Table 8 (p. 166) indicates that the analyses of entering-course variables to pretest and to final course grade accounted for approximately the same total proportions of variation -- fifty-three per cent of the total proportion for the pretest, fifty-two per cent for final course grade. However, an examination of the trees for each outcome and an examination of the contribution of the various entering-course variables appears to indicate differing structures of relations among the variables.

For the pretest, the tree (a representation of the structure of relations among variables) is extremely complex and asymmetric when compared with that of final course grade. (Appendix D1 and Appendix D2) Fourteen of sixteen entering-course variables were used in the analysis of pretest, nine in the analysis of final course grade. (Table 8, p. 166) An examination of the trees also indicates the greater number of subgroups created by splits on variables used a number of times, in the case of the pretest, whereas the final course grade splits are concentrated in fewer groups on less use of variables. This suggests that not only the nature of the pretest (a test the worth of which, in terms of judgment of performance, was judged by the individual) but the context in which the task was performed (an entering-course experience, the nature of the coming instructional process an unknown quantity to students, the nature of judgments of the performance unknown, and so on) is associated with students bringing to bear a wide range of factors to meeting the task, as compared with the final course grade, a composite of performance on known tasks, and under pressures of "reward".

However, while the tree for pretest may appear, in its complexity, abstract, coalescence does occur around certain classes of variables which account for variation. In fact, Table 10 (p. 219) indicates that for both pretest and final course grade a combination

TABLE 10

PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES
BY COURSE PERFORMANCE VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)										
	AID I		AID II			AID III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Score-T	Final Exam Grade	Instructor Grade	Final Cs. Grade
Past Performance											
GPA	.018	.306	.208	.194	.295	.040	.201	.222	.230	.077	.088
CQT-V	.111	.008	.032	.026	.009				.007		
CQT-Q	.053	.061	.041	.025	.017	.024	.010		.046	.018	
CQT-T	.022	-.016	.013	.018	.010	.037	.084	.173	.030		
Total proportion of variation explained	.204	.359	.294	.263	.331	.101	.295	.395	.313	.095	.088
Course Performance											
Pretest(Total prop. var. exp.) *	---	---	.076	.079	.019	.020	.014	.008	.012		
Midterm(Total prop. var. exp.)	---	---	---	---	---	.268	.049	.130	.139	.141	.539

* --- Variable not included in this stage of analysis.

of entering knowledge and abilities (as assessed by past performance) accounted for a far greater proportion of variance than did combinations of attitude, personality, or personal characteristics. (Tables 11, 12, and 13, pp. 221, 222, 223) However, within that combination, the structure of relations appears to be different. In the case of the pretest, entering-course ability as assessed by the verbal score on the college qualification test was the single measure accounting for the largest proportion of variance. The discussion of the pretest in chapter three indicated the questions did involve vocabulary in educational psychology possibly unfamiliar to students. This verbal factor was coupled with major field of study, in accounting for variance, suggesting the importance of an additional entering ability in the form of previous instruction on similar content. By contrast, the CQT-V score accounted for less than one per cent of the proportion of variance in final course grade, compared to eleven per cent in the pretest; however, another past performance indice, gradepoint average, accounted for thirty per cent of the proportion of variance in final course grade, compared with two per cent for pretest.

A comparison of the variables in Tables 10, 11, 12, and 13 indicates that attitudes, personality characteristics, and personal characteristics accounted for twice the proportion of variation in the pretest as compared with final course grade. (In the case of past performance indices discussed above, the weighting was on the side of final course grade, although in both pretest and final course grade past performance accounted for the greatest proportion of variance.) In addition, for the pretest, the propor-

TABLE 11

PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES BY STUDENT PERSONAL VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)										
	AID I		AID II			AID III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Gd.	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade
Sex	.011		.008								
Age			.009	.006	.008		.010		.018		.008
Major	.086	.042	.049	.045	.051	.036	.029	.028	.023		.014
Credits	* ---	---								.023	.009
Current Load	---	---					.010				
Total proportion of variation explained	.097	.042	.066	.051	.059	.036	.049	.028	.041	.023	.031

* --- Variable not included in this stage of analysis.

TABLE 12

PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES BY STUDENT PERSONALITY VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)										
	AID I		AID II			AID III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade
Extraversion	.006	.012	.007		.007		.018	.004	.019	.010	.030
Neuroticism	.023		.007	.036	.024		.018	.022	.006	.029	
Eysenck Lie	.009			.015	.022	.008	.018	.014		.015	
A-H Test Anxiety	.096	.021	.031	.018	.036					.053	.007
Test Anxiety-1							.011				
Test Anxiety-2	* ---	---			.006						
Test Anxiety-3	---	---	---	---	---	.008				.008	
Accuracy	---	---	---	---	---		.010			.020	
Success	---	---	---	---	---					.007	
Total proportion of variation explained	.134	.033	.045	.069	.095	.016	.075	.040	.025	.142	.037

* --- Variable not included in this stage of analysis.

TABLE 13

PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES
BY STUDENT ATTITUDE VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)										
	AID I		AID II			AID III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade
Attitudes											
Learning Set	.059	.042	.013	.009	.024	.026	.021		.041	.009	
Reason Enrolled	.049			.007							
Pre-attitude	-.015		.009	.019	.012		.020			.009	.009
Post-attitude	* ---	---	---	---	---			.007			
Discussion Attitude	---	---	---	---	---	.015	.006			.046	
Total proportion of variation explained	.093	.042	.022	.035	.036	.041	.047	.077	.041	.064	.009
Aspiration-Expectation											
50-50-1	.009	.041	.010	.015	.031	.031	.052	.069			.024
50-50-2	---	---	---	---	---		.021	.030		.007	
Total proportion of variation explained	.009	.041	.010	.015	.031	.031	.073	.099		.007	.024

* --- Variable not included in this stage of analysis.

tions are fairly evenly distributed between the three combinations of variables -- that is, variables classed as "personal", those classed as "personality", and those classed as "attitude". By contrast, the concentration for final course grade is in the attitude area, specifically learning set and the aspiration-expectation level the student has for his performance. A comparison of the tables and the tree for final course grade indicates that the amount of variance "explained" is focused principally in factors associated with competitive instructional situations -- gradepoint average and the aspirations one has for success.

ii. Is the structure of relations between classes of predictors of the final course grade similar for different points in time -- entering-course, mid-course, and end-of-course?

In chapter four, each of the analyses of final course grade was dissected in terms of how students vary across factors associated with their performance and "reward" in the course. Given these variations, the question now becomes which factors, over the length of the instructional process, appear to have the greatest "importance" in terms of accounting for the "reward" received for the "job". Tables 10, 11, 12, 13, and 14 indicate the relative "importance" of each variable and each combination of variables in accounting for a proportion of the variance. Table 8 (p. 166) indicates the total proportion of variation accounted for on each analysis: fifty-three per cent on entering-course variables, fifty-nine per cent on mid-course, and seventy-four per cent on end-of-course. Table 10 indicates that the seeming disproportionate proportion of variance accounted for in the latter analysis is explainable by the contribution of midterm performance -- fifty-three per cent.

TABLE 14

PROPORTION OF VARIATION "EXPLAINED" IN COURSE OUTCOME VARIABLES BY INSTRUCTOR VARIABLES

Variable	AID Reduction in TSS(I)/TSS(T)										
	AID I		AID II			AID III					
	Pretest Score	Final Cs. Grade	Midterm Exam Score	Midterm Exam Grade	Final Cs. Grade	Final Exam Score-1	Final Exam Score-2	Final Exam Total Sc.	Final Exam Grade	Instructor Grade	Final Cs. Grade
Instructor Extraversion	* ---	---	.024		.014						
Instructor Neuroticism	---	---							.026	.015	.008
Instructor Eysenck Lie	---	---				.014				.015	
Instructor Marlowe-Crowne	---	---	.008	.007				.006		.040	
Instructor Sanford-Gough	---	---		.013	.009	.013				.021	
Instructor California-F	---	---		.007			.028	.009	.006	.013	
Instructor Risk	---	---	---	---	---			.027			
Instructor Course Load	---	---	---	---	---		.010	.007		.029	
Instructor Teaching Exp.	---	---	---	---	---						.010
Total proportion of variation explained	---	---	.032	.027	.023	.027	.038	.049	.032	.133	.018

*--- Variable not included in this stage of analysis.

Tables 10 through 14 indicate that there are differences in the structure of relations among the variables in accounting for variation at the secondary level. In the analysis based on entering-course variables, conceptual skills or orientation to conceptual thinking show such secondary importance, particularly among those in the mid-to-low GPA range. In the analysis based on mid-course factors, major field of interest and degree of general test anxiety (particularly among the middle range of GPA's) appear associated with performance. In the analysis on end-of-course factors, degree of extraversion, focused among low GPA's, has been added as having secondary importance.

However, across the range of these analyses the tables indicate the overwhelming extent of the contribution made by factors associated with performance in past instructional situations, and the valuing of such performance. That is, coalescence in all analyses occurs around GPA and aspiration-expectation for success in the course; in the final analysis, midterm performance is added to this combination. (The importance of midterm performance can also be indicated by examining those factors important in midterm exam performance; gradepoint average and performance on the pretest together accounted for the greatest proportion of variance.) The importance of this combination of factors to final course grade can be seen in the groups in the trees of each analysis. Students high on this combination have overall mean course grades at the top of the course curve. This does not infer that others do not obtain grades competitive with those of these particular students. However, the trees indicate that far fewer do, and that it requires a series of advantages on other factors to overcome this deficit.

2. <u>The results will show differences among the outcome variables (assessed student performance) in the type of predictor variables accounting for variance and in the extent of the explanation of variance.</u>

This expectation is an extension of the previous expectation which was concerned with differences in explanation attributable to differences in contextual conditions. In the case of this expectation, concern is primarily with explanatory differences between outcomes in terms of the inherent tasks underlying the outcomes.

The concept of "task" was inherent in the discussion of the analysis of pretest and the analyses of course grade, in terms of role the outcome plays in the course -- for example, placebo exam or "run-through" experience, in the case of the pretest. However, in terms of the concept of "instructional process" developed in the previous chapters, both pretest and final course grade are on the periphery of this process, although inextricably tied to it by the nature of their roles in the course. The outcomes of interest in this discussion are midterm score, the various sections of the final exam, and the discussion section grade, each representing a tangible post in the progression of the instructional process.

i. What accounts for the largest amounts of variance across the range of the different outcome variables?

The largest amounts of variance across the range of examination performance are accounted for by performance variables. Table 10 (p. 219) indicates that for both midterm score and final-1, the recall section of the final exam, performance variables account for approximately the same proportion of variance -- thirty-eight per cent. In addition, Table 8, (p. 166) indicates that for both these outcomes about the same proportion of variation is accounted for in total -- fifty-four per cent. In chapter three, the similarity in content between these two tests was indicated. However, the structure of relations among the variables differs. In the case of midterm score, entering gradepoint average accounts for twenty-one per cent, and pretest performance an additional eight per cent of the total thirty-seven per cent contribution of performance factors. By contrast, GPA accounts for only four per cent, pretest for two per cent in the case of the recall section of the final exam. However, Table 10 indicates that twenty-seven per cent of the variation in final exam-1 is accounted for by performance on the midterm examination. To the extent that midterm performance does appear to have a component of GPA and pretest performance as a basis, this is reflected in final-1.

In contrast, the applied section of the final examination, the variation in which is accounted for by slightly less an amount of a performance-variable combination (thitty-five per cent), does not reflect the importance attached to midterm performance or pretest performance reflected in the recall section of the final. Like the midterm, the greatest proportion of variation is accounted for by an identical amount in the GPA -- twenty per cent, An additional ten per cent is accounted for by the CQT-total score. Further, unlike the midterm, and also final-1, seven per cent of the variance in the applied section is accounted for by a combination of attitudes as reflected in level of aspiration, pre-attitude and discussion section attitude, and conceptual orientation as reflected in the learning set.

The proportion of variation in the instructor grade was accounted for by approximately the same proportion in three areas. Tables 10, 12, and 13 indicate that two similar combinations of variables, student personality factors and instructor characteristics, accounted for 14 and 13 per cent of the proportion respectively, while an additional fourteen per cent was accounted for by midterm performance.

ii. Are there differences between the levels of the different outcome variables in:

a. type of predictors accounting for variance?

b. the extent of prediction by both number of splits and amount of variance explained?

The trees in Appendix D for midterm score, final exam-recall, final exam-applied, and discussion section reflect the differences in type of predictor accounting for variance, and the extent of prediction by splits and amount explained. Midterm exam and the recall section of the final exam bear a resemblance not only in amount of variance accounted for but in number of groups in similar branches, (Appendix D3 and Appendix D6) In addition, while Tables 10 through 14 indicated the differences in the structure of relations among the variables in the two outcomes, and this is reflected in the branches of the trees, important similarities paricularly in initial predictors do appear. For example, in both cases, the performance of students with high GPA's (who as a group have high mean scores) is almost totally "explained" solely by factors associated with "doing well" in school; by contrast, those with high midterm scores but not necessarily strong GPA's are characterized by anxiety toward the final exam, and extent of instructor need for social acceptance -- higher final-1 scores associated with lower scores on these two dimensions. By contrast, the trees for the applied section of the exam and that of instructor grade appear quite complex. However, by comparison with each other they appear similar not only in total amount of variation accounted for but in the extent of prediction by both number of splits and amount of variance explained in the various branches. (See BSS tables, Appendices E7 and E10, and the trees, Appendices D7 and D10).

iii. Are there differences between outcome variables similar in analysis conditions, but different in underlying task, specifically:

a. between the final exam score-1 (recall) and the final exam score-2 (applied)?

b. between the final exam grade and the instructor grade?

The major differences in amount of variation accounted for, the coalescence of factors which are a part of that "accounting", and these variations as reflected in the subgroups in the trees has been discussed for both the recall and applied sections. However, on the applied section of the test the relationship among the variables appears much more complex. Whereas final-recall performance could be "explained" by high midterm performance, the roles of GPA and CQT's, the variables appearing to have the most relative importance to determination of performance on the applied section, are more complex. Those students who as a group had higher mean scores on the applied section were characterized by both high GPA and high CQT. Those students at the mean for all scores on the applied section were characterized by either high GPA or high CQT, but different characteristics distinguished both groups. For those with lower GPA but high CQT-T's an orientation toward conceptual learning was an advantage which made their scores competitive with those among the high GPA-high CQT group. Among students of the reverse persuasion, (higher GPA but low CQT-Q), the factor characterizing scores competitive with the high's in the above groups was level of aspiration, higher scores associated with higher level. In addition, among these high scores, those with a less than favorable attitude toward the discussion section experience performed considerably better than those with favorable attitudes. By contrast with this group of high GPA's, a group of low GPA's expressed similar reaction on the recall section. That is, students who had scores on final-1 competitive with the highest in the course but who were at a disadvantage on other performance indices (C to D GPA, lower midterm scores) but had scored well on the pretest and were oriented toward conceptual thinking had less positive attitudes toward their discussion section experience.

While the applied section of the exam involves a complex relation among factors in its explanation, its complexity is reduced when considered as a structural component of final exam grade which is the grade assigned the two sections of the test in toto. An examination of Tables 10 through 14 and the tree for final exam grade indicate the importance of each of the major characteristics important in the "explanation" of the two test sections. Its comparison with the tree for instructor grade suggests the importance not only of the underlying task but the criteria involved in assessment of that tasks in terms of the structure of relations which develops among the variables which are a part of the instructional process.

3. <u>Measured factors may together represent a weighting of their underlying theoretical constructs in the form of an interaction</u>.

The reality of the instructional setting is such that interactions should be expected. Given the number of students involved in the instructional situation under study, the highly heterogeneous nature of these students, the large number of instructional personnel, and the extensive number of objectives to which the instructional situation was directed, the likelihood of interactions is probable. In addition, because of the lack of homogeneity and independence involved, it would be expected that of the interactions which emerge there would be variations of three dimensions: (1) interactions involving levels of student characteristics to course outcomes and interactions involving levels of instructor characteristics to course outcomes; (2) the interactions involving positive instructional effects (results greater than expected) and negative instructional effects (results less than expected); and (3) the interactions involving different degrees of interactiveness -- that is, interactions might emerge independently of multicollinearity.

i. Are there examples of interactions between instructor characteristics and course outcomes?

In Figure 3 (p. 233) observation of the plotted points indicates the presence of a strong interaction between levels of instructor course load and student performance. It would appear that levels of instructor course load result in differences in student-achieved course grade. The plotted points indicate there is

FIGURE 3

MEAN EXPECTED INSTRUCTOR GRADE PLOTTED BY INSTRUCTOR COURSE LOAD LEVEL ACROSS STUDENT GPA/MIDTERM GROUPS

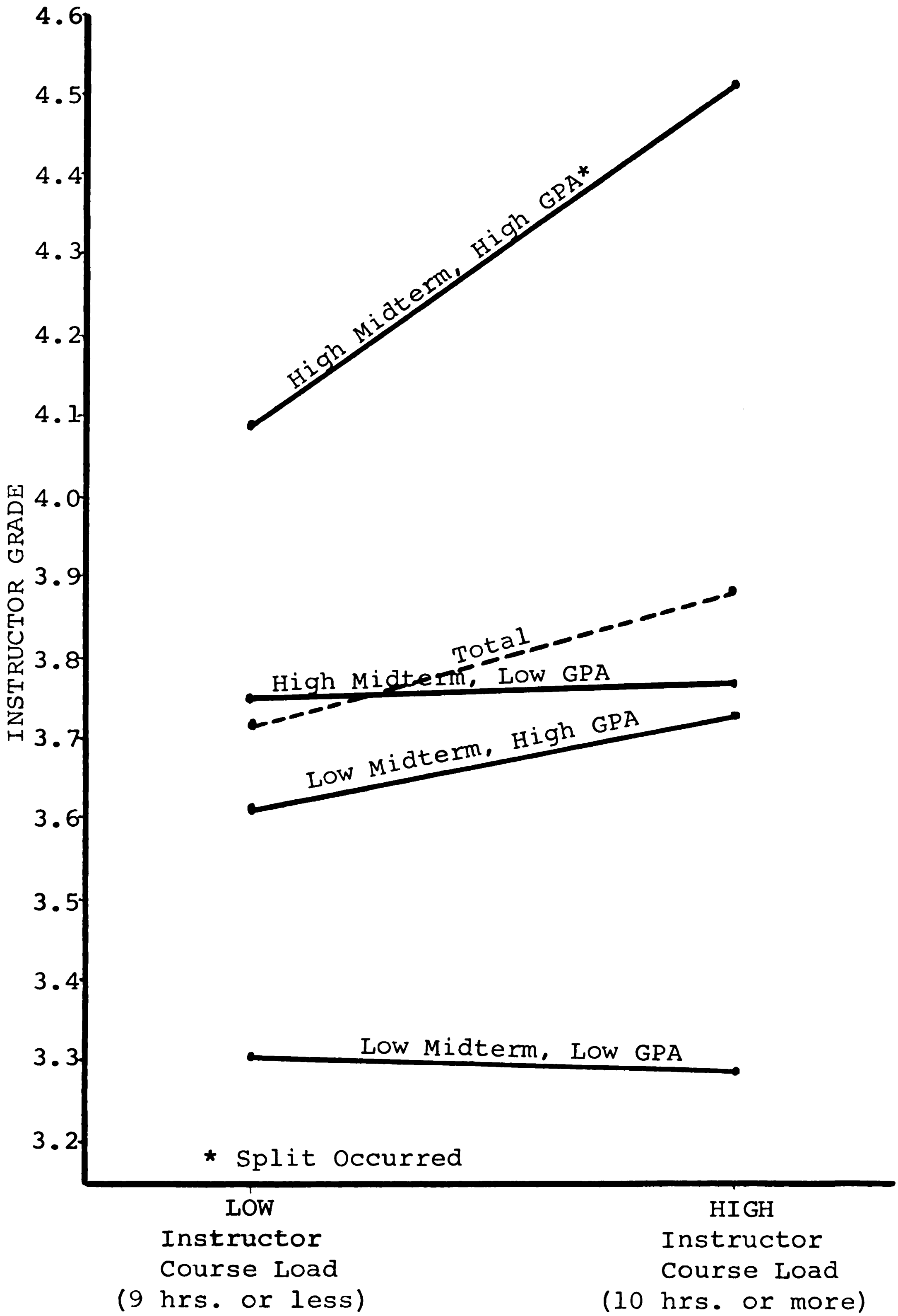


TABLE 15

MEAN EXPECTED INSTRUCTOR GRADE BY LEVEL OF INSTRUCTOR COURSE LOAD ACROSS STUDENT GPA/MIDTERM SCORE GROUPING

Student Groups By GPA/Midterm Performance	LOW-NORMAL INSTRUCTOR COURSE LOAD		HIGH INSTRUCTOR COURSE LOAD	
	$\bar{Y}$	N	$\bar{Y}$	N
Total	3.725	302	3.883	230
Group 4	3.302	53	3.289	38
Group 5	3.618	110	3.735	83
Group 6	3.745	51	3.769	39
Group 7	4.093	86	4.508	63

Group 4: Low Midterm Score, Low GPA

Group 5: Low Midterm Score, High GPA

Group 6: High Midterm Score, Low GPA

Group 7: High Midterm Score, High GPA

High Instructor Course Load: Carrying More Than 9 Hours a slight relationship between all students and level of instructor course load. However, there is a much sharper (interactive) relationship between instructor course load and high performing students. Table 15 (p. 234) shows the means, standard deviations, and number for each of the plotted points by category.

In the discussion of question one of this chapter, it was pointed out that of the seventy-four per cent of the proportion of variance accounted for in final course grade by end-of-course variables, fifty-three per cent of the total proportion was attributable to score on the midterm. Consideration of not only the amount of variation accounted for in final course grade (in comparison to the analyses on the other sets of variables) but also of the extent of the contribution of the midterm to that explanation raises a number of possibilites. It will be recalled that in the discussion of the analysis strategy in chapter three and the discussion of results in chapter four the points were made that a variable may be used more than once in the analysis and that the split eligibility and reducibility criterion were relaxed to create as many possible combinations as possible. This latter point creates the risk of small groups being split off by chance rather than by real differences. However, the tree for final course grade on end-of-course variables (Appendix D11) indicates that in fact the splits on midterm performance involved large groups of students across all ranges. On the other hand, it will be recalled from the discussion of instrumentation in chapter three that midterm performance as assessed by the examination counted as a twenty per cent component in determination of final course grade. In addition, attention to Table 10, (p. 219) indicates the importance of midterm performance in performance on the recall section of the final exam. Further, Table 10 also indicates the importance of gradepoint average to performance on the midterm itself. This consideration would seem relevant to analysis of final course grade variance in terms of the fact that Table 8 (p. 166) indicates GPA alone contributed only nine per cent to the "explanation" of final course grade on end-of-course variables, when compared with the thirty per cent of the proportion accounted for by this factor in the other analyses of final course grade. To some extent this factor may be present in this weighting of midterm score in the analysis of final course grade on end-of-course variables. The cruciality of midterm performance is made clear by an examination of the tree for midterm score.(Appendix D3) The tree indicates that while not all high scores were among the high GPA's, the groups characterized by high GPA did have, in general, mean midterm exam scores at the top or within a point or two of the top scores; any additional factors differentiating students in this group -- that is, factors which depressed scores of some by comparison to others with the same range of GPA -- did not depress the scores of these students sufficiently to make them noncompetitive. That is, the students' midterm performance counted twenty per cent of the final course grade, and for those in the high GPA range no factor depressed their twenty per cent to the point where it was not an advantage as a component in determining final course grade. Figure 3 (p. 233) indicates that advantages in instructor grade accrue to those students with instructors with heavier course loads, and is a differential advantage to those students characterized by high midterm, high GPA. It is possible that this differential is merited by performance and by knowing "the name of the game", as reflected in GPA, in terms of grasping what is necessary in the discussion section to insure success. However, the interaction raises the possibility that instructors with heavy course loads used the midterm score as a preorganizer in making discriminations among the students' performance in discussion section. The possibility of this factor's importance must be judged in the light of the fact that final course grade was a composite of twenty per cent midterm, forty per cent final exam performance, and forty per cent discussion section grade, based in the end on rank with all other students in the course.

ii. Are there examples of interactions between student characteristics and course outcomes?

In the discussion of final course grade based on entering-course characteristics in chapter four, attention was drawn to an interaction involving course-specific motivation with GPA. Figure 2 (p. 173) suggested that the plotted points of aspiration-expectation on course grade for the entire study group indicated that there was a regression, However, the regression rather sharply changed its slope at approximately the mean values of both indices, suggesting an interaction in addition. The evidence supporting regression plus interaction was further exemplified by examining the plotted points for the three levels of GPA occurring in the three initial splits of the data. The points for high GPA involving more than ten cases follow a positively accelerating path; the points for middle GPA

FIGURE 4

MEAN EXPECTED FINAL COURSE GRADE PLOTTED FOR VARIOUS GPA, MIDTERM PERFORMANCE LEVEL GROUPS ON END-OF-COURSE ANALYSIS BY ENTERING-COURSE ASPIRATION-EXPECTATION FOR COURSE GRADE

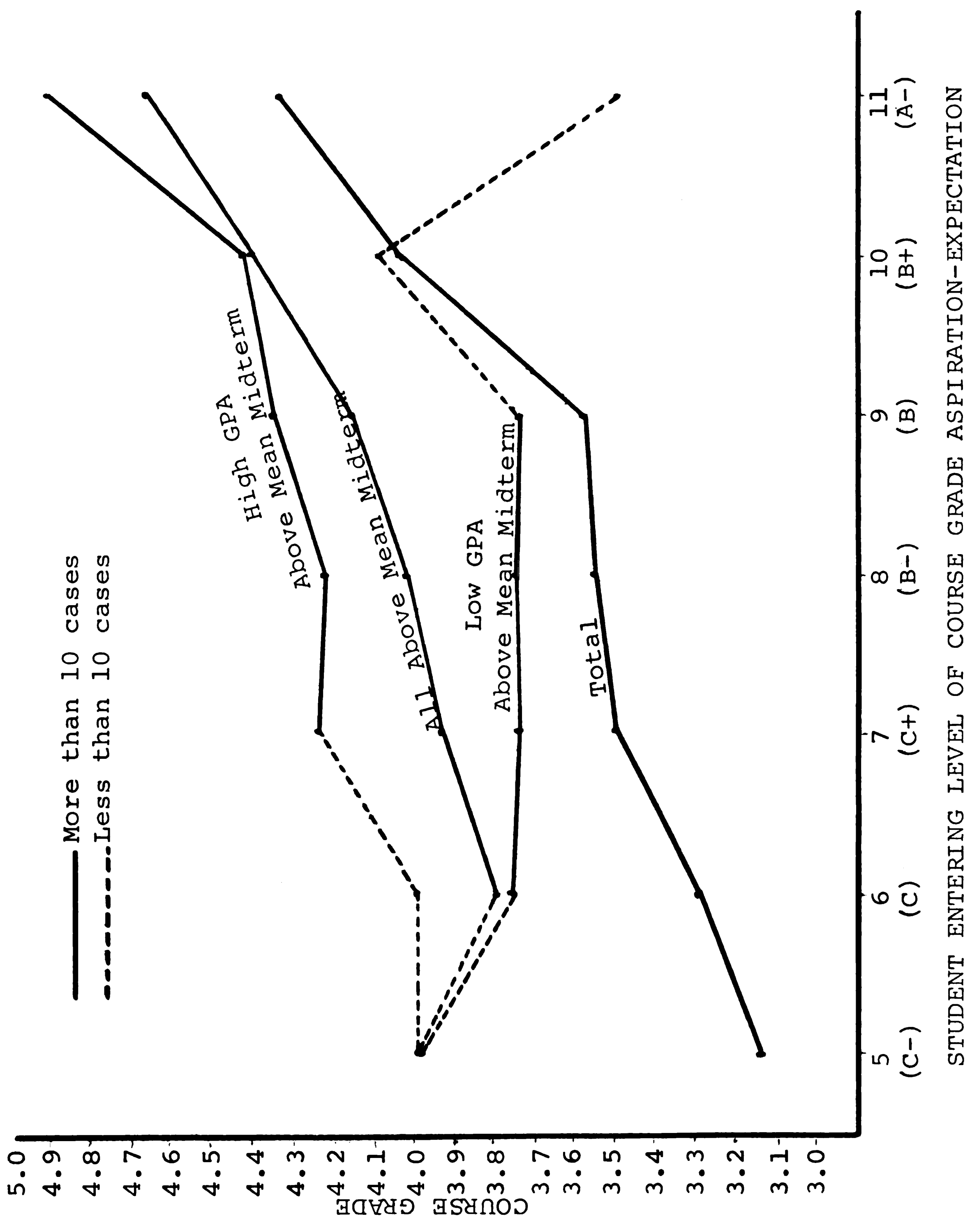


TABLE 16

MEAN EXPECTED FINAL COURSE GRADE USING END-OF-COURSE VARIABLES, BY ENTERING-COURSE ASPIRATION-EXPECTATION FOR FINAL COURSE GRADE

Entering-Course Aspiration for Final Course Grade	Total		Group 6		Group 3		Group 7	
	$\bar{Y}$	N	$\bar{Y}$	N	$\bar{Y}$	N	$\bar{Y}$	N
5 C-	3.176	17	4.000	1	4.000	3	4.000	2
6 C	3.310	29	3.778	9	3.800	10	4.000	1
7 C+	3.500	112	3.750	28	3.932	44	4.267	15
8 B-	3.560	166	3.767	30	4.014	73	4.220	41
9 B	3.885	106	3.750	16	4.170	47	4.367	30
10 B+	4.088	68	4.000	2	4.415	41	4.436	39
11 A-	4.333	30	3.500	2	4.696	23	4.810	21

Group 6: Low GPA; Above Mean Midterm Score

Group 3: All GPA; Above Mean Midterm Score

Group 7: High GPA; Above Mean Midterm Score follow a horizontal path; the points for low GPA follow a negatively accelerating path. It appeared that course-specific motivation interacted with GPA in a positively accelerating manner.

Figure 4 (p. 238) suggests an extension of the general relationship stated above, based on additional information and replication in the end-of-course analysis of final course grade. Table 16 (p. 239) indicates the means, standard deviations, and number for each of the plotted points by category. Figure 4 indicates that there is an interaction involving student variables and the final course grade. All levels of the characteristic represent consistent differences in final course grade, with the plotted points for high GPA following a sharply accelerating path.

iii. Are there examples of positive interactive results (students performing above the expected) on course outcomes?

Figure 5 (p. 241) plots the example of positive interactive results -- that is, students performing above the expected in the course. The review of the literature indicated the role of general test anxiety in performance, higher degree of anxiety being associated with lowering of performance scores. The plotted points for the total group tends to support this contention. However, the plotted lines indicate a distinct interaction between student characteristics and course grade based on level of test anxiety. The points for low GPA tend to follow a negative path not unrepresentative of the total group, while for the middle GPA's the points follow a more sharply accelerating negative path. However, among the high GPA's the points follow a positively accelerating path by comparison with the group path for all students.

FIGURE 5

MEAN EXPECTED COURSE GRADE PLOTTED BY HIGH AND LOW TO NORMAL STUDENT TEST ANXIETY ACROSS ENTERING GPA LEVEL

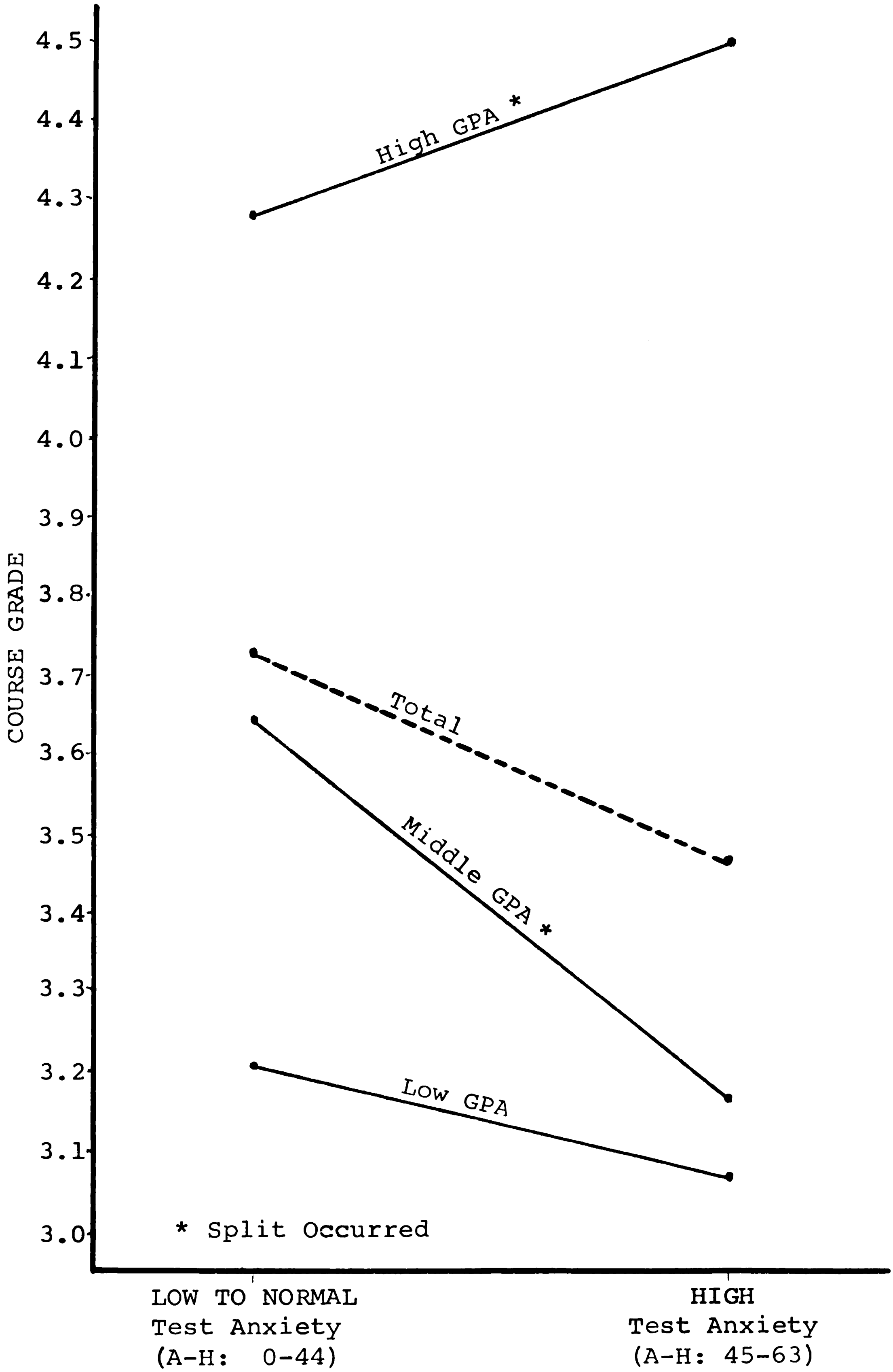


TABLE 17

MEAN EXPECTED COURSE GRADE BY HIGH AND LOW TO NORMAL STUDENT TEST ANXIETY ACCORDING TO ENTERING GPA LEVEL

Student Groups By GPA Levels	LOW TO NORMAL TEST ANXIETY		HIGH TEST ANXIETY	
	$\bar{Y}$	N	$\bar{Y}$	N
Total	3.729	413	3.466	118
Group 3	4.273	132	4.500	16
Group 4	3.207	111	3.066	61
Group 5	3.647	170	3.171	41

Group 3: High GPA (2.8 - 4.0)

Group 4: Low GPA (1.1 - 2.2)

Group 5: Middle GPA (2.3 - 2.7)

High Test Anxiety: All Scores Above +1 SD

Table 17 (p. 242) shows the means, standard deviations and number for each of the plotted points by category.

iv. Are there examples of negative interactive results (students performing below the expected) on course outcomes?

Figure 6 (p. 244) suggests the importance of the factors of extraversion in the instructional process in the discussion section. The plotted lines indicate an interaction between student characteristics and course grade based on extent of extraversion. The plotted lines suggest that the importance of this interaction is focused among those with lower GPA, low midterm scores, and average to low GPA, indicated by the sharply negative acceleration. Table 18 shows the means, standard deviations and number for each of the plotted points by category. (p. 245)

v. Are there examples of interaction with no collinearity present?

vi. Are there examples of interaction combined with collinearity?

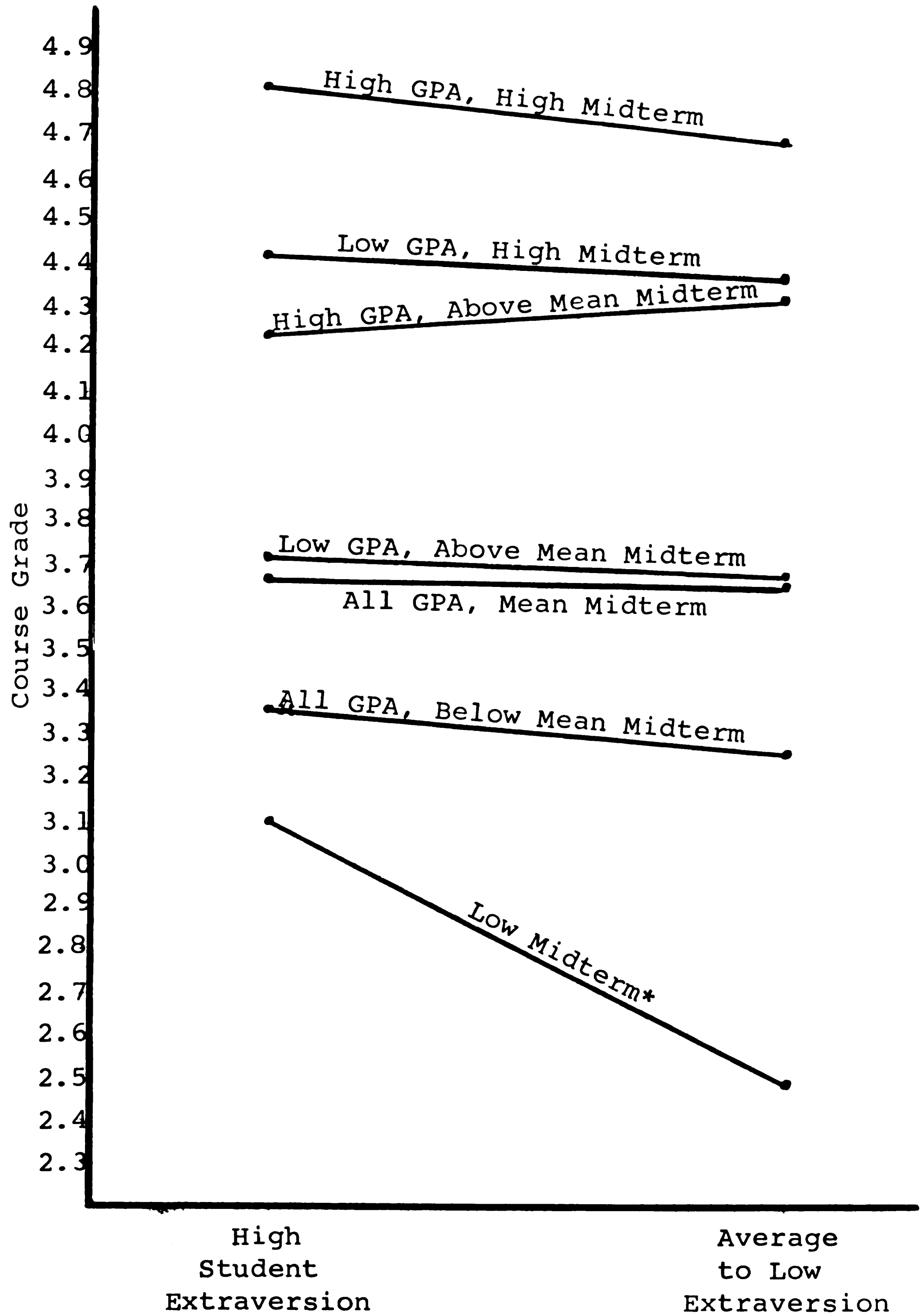
The confounding effect of multicollinearity along with interaction is indicated by reference to the first two interactions discussed above, as indicated in Figures 3 and 4 (pp. 233, 238); The interactions represented in Figures 5 and 6 (pp. 241, 244) are indicative of the lack of ambivalence created by apparent absence of collinearity.

4. <u>Certain instructional process variables operate differentially as facilitators or barriers to student performance in meeting course criteria and outcomes</u>.

From the preceding discussion of interactions, one of the dimensions developed was the quality of the effect of the interaction

FIGURE 6

MEAN EXPECTED FINAL COURSE GRADE BY HIGH AND LOW-TO-AVERAGE STUDENT EXTRAVERSION PLOTTED ACCORDING TO VARIOUS GROUPINGS



* Split Occurred

TABLE 18

MEAN EXPECTED COURSE GRADE BY HIGH AND LOW-AVERAGE STUDENT EXTRAVERSION ACCORDING TO VARIOUS GROUPING

	High Student Extraversion		Average to Low Student Extraversion	
	$\bar{Y}$	N	$\bar{Y}$	N
Group 11	4.706	17	4.580	50
Group 19	4.333	6	4.286	14
Group 10	4.136	22	4.214	56
Group 18	3.613	31	3.579	38
Group 9	3.553	47	3.545	55
Group 8	3.261	46	3.164	73
Group 4	3.000	24	2.394	33

Group 11: High GPA; High Midterm Score

Group 19: Low GPA; High Midterm Score

Group 10: High GPA; Above Mean Midterm Score

Group 18: Low GPA; Above Mean Midterm Score

Group 9: Mean Midterm Score

Group 8: Below Mean Midterm Score

Group 4: Low Midterm Score

High Student Extraversion: Scores of 15 and Above on student performance -- that is, positive interactions as the result of performance above the expected and negative interactions as a result of performance below the expected. While the above discussion was directed solely to the nature of interactions, it is expected that there would be a number of different factors which act as barriers or facilitators of student performance beyond those appearing as interactions. The focus of interest, then, is the extent to which various factors beyond the main initial predictors such as GPA appear associated with groups of students who overcome barriers created by other factors which have put them at a disadvantage, and the extent to which such barriers are not overcome.

> i. What different factors operate consistently across all levels over time as facilitators or barriers to student performance?

The factors which operatedconsistently across all levels over time as facilitators or barriers in student performance were those most closely tied to a conceptual approach to thinking -- specifically the quantitative portion of the college qualifying test and the attitude measure of orientation toward conceptual thinking. An examination of the tree for pretest performance (Appendix D1), characterized by a large number of subgroups (as previously discussed), indicates the repeated use of these two factors throughout all levels of CQT-V (the initial predictor), involving the major proportion of students in the study, in different capacities. In both instances the general pattern is that groups oriented toward conceptual thinking are given an advantage when compared with fellow students characterized by a similar barrier on another factor. The importance of these factors is indicated in outcomes representative of the instructional process -- namely midterm score, final exam-1, and final exam-2. An examination of midterm performance indicates that among students with GPA's in the D to C range and whose entering knowledge as assessed by the pretest was just at the mean score, scores were depressed on the midterm by an indicated preference for factual learning, as assessed by the learning set. The midterm exam was classed as a recall task; however, this recall did involve concepts and principles presented in lecture and the texts, not solely "facts". It appears that among this group a recall task of this nature may perhaps increase their disadvantage, in the light of the weight given to midterm performance in the determination of final course grade (as previously discussed). The advantage of preference for conceptual learning among lower GPA's is indicated by an examination of the tree for the applied section of the final exam. The scores of students with low GPA but high CQT-total scores are competitive with the highest scores in the class if the student also indicated a preference for conceptual learning. An examination of the data for the recall section of the final exam indicates that among students in the GPA range of B to A who had only scored at the mean on the midterm (a recall section), scores on final-1 (also a recall section) were competitive with the highest on the test if they indicated a preference for conceptual learning. This particular example may also be indicative of the extent to which students characterized by high GPA utilize cues -- in this case, the midterm -- to reorient their attack on their objective -- final grade in the course. For all levels of GPA, an examination of the analyses of final course grade indicates that a preference for conceptual learning is an advantage to higher course grade, and particularly to those with lower GPA. It may be that among this latter group the advantage accrues to those with lower GPA whose lower performance (as measured by GPA) is due to laxity in study. The previously mentioned group of low GPA's but high CQT's who had top scores on final-2 suggests this may be so.

ii. Are there differing sets of predictors that act as barriers or facilitators for the different ranges of student performance in the course?

An examination of the data of each of the outcome variables indicates that there are differing sets of predictors that act as barriers or facilitators for the different ranges of student performance.

Among students characterized by high GPA the set of predictors is associated with their performance in the instructional process -- that is, on midterm and final exam, -- and across the three analyses of final course grade, each of these involving competition and a reward value. In addition, the set of characteristics has three dimensions: they are associated with doing "well" in such situations; they tend to act as facilitators; it is the absence of other characteristics that is facilitative. Across each of the outcome variables, the data indicates that high GPA's performance is associated with other performance indices, such as midterm, pretest, CQT's, and specifically, level of aspiration which appears throughout the outcomes. In addition, these factors act as facilitators. That is, among high GPA's those at a disadvantage on one of these factors are not, with a few exceptions, put in a noncompetitive position by having their scores depressed on the test (or final course grade). That is, GPA appears to maintain strata across all the above outcomes—although students in other GPA groups may obtain some high scores among their number, the high GPA's are never put at a disadvantage. Therefore, these factors associated with "doing well" raise scores on the outcome variable for those with the advantage, but not sufficiently to impair those at a disadvantage. GPA carries them through. An examination of the branches in the trees involving high GPA's on these outcomes indicates an associated characteristic. It may be that the absence of factors is as important in their performance as the presence of "performance" factors. Personality factors do not appear, in contrast with the remaining branches. This does not mean these factors are not present. An examination of the BSS/TSS tables indicates they are operative. However, they just do not appear to "get in the way" in terms of depressing their scores in competition with others.

The importance of this fact can be seen by comparison with students in the mid-range of GPA -- (C- to B-). The previous discussion of the importance of midterm and the weight it carried in final course grade can be judged in terms of student reaction by examining the data in the last analysis of final course grade. Among those with high midterm scores were students of both upper and middle GPA. (In addition, the analysis indicates that most of the high GPA's are in this group). An examination of the tree and BSS/TSS tables indicates that two factors operate differentially among those with high midterm. The high GPA's are differentiated on the basis of aspiration-expectation -- those lower on the dimension remaining at the same level of outcome, with slight advantage to those with higher aspiration. The mid-range GPA's are differentiated on the basis of test anxiety -- higher anxiety appearing to depress the scores, the remaining scores being unaltered. And, in fact, an examination of the trees and the BSS/TSS tables across all outcomes indicates the importance of this factor to the performance of students in the middle GPA-range. An examination of the pretest tree indicates that test anxiety, accounting for ten per cent of the proportion of variance, was distributed across all levels of CQT-verbal, the initial predictor, suggesting that this factor operates throughout all levels of GPA. However, an examination of the tree indicates that general test anxiety operates among the high CQT-V's, depressing scores. All levels of GPA are represented in the high CQT-V's, and it is possible that the general test anxiety factor is randomly distributed among them. Among the group in the middle range of CQT-V (seventy-eight per cent of the students in the study), the discrimination of GPA is made, and the tree indicates several splits then made on the basis of test anxiety, among those in the middle range of GPA. In addition, the analysis of final course grade on the same set of characteristics indicates that the effect is focused among those in the middle GPA-range, with additional support as second choice for a number of splits of mid-GPA, in the BSS/TSS. (Appendix E2) Its role is also apparent in the analysis of midterm score, and in the remaining two analyses of final course grade.

By contrast, an examination of the data for those of lower

GPA indicates that from the start of the instructional process personality characteristics, first their own, then coupled with those of the instructor, play a differential role in their performance. In addition, this factor appears to have increasing impact over the length of the course among those who do not do well on the tests. Attention was drawn to this in the explanation of the interaction in Figure 6 (p. 244), lower extraversion associated with lower course grade, and in combination with lower performance on the midterm, depressing final course outcome significantly.

iii. Are there differing sets of predictors that act selectively as barriers or facilitators to student performance at different points in time?

In the earlier discussion of interactions it was suggested that while aspiration-expectation shows its greatest strength among the high GPA's, it acts selectively as a facilitator among those of lesser GPA who have had success on the midterm, aspiration-expectation associated with their perception of how successful they were on the midterm and the accuracy of their judgment of performance for the final.

Instructor characteristics also appear to operate differentially among students over time. An examination of the trees indicates that instructor characteristics are associated with the performance of students of lower GPA, and particularly those with lower pretest scores and lower CQT-Q, by the time of the midterm, increasing in importance over the remainder of the course. Such characteristics show secondary strength in the BSS/TSS tables for those of mid-GPA and isolate small groups in the trees themselves at mid-course, but increase in importance over the final outcomes. Among high GPA's, the significance of the time factors is even more marked. It is not until end-of-course that such factors show any secondary strength in the BSS/TSS tables. Unlike the other levels of GPA such factors do not appear in connection with performance on the recall section (as they had not at midterm time). In addition, among final course outcomes the appearance of such factors is mainly confined to performance as judged by the instructor grade. Among those with good GPA's and very high midterm scores such factors are confined to instructor course load and the students' assessment of the instructor's performance, operating as differentials, rather than a "personal" characteristic as posited in the study.

iv. Are there differing sets of predictors that act selectively as facilitators or barriers to student performance according to the type of outcome?

From a previous discussion it will be recalled that general test anxiety appeared to be associated principally with the mid-range of GPA, across outcomes and over time. An examination of the tree for instructor grade indicates support for this. However, in addition, it appears as a differentiator in this one instance among students of high GPA who did poorly on the midterm. For both groups, a higher degree of test anxiety is facilitative, in that instructor grade is higher. This is not unexpected, since a component of "valuing" success academically is very likely part of high GPA, and the continual presence of the test anxiety factor among mid-GPA also suggests such a valuing. With the exception of two individuals among low GPA's, general test anxiety did not serve as either a facilitator or barrier to performance for low GPA's.

v. Do instructor characteristics differentially operate as barriers or facilitators to student performance?

The points raised in the previous segments of this question can be indicated by examples from the appearance of instructor characteristics on the dimensions of location, time, and criterion.

Table 14 (p. 225) indicates that by comparison with those major predictors such as entering abilities which accounted for large proportions of variance across all students, teacher characteristics served in the capacity of facilitators or barriers to performance, operating differentially among differing levels of student performance over the length of the instructional process. This is confirmed by the representation in the tree.

An examination of the trees suggests how, over time, the instructor characteristics operate to facilitate or act as barriers to student performance. At the time of the midterm, the contribution of such characteristics is associated mainly with the performance of those of lower GPA, particularly students also characterized by low CQT's and low pretest scores. Scores were depressed among student groups with the associated instructor characteristics of more extreme orientation to either rigidity or flexibility (as opposed to a more moderate stance), or a very high degree of expressed extraversion, or a tendency to a higher predisposition to "conservatism" (associated with more authoriatrianism in beliefs, in proneness to to control situations to maintain the status quo, and so on). This latter characteristic appears again later in the instructional process in relation to a similar task -- that is, the recall section of the final examination, in association with similar students. (Low GPA, low pretest, low CQT-Q's) Again, scores are depressed by this higher predisposition, but also depressed by extremes in the other direction -- that is, extremity in either direction depresses scores. The trees also indicate that by the time of the final exam, this factors is associated with those in the B-minus to A range of GPA, in this case depressed scores associated with instructors extremely low on this dimension. The relationship of this dimension to overall course grade is indicated in Figure 7 (p. 255). The figure indicates an interaction between GPA and this instructor characteristic. Over all students, higher instructor predisposition on this dimension appears to depress final course grade slightly but not significantly. The effect among the majority of students in the middle GPA range is representative of the effect among all students considered together. However, among those students characterized by high GPA, higher instructor predisposition is a slight advantage. The impact of this characteristic appears principally among those characterized by low GPA, or GPA in the middle range and a tendency to respond in socially expected ways. Table 19, (p. 256) shows the means, standard deviations and number for each of the plotted points by category.

An examination of the final examination trees also indicates that among students in the low to high average GPA range with very high midterm scores, or students in the B-minus range who scored above the mean on the midterm, higher exam grade is associated

FIGURE 7

MEAN EXPECTED COURSE GRADE PLOTTED BY HIGH AND LOW INSTRUCTOR AUTHORITARIANISM ACROSS STUDENT GPA GROUPS

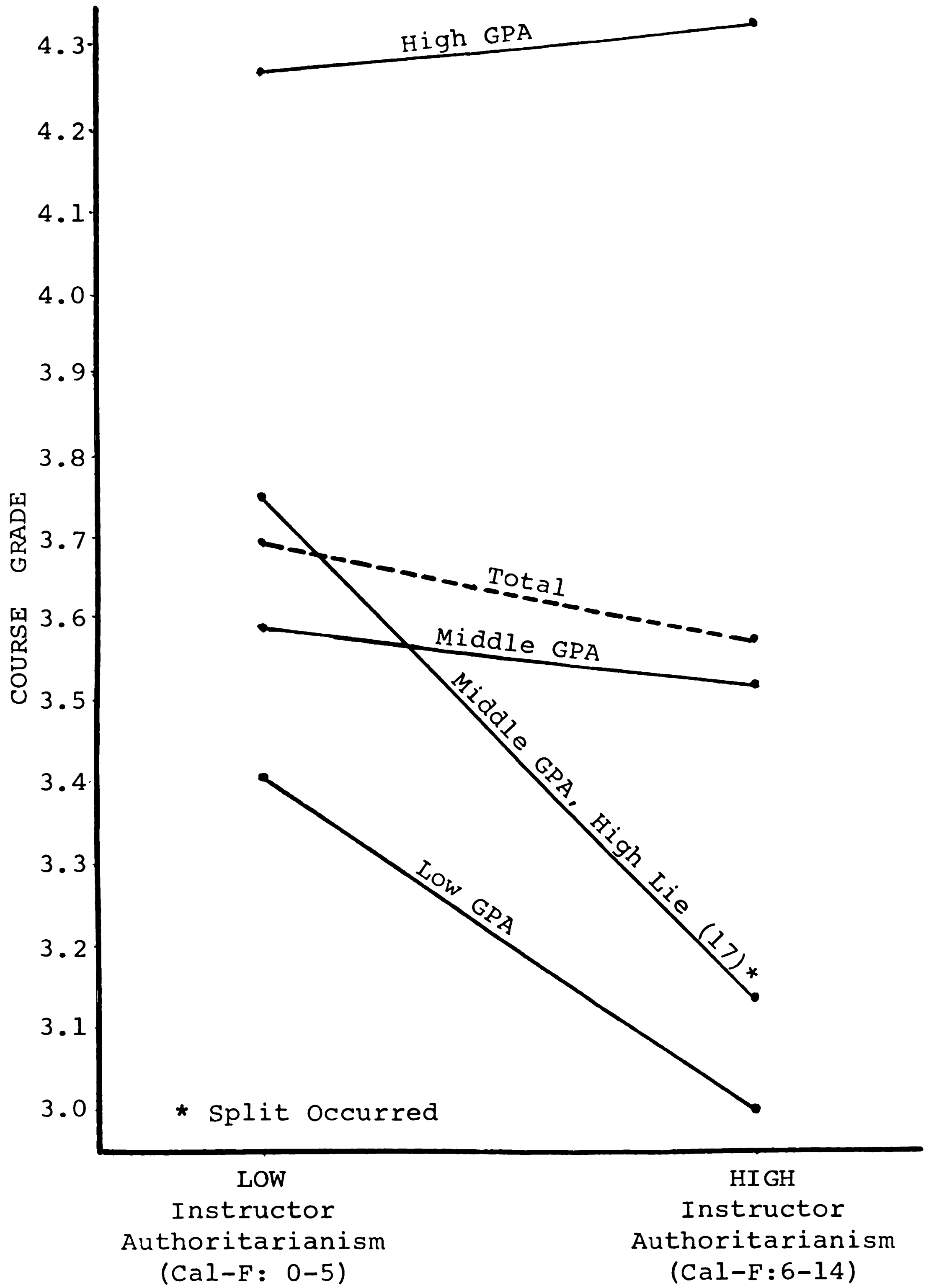


TABLE 19

MEAN EXPECTED COURSE GRADE BY HIGH AND LOW INSTRUCTOR AUTHORITARIANISM ACROSS STUDENT GPA PERFORMANCE GROUPS

Student Groups By GPA Levels	LOW INSTRUCTOR AUTHORITARIANISM		HIGH INSTRUCTOR AUTHORITARIANISM	
	$\overline{Y}$	N	$\overline{Y}$	N
Total	3.690	281	3.568	250
Group 3	4.272	81	4.328	67
Group 5	3.587	109	3.519	102
Group 4	3.407	91	3.000	81
Group 17	3.750	20	3.133	15

Group 3: High GPA (2.8 - 4.0)

Group 5: Middle GPA (2.3 - 2.7)

Group 4: Low GPA (1.1 - 2.2)

Group 17: Middle GPA, High Defensiveness (Eysenck Lie)

Low Instructor Authoritarianism: Cal-F (0 - 5) with the instructor characteristic of willingness to take positions away from the norm, to expose oneself to criticism (as assessed by the judgment-extremity measure).

The question of differential effect of type of task as a function of what instructor characteristics are "important" is indicated by an examination of the tree for instructor grade, in contrast with exam performance outcomes. In the case of instructor grade, instructor predispositions to be more rigid in behavior, or to be more "conservative" in attitude, more "controlling", are associated with higher discussion grade. The students with whom these instructor characteristics and grades are associated are: first, those students with low to average GPA but high midterm performance who have re-evaluated their level of aspiration following the midterm; and second, those students with average to high GPA who did not do well on the midterm by comparison with their grade-point and who were characterized by general test anxiety.

The differential effect of instructor course load as an advantage accruing to students of high GPA was previously discussed and illustrated in the section specifically directed to interactions. An instructor characteristic which appears to operate to the advantage of those of lesser ability as assessed by GPA and performance on course tests, in terms of instructor grade, is that of instructor tendency to respond in expected or socially acceptable ways. Figure 8 (p. 258) For students as a whole there is a slight indication that higher grade is associated with higher predisposition to make such responses among instructors. However, the factor

FIGURE 8

MEAN EXPECTED INSTRUCTOR GRADE PLOTTED BY LOW AND HIGH INSTRUCTOR EYSENCK LIE SCORE ACROSS STUDENT GPA GROUPS

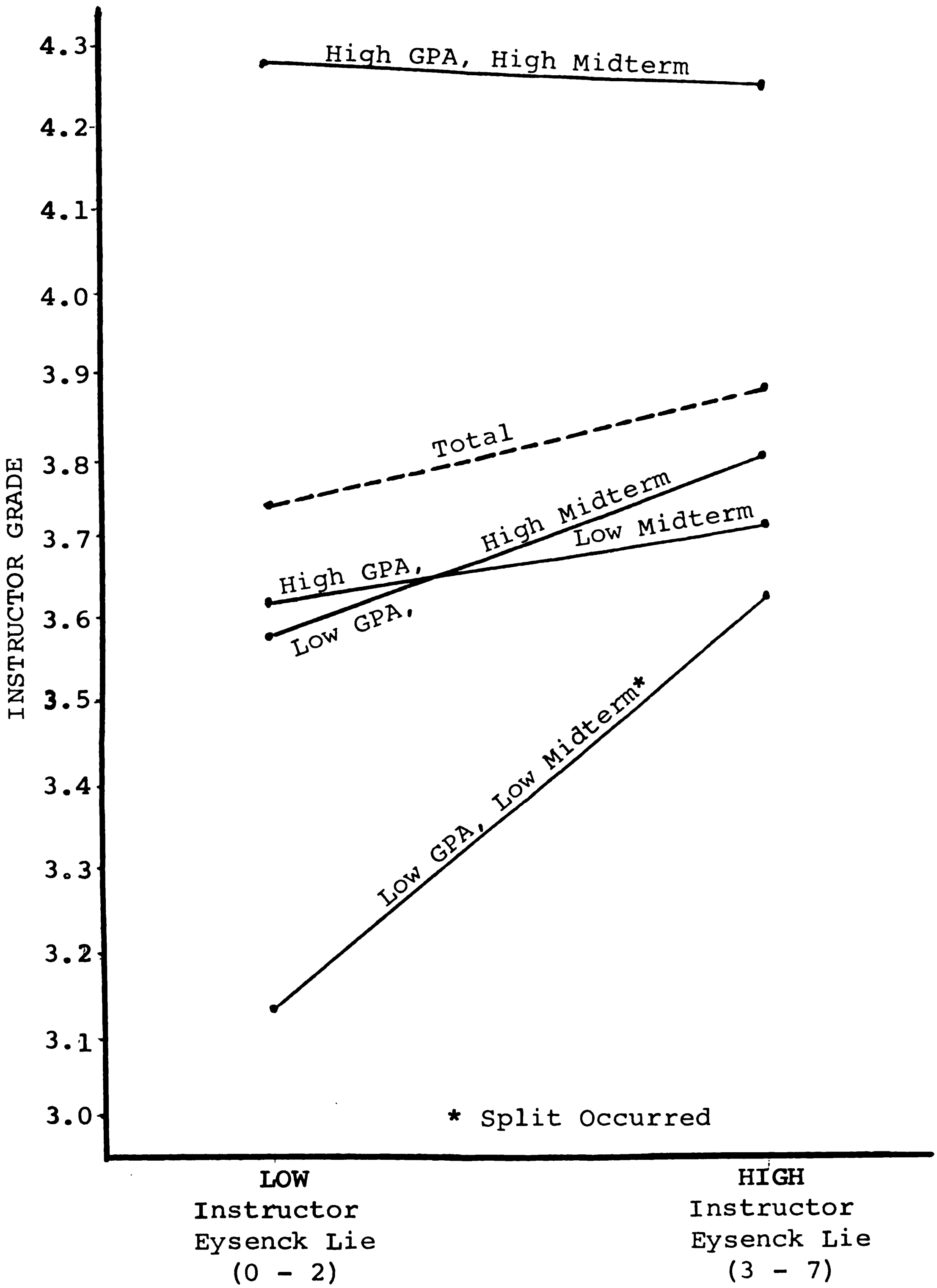


TABLE 20

MEAN EXPECTED INSTRUCTOR GRADE BY LOW AND HIGH LEVEL OF INSTRUCTOR EYSENCK LIE SCORE ACROSS GPA GROUPINGS

Student Groups By GPA/Midterm Performance	LOW INSTRUCTOR EYSENCK LIE		HIGH INSTRUCTOR EYSENCK LIE	
	$\bar{Y}$	N	$\bar{Y}$	N
Total	3.746	346	3.881	185
Group 7	4.286	91	4.241	58
Group 6	3.585	65	3.800	25
Group 5	3.636	121	3.718	71
Group 4	3.131	61	3.633	30

Group 7: High GPA, High Midterm

Group 6: Low GPA, High Midterm

Group 5: High GPA, Low Midterm

Group 4: Low GPA, Low Midterm

Low Instructor Eysenck Lie: Score of 0 - 2 on Socially Desirable Response Scale appears to be slightly less of an advantage among students of high GPA but low midterm, and to be a slight depressant among students of high GPA and high midterm. By contrast, this instructor predisposition is a slight advantage among those of low GPA and high midterm, and appears to be a distinct advantage among students of low GPA and low midterm. Table 20 (p. 259) shows the means, standard deviations, and number for each of the plotted points by category.

Further evidence of the role of the instructor in determination of grade is suggested by student reaction to the discussion section experience in comparison to instructor grade. In the above discussion, reference was made to students of average to high GPA but low midterm scores who received higher instructor grades from instructors characterized by more rigid behavior than did comparable students with instructors not so characterized. Among the former, a less favorable attitude toward the discussion section experience was associated with lower mean instructor grade. A similar differentiation on instructor grade appears among students of high GPA and high midterm, a lower mean instructor grade associated with less favorable attitude, although fewer students are involved proportionally. By contrast, an examination of discussion section attitude as associated with test performance among certain levels of students indicates the reverse effect. In the previous discussion of the applied portion of the final exam it was indicated that as a group, the high scores were among those having both high GPA and high CQT's. But among those of higher GPA but lower CQT's, those with higher level of aspiration were put at an advantage, and among this latter group those with less than favorable attitudes toward the discussion section experience had even higher mean scores, competitive with the top scores on the test. Further, in the previous discussion of the recall section of the final exam it was indicated that among students of low GPA and low midterm scores but characterized by high pretest scores and an orientation toward conceptual learning, scores on the recall section of the final were competitive with top scores among all students, among those also expressing a less favorable attitude toward the discussion section experience.

5. The results will show isolated exceptions, normally relegated to measurement or statistical error, which represent either important exceptions to general prediction or real instructional problems.

This expectation is an extension of the concept of characteristics as barriers/facilitators, discussed above. In the discussion in chapter four the role played by chance fluctuation in the creation of small isolated groups, due to relaxed eligibility and reducibility criteria, was indicated, along with illustrations such as those in the tree for midterm grade, where one or two individuals are split from a large number of students, particularly late in the tree, and such groups appear nowhere else in any analysis. (Appendix D4, groups 54 and 55, groups 50 and 51, 52 and 53). Such cases were differentiated from those created by the nature of the outcome variable -- specifically the case of the instructor grade where the criteria for assessment of grade varied across instructor as did grading level. (Appendix D10) In addition, there also appear in the trees over the timespan of the course small groups isolated on the same variable. For example, although the trees indicate that over the timespan of the instructional process general test anxiety operates among the middle range of GPA as a depressant to performance on tests, and the interaction in Figure 5 indicates that for students in toto higher general test anxiety is associated with depressed grade, there is among those with high GPA (who as a group are characterized by a low to normal range of general test anxiety), a group of sixteen for whom very high general test anxiety is facilitative, resulting in high performance in the course. An additional example is provided by the student extraversion continuum. Figure 6 (p. 244) indicates that students characterized by low midterm scores and average to low extraversion have low course grades. The pretest indicates that among this group of students those characterized by lower CQT-Q's still have pretest scores above the mean. An examination of the data of the applied section of the final exam indicates that their mean score is higher than that of the more extraverted students with low GPA. However, over the timespan of the course this group's performance is increasingly depressed, and it appears that the problem represented in the interaction of Figure 6 is even greater for these students in terms of overcoming barriers to performance and of using their entering-course abilities under these instructional conditions.

6. <u>To some degree the data will provide an estimate of congruence between course goals and conduct of the course</u>.

The questions posed in the study and the design to provide answers to these questions were not conceived as an evaluative component. However, to the extent that it was necessary to consider the course "model" in the study design, an estimate of congruence between course goals and conduct of the course can be inferred, based on a reexamination of the considerations in the previous questions and a further examination of associated data. The goals and assumptions were discussed in chapter two, and summarized in the discussion of this expectation in chapter three.

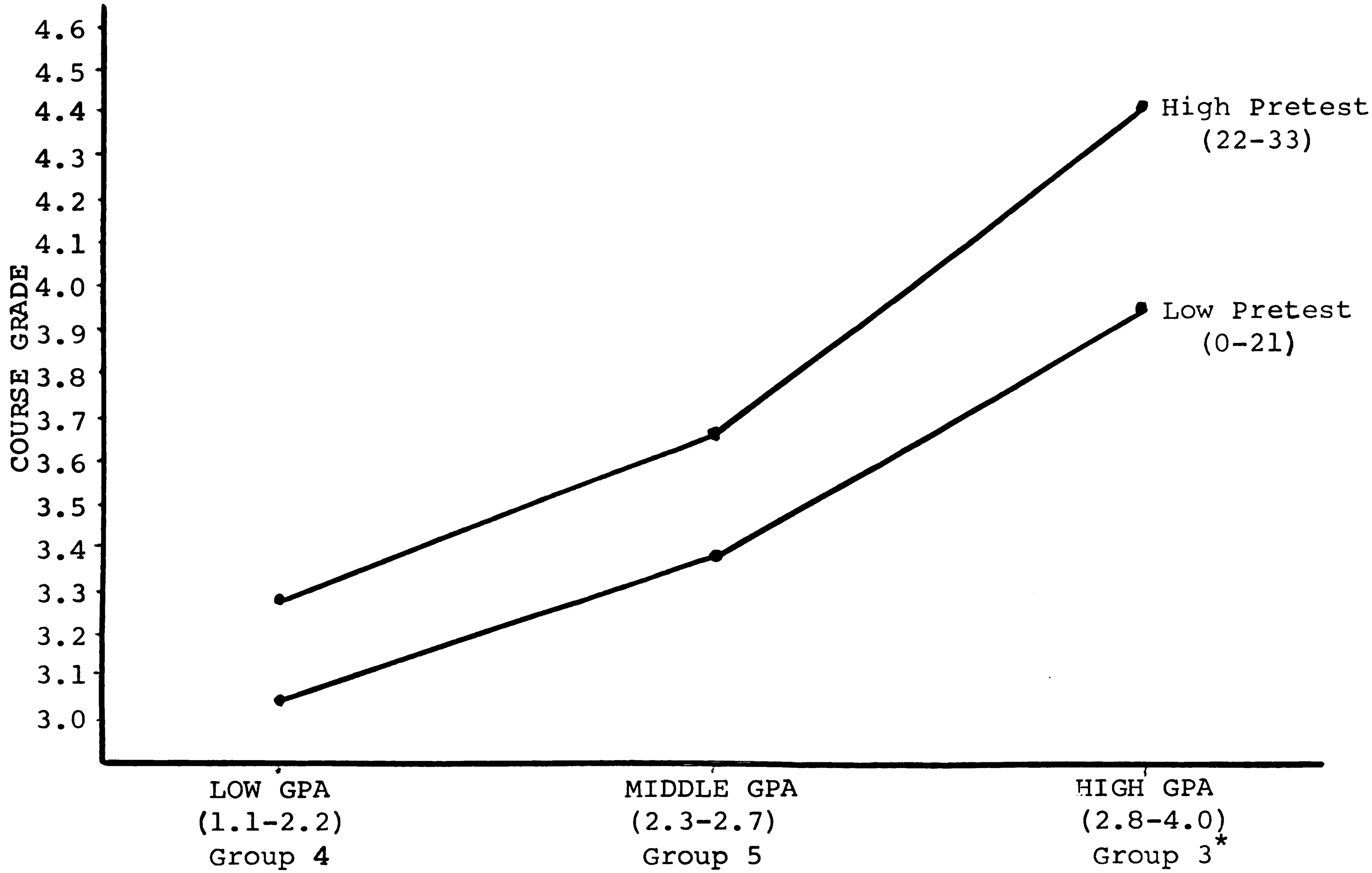
> i. Was educational opportunity a part of instruction so that entering characteristics of students would not be the main determiner of degree of instructional impact (performance outcomes)?

The goal of provision for educational opportunity was based on the assumption that opportunities would be provided for students to overcome barriers created by entering characteristics. The extent of the impact of entering-course characteristics, discussed in the previous sections of this chapter, can be summarized by the example in Figure 9 (p. 264). Pretest performance operated as a consistent "facilitator" or barrier (depending upon student location in the plotted points), with a slight indication that the factor may have operated selectively across GPA. Table 21 (p. 265) indicates by category the means, standard deviations, and number for each of the plotted points. As representations of the course over time, the data in the trees indicate the extent to which GPA maintained strata across all outcomes. In addition, the data indicate the extent not only of student heterogeneity but the extent to which characteristics operated differentially among student levels, having their major effect as facilitators in the upper ranges of GPA, and as barriers in many cases among lower GPA levels.

One of the beliefs underlying the above assumption was that common exams would not create an atmosphere based mainly on competition for the high exam score. However, exam content was recall-oriented, based on specialized information drawn from disaparate lectures and readings. In addition, it appeared that in reality the

FIGURE 9

MEAN EXPECTED COURSE GRADE PLOTTED ACROSS GPA LEVEL BY PRETEST PERFORMANCE LEVEL



* Split Occurred

TABLE 21

MEAN EXPECTED COURSE GRADE BY HIGH AND LOW PRETEST PERFORMANCE ACROSS STUDENT GPA LEVEL GROUPINGS

Student Groups By GPA Levels	HIGH PRETEST		LOW PRETEST	
	$\bar{Y}$	N	$\bar{Y}$	N
Total	3.728	298	3.362	224
Group 4	3.291	79	3.044	90
Group 5	3.681	113	3.398	93
Group 3	4.415	106	3.976	41

Group 4: Low GPA (1.1 - 2.2)

Group 5: Middle GPA (2.3 - 2.7)

Group 3: High GPA (2.8 - 4.0)

Pretest Level: Determined By Approximate Mean Split tests determined the course objectives; they did not judge student performance to established criteria but served to differentiate student scores into grading units. GPA was the principal discriminator of student performance, and the data indicate that the weight of the midterm was disproportionate to the value assigned it under the course assumptions.

Two additional beliefs underlying the assumption of "opportunity" was that within the discussion section the teaching assistant would make discriminations among students on the basis of their heterogeneity, and would provide opportunities to overcome barriers. In addition it was assumed that instructor grade would make discriminations on important variables upon which exam did not discriminate. The data indicate that across all discussion sections over time GPA held strata, coupled with the tendency for secondary characteristics to increase distances between highs and lows. The impact of degree of intraversion among students of lower GPA appeared to increase over time, across all such students, depressing performance scores and final course grade. In the instructional process it is expected that there will be instructor trait and circumstance regression and interaction with student performance and assessment. The question is the extent to which such regression and interaction suggest positive instructional results (that is, increasing individual opportunity) or negative results (pre-judgments, unfair grade distribution, and so on). The data illustrated several instances of this question. For example, studentscharacterized by instructors with heavy course load were characterized by higher mean instructor grades than those students not associated with such instructors, with advantage particularly accruing to those of high GPA. Conversely, students characterized by instructors who tended to respond in socially acceptable ways were also at an advantage, particularly if GPA was low and even moreso if midterm performance was also low. An additional illustration is among certain groups characterized by instructors who tended to be more rigid -- higher instructor grade associated with high GPA students who had not done well on the midterm and gave evidence of general test anxiety, and with those of lesser GPA who had scored high on the midterm and re-evaluated their expectation level. The data do not indicate on what bases or the extent to which discriminations were made by each instructor. The examples from the data do raise the question of the extent to which discriminations were made on bases congruent with the assumptions of the course "model".

ii. To what degree did the course prepare the students to use disparate information in an integrated approach to solving classroom problems?

Data relative to the nature of the outcome variables themselves and student reaction to the instructional process suggest the possible extent of congruence on this goal. The pretest, as a "dry run-through" appeared to indicate the recall nature of the type of task involved in the course. The midterm tended to confirm this assumption, both by item content and the nature of the initial predictors of success. Data for the recall section of the final exam were not unlike that of the midterm. It was assumed by the course "model" that the applied section of the final exam would reflect the degree to which this goal was achieved in the discussion sections. The nature of the data derived do not specify the extent to which this was achieved. However, based on the assumptions of the applied section's purpose in the course, the expectation would be that student characteristics which would seem most important to this performance should include general test-taking abilities, motivational and general ability components (as represented in the GPA), effort extended to course and discussion section, and interactions between student characteristics and instructor characteristics. In chapter four, the discussion of the data for the applied section confirmed the importance of GPA, along with CQT-T, as the best estimators of success. The data also indicate there were many alternate facilitating or inhibiting factors to high performance; however, the data do not indicate that interaction between student and instructor characteristics is one of these. This may reflect a a conceptualization problem in the study design. It is also possible that course intervention did, in fact, play an insignificant role in performance. An indication of this possibility may be reflected in student reaction to the discussion section and the course in relation to their future teaching. The data for the applied section of the test indicates that among students of high GPA but lower CQT (who, as a group did well on the applied section) higher scores were associated with students indicating less favorable attitudes toward the discussion section experience. On the recall section, among those students with lower GPA's but high CQT-Q's, scores competitive with the highest on the recall section went to those with less favorable attitudes toward the discussion sections. In addition, over time in the course students were asked to reassess the course in terms of its relationship to their commitment to enter teaching, their preparation for teaching, and to indicate the importance of theory to their preparation. The two most important inferences derived from these were: first, the relative lack of effect of the course on student attitude toward entering the teaching profession and the relatively low attitude to the course as preparation; and second, the consistently decreasing attitude toward theory and principles which were the primary content of the course. Those students with a high GPA had both the lowest entering-course attitudes and the lowest post-course attitudes. Those with the lowest GPA showed the greatest proportional decrease over time.[184]

iii. To what extent did the course provide models of the instructional behavior suggested as goals for students?

Inferences as to the extent to which congruence was achieved on this question include and enlarge upon those in the above discussion. Two of the stated goals relative to this question were: the experience would begin to develop in students those attitudes which reflect abilities, competencies, and understandings characteristic of a "competent" teacher; and students were to engage in integrating disparate content into a problem approach to learning in the classroom. To achieve these goals, a number of roles were assigned the instructor: initiator of discussion, moderator, discriminator of individual differences, integrator of content, and model (this latter undelineated). Based on the goals, it was assumed that "model" referred to a model of behaviors in which students were themselves asked to engage, and behaviors which a given student might view as possibly relevant as a component of his own modus operandi. On this basis, various characteristics, any of which might be a component of such a "prototype," were hypothesized in chapter three. The data indicate that these characteristics

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[184]*Ibid.*, pp. 151-154.

did not account for nearly as great a proportion of variance as did major and secondary student characteristics. Where instructor characteristics did appear in different levels of student performance, the following were indicated: in terms of test performance, a higher extent of "conservatism", or rigidity, or high extraversion were associated with depressed scores among students of lower GPA; a higher degree of "conservatism" was associated with higher scores on recall exams among high GPA students; a higher degree of instructor "risk" was associated with higher final exam scores among students of middle GPA and above; in terms of discussion section performance, certain instructors were characterized by amount of time available to devote to their teaching, or the tendency to respond in socially acceptable ways, or extent of rigidity in association with grading practices. The extent to which students were actually aware of instructor behavior as a "model" in the sense of the course assumptions can only be inferred from actual student reaction to the discussion section experience on these goals. Two instances associated with specific outcome variables were cited previously. In addition, analysis of student evaluation of the discussion experience across all students indicated that students rated the instructors: highest on items related to the fact that discussion actually did take place (as opposed to lecture), and on the instructor interest in the students' discussion; less highly on instructor knowledge of content and particularly its application; and least highly on instructor ability to employ teaching strategies to stimulate discussion, to provide examples, to integrate disparate content, and to enable students to understand course materials.[185]

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[185] _Ibid._, pp. 151-154.

Summary

The concepts of "instructional process" and "importance" suggested a number of expectations about the structure of relations among factors in the instructional situation.

The first was that coalescence would occur around certain classes of predictors in their description of an outcome, coalescence differing by conditions surrounding the outcomes. Coalescence was examined on two dimensions. First, contextual characteristics around outcomes were examined for two outcomes -- pretest (noncompetitive context) and final grade (competitive) -- entering variables accounting for the same proportion of variance. Whereas pretest used fourteen of sixteen variables with CQT-V as major predictor and distributing accounted variance equally across attitudes, personality, and personal factors, final grade concentrated accounted variance among factors associated with competitive situations -- GPA, level of aspiration, learning style. Second, coalescence, based on points in time, was examined across final course grade on entering-, mid-, and end-of-course variables. Over time, orientation to factual learning, general test anxiety, and introversion increased in secondary importance as depressants among middle and low GPA, with increasing contribution in major roles to past performance and the valuing of such performance, concentrating around GPA, aspiration, and the increasing weight of midterm.

The second expectation was that results would show differences among outcomes in type of predictors accounting for variance and extent of explanation -- an expectation concerned with explanatory differences in terms of tasks underlying the outcomes. The largest amounts of variance across the range of examinations were accounted for by performance variables. The recall-midterm and final exam-recall section were similar not only in amount of variance accounted for but in number of groups, concentrating factors around GPA, previous test performance in the course, and attitudes toward academic performance and the course. Final exam-applied section and instructor grade were similar in extent of prediction by number of splits, variance explained in various branches, and in complexity by comparison to recall tasks. Superior applied-exam performance could be as well explained by higher CQT-T as by higher GPA, plus orientation to conceptual learning and less favorable discussion attitude. Less favorable discussion attitude was a factor in instructor grade (with reverse effect); GPA, along with instructor characteristics of rigidity, course load, and need for social approval, were factors associated with high grades among various groups of students.

The third expectation was that measured factors would together represent a weighting of their theoretical constructs in the form of an interaction. Interactions emerged on three dimensions: (1) interactions of levels of student characteristics to course outcome, such as aspiration level and GPA to course grade, with increasing positive acceleration among high GPA over time; interactions of levels of instructor characteristics with student levels, to course outcome, such as instructor level of course load and student GPA to instructor grade, with advantage on heavier load and higher GPA; (2) interactions of instructional effects -- positive, (results greater than expected), such as high test anxiety with GPA to course load, a depressant for most, but facilitative for a small group of high GPA; or negative, (results less than expected), such as extraversion and GPA to course grade, with sharp negative acceleration among those of more introversion, low GPA, and low exam scores; (3) interaction with, and independent of, multicollinearity -- the examples in (1) the former, in (2), the latter.

Another expectation was that certain variables operate differentially as facilitators or barriers to student performance in meeting outcomes. Factors operating consistently across all levels over time were those tied to a conceptual approach to learning. There were differing barriers or facilitators for ranges of student performance. High GPA students were characterized by factors associated with "doing well," factors acting facilitatively, and absence of personality depressants. Across outcomes, level of test anxiety operated differentially among middle GPA. From the start, personality characteristics, first their own, then coupled with those of instructor played a differential role in the performance of low GPA.

An additional expectation was that to some degree data would provide an estimate of congruence between course goals and course conduct. The extent to which provision for individual differences was realized is suggested from: GPA holding strata over time, secondary characteristics increasing distances between highs and lows, disproportionate weight of midterm in course grade, and examples of the extent to which instructor discriminations among students were made on bases congruent with course assumptions. The extent to which the course prepared students to use disparate information in an integrated approach can only be inferred from: the recall nature of the orientation test, midterm, and half the final; GPA accounted for the greatest proportion of variance on the applied section; the negative attitude of high GPA-low CQT-T and of high CQT-Q students toward discussion section, and the decreasing attitude across all students toward theory. The extent to which models of the instructional behavior suggested as goals for students were provided can be inferred from student evaluation of discussion section in which students were critical of instructor knowledge of content and its application, and of instructor ability to integrate content and to enable students to understand course materials.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

Many undergraduate college courses serve as exemplars of the failure to compensate in instructional procedures for the dimensions of any factors beyond the homogeneous descriptions of predominant characteristics in the instructional situation and to take into consideration the important heterogeneous descriptions and exceptions to general prediction which create instructional problems.

Those looking for help in improving instruction in such settings direct their criticism at research on teaching and learning for failure to provide satisfactory means of dealing with "the real world". One criticism is that attempts to analyze the instructional situation take the form of summative evaluation, indicating the weaknesses in the instructional complex but failing to suggest procedures for actual instructional development or to provide a basis for formative research as an integral operation within the situation to act as an intervening process between results of "basic" research and their application to improvement of instruction. A second criticism is that the models of methodological design and statistical analysis used in basic research are rooted in a set of assumptions and a tradition of parsimony not tenable in the complex structure of the classroom. Some of these latter critics have put forward the following suggestions: first, research studies should be made part of the already-established setting, the measures being an integral element of the instructional process, and over time developing, by replication, a body of data as a basis for generating further research; second, the research should be regarded as an iteration -- an adaptive learning process, in which a series of designs are used over time, adapting the strategy to results as they are derived; third, the initial step in such an investigation is to discover the structure of relations existing among factors in the specified instructional situation.

The review of the literature served to show that there are a number of ways to view teaching and learning and, on the basis of whichever viewpoint chosen, to analyze any given component of the instructional situation. It further served to indicate that while difficulty in using the results of some studies is due to methodological inadequacies in conception and development, in many other cases the difficulty is that the results taken in isolation explain a very small portion of behavior when viewed within the entire instructional complex. No one method, style, or personality factor, for example, is more important than another, independent of the realities in the classroom.

In this study the purpose was to attempt to unravel the components by discovering the structure of relations among potentially important variables in the instructional situation, and under what conditions and through what intervening processes this relationship occurred, in order to determine the relative importance of the variables to course criteria or outcomes in a manner functional to improving instructional conditions. This method was a way of partitioning the diverse multi-faceted factors that constituted the relationships in the instructional situation and of providing a basis for going further into the analysis of the educational process. Since the structure of relations among the factors in this study was derived from the interaction process in a particular instructional situation, their impact upon a given student in another instructional situation would not be expected to be precisely the same. In this study, the underlying questions concerned the options which, as a result of the structure of relations among instructional factors, were open to students working their way trhough a given instructional situation.

Stanley, Box, and Campbell point out that there must be a functional relationship between the questions being posed in a study and those the entire study design is capable of answering. Thus it becomes necessary in studies in the natural setting where a complex network of factors is involved, to take into account the problem of reconciling the factors to the assumptions underlying three models. The first of these is a theoretical model or set of assumptions upon which the design for the study is based -- the design embodying the methods of securing proper data to which to apply statistical procedures, which are themselves based on a second model or set of assumptions. Blalock points out that in the initial phase of research in the natural setting, when the task is to identify and evaluate explanatory factors, design and statistical assumptions such as independence or absence of complex interactions cannot be assumed; under these conditions, the quantitative criterion for judging the relative importance of explanatory variables is not based on the researcher asking about the direct effects of one variable at a time all else held constant, but more meaningfully based on asking what it is that is most critical in order to reduce predictive error a maximum amount. Research as an integral part of ongoing instructional activity has been considered on the basis of the two models which must be taken into account. However, under such conditions, a third model must be considered -- the model or set of assumptions (of those who designed the instructional situation) which delineates the conditions under which the instructional process operates in that particular setting. Since the researcher is to operate within this given setting, the research must include some assessment of the degree of congruence between the "model" of "important" factors and those which actually appear to be "important" in the situation.

The concept of "importance" refers to a given variable in terms of its weight or usefulness to a given instructional situation. In this context four characteristics of "importance" together provide the basis for evaluation of variables. The first characteristic is expressed statistically, in terms of the relative amount of variance accounted for by the particular variable. The second characteristic is that of location, inferring in the sense of interaction or of multicollinearity that some variables account for variance in special locations. The third characteristic is that of time, referring to the relative appearance or increase and decrease of the variable accounting for a proportion of variance over the time setting of the instructional situation. The fourth characteristic is that of criterion; that is, accounting for variance in relation to the nature of the outcome or "dependent" variable.

Theoretically, no matter what formal instructional situation is being viewed in terms of this concept of "importance", there is some overall "job" going on in the situation. That is, there is some overriding goal (or set of subgoals) to which all factors in the situation are supposedly geared. The form taken by this instructional process of doing what needs to be done to get to this overriding goal is defined by these factors. This "job" or instructional process cannot be understood without taking into account four considerations: first, the impact of the various subgoals; second, while the form of the "job" is defined by the factors, specific dimensions of certain of these factors may carry more relative "importance" in this definition; third, at any given moment the instructional process has two parts -- the part which is goal-oriented, and the part which deals with pressures on the instructional situation at that moment; fourth, the focus of attention is not only what students have in common but also now they vary.

The above considerations necessitated including in the analytic model not only potentially important entering-course factors but also those which over time play a role. In choosing those factors to be included in the model from the mélange of factors in the instructional situation, it was necessary to consider not only recommendations from previous findings and theory but also the "model" or set of assumptions of those who designed the instructional situation as it exists. In this instance the implied "model" involved: providing "quality" instruction to large numbers of students while decreasing faculty participation to mass lecture-sections; providing for student heterogeneity by assigning students to discussion sections led by graduate teaching assistants; also providing, through the discussion section, for interaction between student and teacher, for an "inquiry" approach to learning, and for developing beginning attitudes and skills toward the future profession chosen by the students. The review of the literature suggested a number of factors with potential importance to the assumptions of this model, and also suggested that the core of any given instructional situation is the interactive relationship between student and teacher. Therefore, factors in the analytic model were confined to those from the discussion section which were potentially important student characteristics and potentially important instructor characteristics relative to their assumed roles in this instructional situation in the study. Factors concerning students were chosen from the areas of performance (both previous to and in the context of the instructional situation in the study), attitudes, personality, and personal characteristics. Factors concerning the instructors included: conservatism and uncertainty in own judgments in ambiguous contexts; conservatism in beliefs; proneness to settle for the status quo; proneness to control situations; rigidity; defensiveness; reticence and anxiety in interactive situations, course load, and previous teaching experience.

This study was concerned with the relative importance of the above "predictor" factors to the instructional process "outcome" factors. The outcome factors were of two forms: performance factors -- represented by examination scores; reward factors -- represented by grades.

Participants included five hundred and thirty-two students and fifteen graduate teaching-assistant instructors. The structure of the instructional situation of which students and teaching assistants were a part was a large lecture section conducted by varying professors, with accompanying discussion sections manned by teaching assistants, for an introductory course in educational psychology, required for teacher certification.

The structure of the research design approximated the instructional process over time by extracting data at different points in time as the instructional process progressed. Extractions were made on two categories of factors: outcome and predictor. Both types were extracted at the following three points: entering-course, mid-course, end-of-course. The data analysis paralleled the research design, involving analyses represented by the three extraction points in the research design. The purpose of the study led to the analysis questions being centered around two major categories: instructional process and instructional outcomes. Interest centered on what happens to the explanation of outcomes when data are added from the time perspective of the research model. An extension of this was the interest in the explanation of results as they occurred sequentially in the instructional process. That is, the attempt was to maximize explanation by looking at changes in structure as well as changes over time.

A total of eleven analyses of nine course outcomes were made on the basis of three sets of predictor factors: pretest and final course grade on entering-course factors; midterm exam, midterm grade, and final course grade on mid-course factors (including the set of entering-course); final exam scores -- recall section, applied section, and total score, final exam grade, discussion section grade, and final course grade on end-of-course factors (all predictor factors extracted). The analysis strategy adopted was an analysis process which accounted for variance in a specified outcome factor by optimal splits of a specified set of predictor factors.

The first-stage analysis involved the outcomes pretest and final course grade, using entering-course factors. In the analysis of pretest, fourteen of sixteen variables accounted for fifty-three per cent of the total sum of squares, suggesting there were many forces at work which were not so highly correlated with one another that the division of the total group on one made the other unnecessary. The test, of no weight in determining course grade, held varying degrees of personal worth to students, and thus there were many alternative barriers to high performance any one of which was sufficient to depress pretest score. Nine of fifteen entering-course variables were used in the analysis of final course grade. The findings indicated the importance of grade point average to assigned final course grade across all students, higher conceptual ability and preference for conceptual learning an advantage across all levels.

The second-stage analysis involved the midterm score, midgrade, and final course grade on mid-course variables. In the analysis of midterm score, sixteen mid-course variables accounted for fifty-four per cent of the total sum of squares, and indicated the importance of performance variables both pre-course and course. GPA, the CQT's, and the pretest score appeared throughout the tree. In addition, for those with higher GPA, high midterm scores were associated not only with advantages on performance criteria but absence of disadvantages on personal factors such as test anxiety or relations with instructor. Negative preattitude toward the course, strong preference for factual learning, or tendency to respond in socially acceptable ways were alternative disadvantages to high midterm exam score. The midterm grade, based on midterm score, bore a strong resemblance to the tree of the latter, the same group of variables accounting for much the same weight of unexplained variation. The second analysis of final course grade indicated that higher course grades were associated with higher GPA, and at every level preference for conceptual learning was an advantage to higher grade, and a particular advantage to those with low GPA. Among those of lower GPA and lower conceptual skills a combination of personality variables cumulated into lower course grades, with lower social extraversion, less emotional stability, greater tendency to respond in socially acceptable ways tending to depress final grade. The deletion regression analysis attribtued approximately the same amount of accounted variation to the force of the pretest, but the tree added the impression that the force was centered among those of higher GPA.

The third-stage analysis involved the outcomes of recall and applied sections of final exam, final exam score total and grade, instructor grade, and final course grade. Twelve end-of-course variables accounted for fifty-four per cent of the variation in the recall section of the final exam. The analysis indicated the importance of midterm performance to success on final-1, both containing primarily recall material. The end-of-course variables used in the analysis of the "application section of the final accounted for sixty-four per cent of the total sum of squares. The overall restuls for this section were slightly skewed negatively and quite leptokurtic.While

there were a number of descriptive predictors characterizing student performance, descriptions also included those isolating extreme exceptions to general descriptive predictors, and descriptions surrounding the mean score were relatively interchangeable. That is, comparable scores could be obtained by high GPA or high CQT-T. In the case of final exam total score, a compilation of recall and applied sections, the majority of the splits were accounted for on the basis of the major predictors appearing in the two sections of the exam. Final exam grade rather than total score was used in the calculation of final course grade; since final exam grade was the representation in grade form of final exam performance, the tree was not unlike that of final exam total score. In the analysis of instructor grade, twenty-one end-of-course variables accounted for sixty per cent of the total sum of squares. While grade point average and midterm score were the major initial predictors, instructor grading practices (inconsistencies in criteria and assignment), and instructor and student characteristics acted as alternatives, any one of which caused deviations from these major trends, isolating small groups on the basis of extreme scores on any given predictor.
In the third analysis of final course grade the end-of-course variables accounted for seventy-four per cent of the toal sum of squares, with midterm score by far the most powerful predictor. The deletion regression analysis also indicated the midterm as the most powerful predictor. Factors associated with "doing well" -- such as GPA, aspiration level, played an increasingly important role over the three analyses of final grade.

In attempting to unravel the component parts of the instructional situation by exploring the structure of relations among potentially important factors in the instructional process, the considerations underlying the concepts of "the instructional process" and "importance" suggested a number of expectations about the structure of relations among the factors at any given moment and over time.

The first expectation was that coalescence would occur around certain classes of predictors in their description of an outcome, coalescence differing by conditions surrounding the outcomes. Coalescence was examined on two dimensions. First, contextual characteristics around outcomes were examined for two outcomes -- pretest (noncompetitive context) and final grade (competitive) -- entering variables accounting for the same proportion of variance. Whereas pretest used fourteen of sixteen variables with CQT-V as major predictor and distributing accounted variance equally across attitudes, personality, and personal factors, final grade concentrated accounted variance among factors associated with competitive situations -- GPA, level of aspiration, learning style. Second, coalescence, based on points in time, was examined across final course grade on entering-, mid-, and end-of-course variables. Over time, orientation to factual learning, general test anxiety, and introversion increased in secondary importance as depressants among middle and low GPA, with increasing contribution in major roles to past performance and valuing of such performance, concentrating around GPA, aspiration, and the increasing weight of midterm.

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differences in terms of tasks underlying the outcomes. The largest amounts of variance across the range of examinations were accounted for by performance variables. The recall-midterm and final exam-recall were similar not only in amount of variance accounted for but in number of groups, concentrating factors around GPA, previous test performance in the course, and attitudes toward academic performance and the course. Final exam-applied section and instructor grade were similar in extent of prediction by number of splits, variance explained in various branches, and in complexity by comparison to recall tasks. Superior applied-exam performance could be as well explained by higher CQT-T as by higher GPA, plus orientation to conceptual learning and less favorable discussion attitude. Less favorable discussion attitude was a factor in instructor grade (with reverse effect); GPA, along with instructor characteristics of rigidity, course load, and need for social approval, were factors associated with high grades among various groups of students.

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An additional expectation was that to some degree data would provide an estimate of congruence between course goals and course conduct. The extent to which provision for individual differences was realized is suggested from: GPA holding strata over time; secondary characteristics increasing distances between highs and lows; disproportionate weight of midterm in course grade; and examples of the extent to which instructor discriminations among students were made on bases congruent with course assumptions. The extent to which the course prepared students to use disparate information in an integrated approach can only be inferred from: the recall nature of the orientation test, midterm, and half the final; GPA accounted for the greatest proportion of variance on the applied section; the negative attitude of high GPA-low CQT-T and of high CQT-Q students toward discussion section; and the decreasing attitude across all students toward theory. The extent to which models of the instructional behavior suggested as goals for students were provided can be inferred from student evaluation of discussion section in which students were critical of instructor knowledge of content and its application, and of instructor ability to integrate content and to enable students to understand course materials.

Discussion

Through the design and analysis strategy in this study, an attempt was made to (a) measure learning (that is, change in behavior occurring over time in the progression of the instructional process), (b) to quantify various learner characteristics (that is, to make explicit student characteristics such as abilities and achievements which might contribute to their performance in the instructional process), (c) to measure teacher characteristics relevant to the instructional process, and (d) to relate the interactions of these student and teacher characteristics to student learning. On this basis three conceptualizations were examined within a specific instructional situation -- a conception of a strategy for research in the initial stage in the ongoing classroom; a conception of the instructional process; and a conception of a set of teacher characteristics important to that instructional process.

The first of these conceptions concerned the nature, role, and feasibility of research in the ongoing instructional situation. In the initial stages of such research, theoretical considerations and conceptual schemes are what provide suggestions as to the type of data to collect. Since such conceptual ways of viewing the instructional situation often do not constitute a precise model, the specification of probabilistic relationships between clearly operationalized variables and deduction of specific hypotheses are untenable. However, the design represented a model of an instructional situation, and each of the six expectations investigated involved the attempt to operationalize various aspects of the instructional process by (a) defining the content of the situation, (b) conceptualizing the instructional process, and (c) dealing with the interactive nature of that situation. On this basis, a more precise statement about the behavior of the variables in the defined instructional process was possible, the analysis specifying variables which discriminate between classes of observations for which predictability was good, and classes for which it was poor, and suggesting additional refinements in the approach.

One such refinement arises in regard to the question of the stability in the trees. One way of assessing the stability of the subgroups would be to make similar analyses over several years. The expectation is that there would be a good deal of agreement as to which predictors accounted for most of the reduction in unexplained sum of squares, although the order in which it took place would possibly vary. That is, there are several alternative ways to achieve roughly the same subgroups; therefore, in investigating stability, attention is focused on the composition of the final groups, the interpretation of the combination of factors they represent, and the explanatory power of the predictors at different stages in the tree, rather than on the paths themselves. An additional factor in increasing stability is, of course, the readjustment to more stringent levels of group size, and of eligibility and reducibility criteria. These factors along with data in interval form and constraining some factors differently would increase stability, eliminating small groups which may involve fortuitous splits.

The difficulty encountered in constraining a predictor is illustrated by the variable "major field of study". An examination of the table and trees indicates that although "major" was used throughout the analyses, its use is unexplicable. That is, the classes established to distinguish students by "major" appear to work randomly. The review of the literature suggested the potential importance of this factor to student performance in this type of instructional situation; however, the results indicate faulty conceptualization in establishing the categories for this proxy (Appendix A). This is an example of a second necessary refinement -- the differential quality of the measures used. One difficulty is that constructs of theories do not have a one-to-one correspondence with the proxies used to measure the constructs. A second is that when measures already part of the instructional process are used, the definition of the instrument is a function of the assumptions of the instructional situation.[186] For example, under the assumptions of the course in this study, the exams were measures of learning, and in approximating the course structure the design model therefore

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[186]M. Wittrock, and D. Wiley, (eds.), The Evaluation of Instruction: Issues and Problems, (New York: Holt, Rinehart, and Winston, 1970), pp. 77-123.

used these as measures of learning. However, the exam emphasis was on ascertaining individual differences for grading levels rather than on learning relative to a criterion or mastery of objectives.

Two additional reservations pertain to number of subjects and to the question of causality. With regard to the former, observations with missing data were omitted from the analyses, decreasing observations in the study by a third, to five hundred and thirty-two. With regard to causality, it is not possible to say that students found to be representative of patterns a, b, c, and so on in the trees would always achieve in the same way as did these students, but it does suggest that a, b, and c are among the ways that students react in the instructional process. Logical priorities among the variables could have been handled by keeping the explanatory variables in separate sets and, taking the pooled residuals from the analysis using the first set of variables, analyzing these residuals against the second set, then analyzing the residuals from the latter against the third set. By reintroducing in the second and third analyses factors the simple effects of which had already been removed but which might also mediate the effects of factors at one of the later stages, the possibility of interactions between variables in different stages could be dealt with.. However, in discussing the usefulness of this strategy in multivariate analysis Freund has cautioned that a two-stage or more analysis is not equivalent to the usual one-stage, in that the resulting estimates are biased by underestimation of the coefficients.[187]

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[187] R. Freund, R. Vail, and C. Clunie-Ross, "Residual Analysis," Journal of American Statistical Association, 1961, 56.

The second conception developed for the study was that of a "prototype" of a teacher under specified instructional conditions. The prototype constructed was not directed at the question of "teacher effectiveness" -- a term inferring that the teacher operates as if the class's success depended solely on his performance. Rather, in the conception of the instructional process constructed, it was assumed that maximization of the instructional process is not the result of any one person but rather the result of a group that evolves a structure of relations over time. That is, the question is not "what is a good teacher" but "what teacher characteristics maximize the educational relationship in the instructional process under the conditions specified in that instructional situation." The teacher does have a unique role to play, since there are barriers to getting done what needs to be done in that process. The teachers' contribution is connected to his efforts to specify and act on his priorities, and the meshing of the teachers' priorities with the expectations of the students. The interest in a conceptualization of the teacher in this instance was based on the fact that the instructors were the crux for meeting the assumptions of the instructional situation, and their roles in the instructional situation model were specific -- in fact, certain priorities were implicit. The prototype was an attempt to approximate characteristics which,on the basis of the literature, appeared important in filling and meeting the roles and acting on the priorities, and was concerned not with individuals as such but with a set of variables and their general relationships.

This set of factors and its relationship to each role as specified in the assumptions of the course was discussed in chapter five. Here, interest is addressed to the theoretical question of whether these factors can contribute to understanding how teachers specify and act on their priorities and what happens when their priorities tangle with the expectations of students, as represented by the instructors in this instructional situation.

The first aspect of this question is how important were these factors as reflections of instructor attempts to specify and act on their priorities. "Importance," in terms of the qualitative dimension of amount of variation accounted for, indicated that by comparison with student characteristics, the instructor characteristics as specified were used much less frequently and accounted for much smaller proportions of variation. This was not unexpected. Studies of predictability of college success have indicated the powerful effects of such factors as student past performance in accounting for variance in prediction. However, if, as previously stated, the teacher's role is not judged as the sole criterion of success of the instructional process but rather as a catalyst which as the structure of relations evolves over time, at critical moments in a student's progress through that instructional process acts as a facilitator or barrier, rather than as a constant over time, it is necessary to consider importance in terms of qualitative dimensions -- location, time, and criterion.

For example, higher flexibility was associated with depressed scores on test performance criteria, particularly among students of lower academic ability. Perhaps those instructors characterized by a high degree of flexibility did not provide sufficient structure to enable students to follow what was being demanded of them. This point is not unlike similar results of instructors characterized by a high degree of extraversion. Results of student assessment of instructors in general indicated that students considered instructors weak in command of subject matter and ability to help students to integrate materials. It may be that lacking these skills, teachers characterized by high flexibility or high extraversion fall back on these characteristics to carry them through rather than overcoming the deficit, thus altering the priorities, and in fact act as barriers to student performance, particularly if the student is weak in grasping and integrating diffuse subject matter in a useful framework on his own. This may be a critical factor, particularly early in the evolving instructional process; the data suggested that students of lesser ability were at an increasing disadvantage throughout the course; it may be that such students are so preoccuppied with their own concerns that cues directed at them are missed or are put into a quite different scheme than that being used by the instructor, a problem heightened by these instructor characteristics.

An additional example of "importance" considered on qualitative dimensions is that of the concept of "conservatism". As with the above characteristics, higher manifestation of this factor was associated with depressed socres among students of lower ability. However, among students of higher GPA it was facilitative under conditions of recall tasks. However, high GPA students as a group, including those given the advantage by this instructor characteristic, tended to be less positive about the entire experience, including that of the discussion section. In this particular instructional situation it was not the faculty who responded to challenges from the students, but rather the instructors. It is possible that this increased the caution with which those instructors characterized by "conservatism" approached deviation from set course materials or being unprepared on that set material. However, the question arises as to whether the priorities set and acted upon were not disparate with those set by students of high GPA (and also high CQT), who did not need or wish the instructor priorities, having mastered skills of obtaining recall information.

The second aspect of the question of acting on priorities related to this set of factors as important to the instructional process under the "assumed model" or to the process under conditions of reality. The factors were chosen on the basis of their potential importance in the assumed model. The discussion in chapter five of the degree of congruence between these assumptions and the reality suggested a considerable discrepancy. So, in fact, under the realities of the situation not only were such factors as less rigidity not facilitative, but could act as barriers to achievement of the instructional outcomes, as assessed by the realities of success under those outcomes -- recall performance under highly competitive conditions.

The third aspect of the question of acting on priorities as related to this set of factors pertains to how it is that students wish to define the educational relationship in the instructional process. This study only indirectly addressed this question, in terms of student reaction to the instructional process, to the course as preparation for their future work, and to the importance of theory in a framework of problem-solving. A more specific indication was derived from examination of the reaction of high GPA students. However, the study does not make clear how the educational relationship is defined by students such as those students given grade advantages by instructors with high need for social acceptance, or by students who appeared to increase their grade by conforming to precisely what the instructor established. Additional information should be derived relative to students' conceptions of themselves and their roles in the course, and to what it is that students desire the teacher to be in the instructional process.

This latter factor seems important in terms of the set of characteristics posited for instructors in this study. First, literature by students at various levels of instruction (for example, high school, junior high, college) suggests that students at a given level tend to view those at the next higher level less as models in terms of modus operandi in lifestyle. (That is, students in high school view college students as already "old".)[188] Additional literature relative to adults as models of lifestyles in terms of values, beliefs, and so on suggests that students at all levèls do not see such characteristics as espoused by adults as germane to their approach to life.[189] This is not unexpected

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[188]J. Birmingham, (ed.), Our Time is Now, (New York: Frederick A. Praeger, 1969), as an example of student literature.

[189]M. Mead, Culture and Commitment, (New York: Doubleday & Co., 1970), as an example of such a discussion.

since there is reason to believe individuals out of need to belong and believe, and through such devices as imitation and conditioning often take over the opinions and attitudes characteristic of groups in which they have membership. It is possible that there is little likelihood of faculty and instructors significantly influencing student attitudes about lifestyle, since there was little evidence to suggest students could view themselves as members of a community of students and faculty. When students go out to teach, out of being at a loss on how to proceed or perhaps deficient in skills, students may tend to imitate behaviors seen and reflect values commensurate with those behaviors. This is not necessarily negative, but its usefulness as a force for change can be questioned. Thus, if in fact students do not view instructors and faculty as possible models of values and attitudes in general, can this modeling be limited to sets of behaviors in which students are at a loss or less skilled, sets of behaviors that cut across group membership.

The third conception developed was that of the instructional process, involving examination first of student entering abilities and expectations, then of characteristics representative of students attempting to adapt to reality as they saw it, and of what characteristics (their own and the instructors) were associated with interference with ability to do this, and of development of student views of the instructors.

This conception is tied to that in the previous paragraph -- that is, how students wish to define the educational relationship, as represented in the instructional process, and how those nominally in charge of the instructional process choose to define it. The developing instructional process can be examined in terms of the apparent lack of congruence between the assumed model and reality, and student reaction to the instructional situation.

The assumed model was defined principally in terms of end-product. That is, the model was more specific concerning the students as potential teachers than concerning students as team members in creating a viable relationship in the instructional process. The model acknowledged student entering differences, and the instructional situation provided a pretest and discussion group contact as evidence of this awareness, but appeared to fail to provide information about the nature of the students who themselves had a definition of the instructional process. Katz, Sanford, et al have pointed out that very little is known about the relationship between characteristics students bring to college instructional situations and their academic achievement, and have stressed the necessity of knowing students against their backgrounds and the milieu of the college setting.[190]

The lack of congruence between the assumed model and reality suggests that the instructional process is a function of both the entering-product and the desired end-product, and that problems arise in the instructional process through failure to consider both products. For example, there were no student criteria against which to compare student assessments of their experience in the instructional situation, and upon which to make judgments concerning the instructional process (other than those during

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[190] J. Axelrod, M, Freedman, J. Katz, N. Sanford, Search for Relevance -- the Campus in Crisis, San Fransisco: Jossey-Bass In., 1969.

the duration of the study). In addition failure to provide information relative to such factors to the instructors and to emphasize their importance appeared to be reflected in instructor inability (or disinclination) to make discriminations concerning student performance -- not only in terms of grading levels but in terms of developing priorities within the instructional process. Third, student judgments of the lack of relevance of theory and of the course as preparation for their future roles suggests lack of awareness of the curciality of using student background and current milieu as a part of the curriculum, to make the transition from abstract theory to a still abstract (for the student) classroom situation in the future.

The student characteristics were not only a set of factors but were representative of a student subculture not unrepresentative of the student college culture in general. In the review of the literature in chapter three reference was made to students in this culture attempting to move from thought based on discrete rightnesses to thought as based on abstractions and relativisms, and seeking in their teachers characteristics supportive of their efforts. Roszak has extended this conception to the supposition that the counter-culture of the young is the result of a crisi of belief (reflected in skepticism) and a search for relevancy.[191] The question becomes, then, the extent to which the

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[191] T. Roszak, The Making of a Counter-Culture, (New York: Knopf, 1970).

instructional process provided students with models with characteristics supportive of student efforts to make the transition from discrete rightness, and to sustain them over this crisis of belief and search for relevancy. In Chapter three, the instructor prototype was developed on the basis of factors derived from the literature considered important in such an attempt on the part of students. While the "importance" of these factors may be a function of the design of the study definition of the proxy, it is equally possible that the use of the factors in the study reflects instructors devoid of command of relevant subject matter and with nothing to say, and devoid of a style which might be considered as a possible incorporation into students own styles. The instructional process's contribution to relevancy and to student crisis of belief is reflected in the value placed upon the course by students as preparation for teaching and reflected in skepticism about the role theory could play in their future careers.

In his dissection of the instructional situation at the college level, Schwab diagnoses a number of flaws in the instructional situation reflective of the inability of such situations to sustain students through the search for relevancy and the crisis of belief. First, students are mocked in decision-making and deprived of any viable opportunity to engage in it in the classroom. Second, student likes and dislikes are not viewed as important, yet teachers have to live with results of this in terms of motivation. Third, there is a scarcity of models, in that faculty is rarely seen or if seen, what they model, that is their competencies, are not accessible to students in the classroom.

Fourth, there is a privation of competencies among students.[192]

These criticisms of the instructional process are reflected in the lack of congruence between the assumed model and the reality of the instructional process in the instructional situation in the study. Students acknowledged that instructors did, in fact, engage students in discussion, but faulted them not only on lack of command of subject matter but on ability to help students to develop strategies to use in a problem-solving approach to integrating theory.

At any given time in the discussion section it is possible that students have not done the readings and hope that the teacher will conduct discussion section matter as a lecture or that the section will be conducted as what students refer to as a "bull" session. This lack of attention to the readings is not unexpected, if such readings constitute assignments rather than challenges, and lectures are no more than doctrine re-explained, and the tests function to determine if the student did his homework.[193] But the deterioration of the discussion section is not merely a function of possible student lack of preparedness. (Bull sessions are, in fact, what students engage in, quite profitably, among friends and acquaintances.) But in the instructional situation as defined, students who have never engaged in the type of behavior assumed in the course model

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[192]Schwab, loc. cit., pp. 3-62.

[193]S. Kelman, Push Comes to Shove: The Escalation of Student Protest, (Boston: Doubleday, 1970).

(that is, inquiry behavior with a definite purpose in mind), they are not practiced in the competencies and in developing them may need what Schwab referred to as models reflecting competencies desired in students. The lack of this practice in the discussion section is what possibly leads to student charges of "nonrelevancy" and the instructional situation as "non-lifelike". Jackson noted the danger that can accrue from this as an extension into later behavior, in pointing to much teacher seeking behavior as a series of "how-to's" rather than new behaviors and strategies as the result of their own careful problem solving.

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APPENDIX A

COURSE CRITERIA, SUMMARY OF PREDICTORS, DATA CODING FOR PREDICTORS

SPECIFIED EXPECTED COMPETENCIES FOR COURSE ONE

The responsibility for the development of expected competencies in educational psychology, human growth and development and human learning are assigned to ED 200, THE INDIVIDUAL AND THE SCHOOL, for five term credits.

In addition, an orientation to the profession is expected since this is the first course in the required sequence.

The student who completes this course:

Orientation to Professional Education:

1. Understands the structure and relevance of the various aspects of the program of Teacher Education at Michigan State University.

2. Recognizes the criteria by which a profession and a professional educator can be identified, and measures himself against these criteria.

Observation and Interpretation of Behavior in the Classroom:

3. Recognizes the pupil behaviors characteristic of different levels of mental ability.

4. Recognizes the pupil behaviors symptomatic of possible emotional disturbances.

5. Recognizes the range of individual differences in abilities between pupils in the same classroom.

6. Recognizes the differences among abilities manifested by the same pupil.

7. Distinguishes among the kinds of thinking which can be expected of children of different ages.

8. Recognizes the relationship between levels of thinking and what can be taught and learned.

9. Recognizes the wide variety of non-cognitive variables affecting learning in the classroom, e.g., sex, social class, specific needs, etc.

10. Recognizes the differences in frustration tolerance characteristic of pupils of different ages.

11. Determines the proper length of teaching units on the basis of an understanding of frustration tolerance.

12. Understands the internal needs of pupils and their relationship to various kinds of teacher-induced motivation.

Learning and Thinking in the Classroom:

13. Discriminates among the kinds of learning that take place in the classroom.

14. Distinguishes among the learning of skills, information, concepts and principles.

15. Distingues between cognitive and attitudinal learning.

16. Distinguishes between the products and processes of learning, i.e., between what is learned and how it is learned.

17. Recognizes the positive and negative consequence of "ability" and other kinds of grouping in developing formal classroom groups.

18. Recognizes inter-pupil and pupil-teacher behavior situations in relationship to principles of group psychology and individual development.

19. Analyzes teaching behaviors which elicit different educational outcomes, e.g., rote memorization, problem solving, self-expression.

20. Recognizes the hierarchical nature of objectives; that is, that more complex behaviroal changes presuppose the prior modification of simpler behaviors.

21. Recognizes that objectives can be of different sorts, e.g., cognitive, affective, psychomotor, and that these are developed by specific kinds of learning experiences.

22. Recognizes the differences in levels of objectives, e.g., knowing, applying, analyzing, synthesizing.

23. Understands the value of many kinds of standardized psychological tests and their general areas of application.

Human Growth and Development

24. Recognizes the developmental tasks and general conflicts characteristic of children of different ages.

25. Recognizes the patterns of development for various human characteristics and the points in time when educational interference is mot likely to be successful in modifying.

SUMMARY OF PREDICTOR FACTORS

ENTERING-COURSE (AID I)	MID-COURSE (AID II)	END-OF-COURSE (AID III)
Personal	Personal	Personal
Sex	Sex	Sex
Age	Age	Age
Major	Major	Major
	Credits earned	Credits earned
	Current load	Current load
Past Performance	Past Performance	Past Performance
GPA	GPA	GPA
CQT	CQT	CQT
Personality	Personality	Personality
Extraversion	Extraversion	Extraversion
Neuroticism	Neuroticism	Neuroticism
Social acceptance	Social acceptance	Social acceptance
Test anxiety	Test anxiety	Test anxiety
Pretest anxiety	Pretest anxiety	Pretest anxiety
	Midterm anxiety	Midterm anxiety
		Final exam anx.
Attitudes	Attitudes	Attitudes
Learning set	Learning set	Learning set
Reason enrolled	Reason enrolled	Reason enrolled
Pre-attitude	Pre-attitude	Pre-attitude
		Post-attitude
		Discussion att.
Course-specific motivation at pretest	Course-specific motivation at pretest	Course-specific motivation at pretest
		Course -specific motivation after midterm
		Success expect.
		Accuracy judgment
	Course Performance	Course Performance
	Pretest score	Pretest score
		Midterm score
	Instructor	Instructor
	Extraversion	Extraversion
	Neuroticism	Neuroticism
	Social acceptance	Social acceptance
	Defensiveness	Defensiveness
	Rigidity	Rigidity
	Authoritarianism	Authoritarianism
		Risk
		Course load
		Teaching exp.

DATA CODINGS FOR PERSONAL PREDICTORS

Credit Hours Earned

1 - 40 and below

2 - 41 to 70

3 - 71 to 100

4 - 101 to 150

5 - 151 and above

Current Credit Load

1 - 0 to 5 hours

2 - 6 to 9 hours

3 - 10 to 12 hours

4 - 13 to 15 hours

5 - 16 hours and above

Age

1 - 17 and under

2 - 18 and 19

3 - 20 and 21

4 - 22 to 24

5 - 25 and older

Major

1 - elementary education

2 - physical education

3 - special education

4 - other education -- child development, home economics, industrial arts, agricultural education

5 - social science

6 - liberal arts

7 - business education

8 - other

APPENDIX B

SUMMARY OF VARIABLES BY NUMBER, MEAN, STANDARD DEVIATION, SKEWNESS, AND KURTOSIS

TABLE B1

SUMMARY OF VARIABLES BY NUMBER, MEAN, STANDARD DEVIATION, SKEWNESS, KURT.

Variable	N	Mean	S.D.	Skewness	Kurtosis
Outcome Variables					
Pretest	532	22.205	3.366	.060	3.142
Midterm Score	532	30.716	4.046	-.624	3.173
Midterm Grade	532	3.662	1.009	-.275	2.653
Final Exam Score-1	532	29.524	4.101	-.578	4.078
Final Exam Score-2	532	24.688	4.333	1.204	16.815
Final Exam Score-Total	532	53.801	7.157	-.685	5.183
Final Exam Grade	532	3.327	1.017	-.279	2.828
Instructor Grade	532	3.793	.775	.011	2.305
Final Course Grade	532	3.633	.821	-.133	2.698
Predictor Variables					
Sex	532	1.671	.474	-.675	1.602
Age	532	2.630	.693	.950	4.003
Major	532	4.975	2.506	-.266	2.085
Credits	532	3.016	.914	.168	2.829
Current Load	532	4.557	.624	-1.473	5.990
GPA	532	2.518	.503	.475	3.186
CQT-V	532	23.303	14.421	.162	1.807
CQT-Q	532	21.443	14.613	.345	1.871
CQT-T	532	21.518	14.394	.304	1.792
Extraversion	532	12.996	3.950	-.366	2.754
Neuroticism	532	10.613	4.568	.071	2.380
Eysenck Lie	532	2.553	1.607	.540	2.995
A-H Test Anxiety	532	37.523	9.102	-.109	3.465
Test Anxiety-1	532	1.011	.122	12.111	164.573
Test Anxiety-2	532	2.731	.891	.265	2.871
Test Anxiety-3	532	3.006	1.004	.078	2.509
Learning Set	532	20.216	6.542	-.203	2.823
Reason Enrolled	532	3.216	1.115	-.594	2.966
Pre-attitude	532	27.297	4.346	-1.816	6.889
Post-attitude	532	27.351	5.277	-1.789	5.875
Discussion Attitude	532	18.232	5.470	-1.018	3.784
50-50-1 (Asp.-Exp.-1)	532	8.201	1.454	-.333	4.581
50-50-2 (Asp.-Exp.-2)	532	8.244	1.534	.122	2.587
Pretest Score	532	22.205	3.366	.060	3.142
Midterm Score	532	30.716	4.046	-.624	3.173
Instructor Extraversion	532	11.449	2.683	-.368	2.318
Instructor Neuroticism	532	6.487	4.159	.664	2.358
Instructor Lie	532	2.282	1.923	1.052	3.455
Instructor Marlowe-Crwn.	532	13.620	6.713	.441	1.824
Instructor Sanford-Gough	532	8.280	2.904	.002	2.100
Instructor Cal.-F	532	5.282	3.608	.589	.282
Instructor Risk	532	34.778	9.776	-.026	2.432
Instructor Course Load	532	3.058	1.556	.334	2.124
Instructor Teaching Exp.	532	2.880	1.487	-.031	1.950

APPENDIX C

INTERCORRELATION MATRIX OF STUDY VARIABLES

TABLE C1

INTERCORRELATION MATRIX OF STUDY VARIABLES

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pretest	(1)	1.000							
Midterm Sc.	(2)	.290	1.000						
Midterm Gd.	(3)	.293	.918	1.000					
Final-1	(4)	.282	.503	.475	1.000				
Final-2	(5)	.248	.412	.348	.511	1.000			
Final-Total	(6)	.297	.526	.495	.864	.858	1.000		
Final Ex-Gd	(7)	.326	.532	.502	.824	.806	.932	1.000	
Inst. Gd.	(8)	.151	.382	.372	.319	.282	.343	.307	1.000
Final Cs-Gd	(9)	.308	.672	.671	.730	.655	.790	.781	.642
Credits	(10)	.094	.065	.078	.142	.053	.106	.101	.111
Current Ld.	(11)	.011	.049	.093	.030	.053	.057	.054	-.004
GPA	(12)	.247	.458	.470	.392	.452	.484	.474	.371
CQT-V	(13)	.308	.302	.243	.261	.359	.348	.341	.101
CQT-Q	(14)	.145	.201	.194	.250	.339	.332	.335	.134
CQT-T	(15)	.286	.292	.268	.302	.420	.405	.402	.113
Extravert	(16)	-.110	-.096	-.081	-.061	-.131	-.116	-.092	-.037
Neuroticism	(17)	-.017	.050	.063	-.017	.038	.004	.028	-.025
Eys. Lie	(18)	-.121	-.010	-.070	-.076	-.126	-.104	-.123	-.073
A-H Anx.	(19)	-.216	-.259	-.245	-.244	-.256	-.286	-.281	-.091
Test Anx.-1	(20)	.067	.029	.031	.024	-.042	-.009	-.014	.005
Test Anx.-2	(21)	-.137	-.112	-.090	-.168	-.116	-.159	-.161	-.060
Test Anx.-3	(22)	-.110	-.176	-.162	-.119	-.078	-.116	-.138	-.088
Accuracy	(23)	.005	.110	.084	.010	.051	.050	.049	.012
Success	(24)	.053	.135	-.045	.083	.057	.089	.097	.038
Learn. Set	(25)	.216	.230	.205	.212	.253	.258	.269	.038
Reason En.	(26)	-.063	.037	-.010	.018	-.024	-.011	-.004	.063
Pre-att.	(27)	-.021	.041	.001	.019	-.017	.001	.009	-.019
Post-att.	(28)	.019	.096	.132	.043	.051	.050	.066	.045
Disc. Att.	(29)	.003	-.064	-.089	-.075	-.043	-.056	-.085	-.002
50-50-1	(30)	.207	.255	.257	.217	.235	.257	.271	.163
50-50-2	(31)	.283	.601	.680	.414	.354	.439	.452	.310
Inst. Ext.	(32)	-.018	-.056	-.035	-.034	-.007	-.016	-.025	.090
Inst. Neu.	(33)	.097	.029	.008	.047	.043	.041	.064	-.141
Inst. M-C	(34)	.044	-.035	-.006	.036	.053	.054	.086	.068
Inst. S-G	(35)	-.006	.037	-.006	.056	.001	.034	.048	-.004
Inst. Cal-F	(36)	-.061	-.073	-.076	-.044	-.035	-.046	-.032	.004
Inst. Risk	(37)	.002	-.053	-.053	-.116	-.078	-.119	-.129	-.031
Inst. Load	(38)	-.031	.042	.041	.020	.059	.051	.025	.129
Inst. Teach	(39)	-.061	-.136	-.124	-.098	-.085	-.098	-.069	-.074
Inst. ED200	(40)	-.089	-.091	-.077	-.142	-.120	-.156	-.163	-.147

TABLE C1: (continued)

		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Final Cs-Gd	(9)	1.000							
Credits	(10)	.141	1.000						
Current Ld.	(11)	.065	-.062	1.000					
GPA	(12)	.547	.052	.158	1.000				
CQT-V	(13)	.329	.080	.120	.365	1.000			
CQT-Q	(14)	.302	.171	.101	.334	.326	1.000		
CQT-T	(15)	.362	.125	.138	.424	.793	.709	1.000	
Extravert	(16)	-.108	-.009	-.043	-.209	-.199	-.077	-.185	1.000
Neuroticism	(17)	.009	-.034	-.003	.035	-.034	.017	-.044	-.138
Eys. Lie	(18)	-.095	.008	-.043	-.026	-.075	.002	-.068	-.155
A-H Anx.	(19)	-.254	-.078	-.123	-.390	-.394	-.239	-.415	.076
Test Anx.-1	(20)	-.014	.018	.018	.050	-.035	.054	.006	-.031
Test Anx.-2	(21)	-.142	-.010	.027	-.126	-.179	-.138	-.208	.042
Test Anx.-3	(22)	-.143	-.064	-.039	-.178	-.167	-.109	-.217	.049
Accuracy	(23)	.035	.009	-.021	.071	.035	-.059	-.030	-.019
Success	(24)	.071	.029	-.072	.089	.088	.004	.049	-.042
Learn. Set	(25)	.226	.067	.023	.208	.257	.126	.262	-.084
Reason En.	(26)	.007	-.020	-.032	-.019	-.043	-.038	-.061	.026
Pre-att.	(27)	-.038	-.153	-.058	-.101	-.125	-.078	-.143	.034
Post-att.	(28)	.062	-.068	-.017	-.086	-.042	.024	-.031	.066
Disc. Att.	(29)	-.085	-.044	-.064	-.163	-.118	.010	-.080	.012
50-50-1	(30)	.260	.121	.008	.472	.266	.247	.290	-.045
50-50-2	(31)	.526	.106	.033	.442	.246	.212	.268	-.050
Inst. Ext.	(32)	-.023	.070	-.088	.044	-.082	.052	-.039	.079
Inst. Neu.	(33)	-.023	.014	.061	-.026	.059	.006	.048	-.069
Inst. M-C	(34)	.044	.035	-.024	.094	.003	.079	.029	-.006
Inst. S-G	(35)	.063	.029	.052	.038	.053	.023	.015	-.051
Inst. Cal-F	(36)	-.042	.027	.019	.035	-.038	.025	-.028	.040
Inst. Risk	(37)	-.107	-.021	.008	-.119	-.033	-.048	-.021	.057
Inst. Load	(38)	.071	.016	-.012	-.003	.029	.019	.005	.047
Inst. Teach	(39)	-.127	-.044	-.021	.002	-.109	-.055	-.094	.068
Inst. ED200	(40)	-.159	-.103	.005	-.091	-.029	-.140	-.089	.013

TABLE C1: (continued)

		(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Neuroticism	(17)	1.000							
Eys. Lie	(18)	-.221	1.000						
A-H Anx.	(19)	.238	-.014	1.000					
Test Anx.-1	(20)	.045	-.079	-.024	1.000				
Test Anx.-2	(21)	.222	-.058	.314	.045	1.000			
Test Anx.-3	(22)	.193	-.058	.322	.045	.537	1.000		
Accuracy	(23)	-.068	.034	-.062	.059	.034	-.030	1.000	
Success	(24)	-.084	.075	-.137	.007	-.062	-.186	.383	1.000
Learn. Set	(25)	-.066	-.076	-.207	.025	-.144	-.115	.022	.036
Reason En.	(26)	-.154	.017	-.052	.016	-.019	-.056	.069	.008
Pre-att.	(27)	-.086	.052	.043	.054	.048	.069	.131	.113
Post-att.	(28)	-.008	.002	.059	-.015	.079	.053	.099	.024
Disc. Att.	(29)	-.034	.046	.074	-.123	.023	-.030	.105	.098
50-50-1	(30)	-.069	.005	-.392	.009	-.187	-.213	-.003	.147
50-50-2	(31)	-.085	-.023	-.353	.053	-.167	-.206	.071	.176
Inst. Ext.	(32)	-.005	.017	-.016	.013	-.012	-.014	-.026	.004
Inst. Neu.	(33)	-.004	.017	-.019	-.048	-.082	.004	.059	.013
Inst. M-C	(34)	.032	.019	-.034	.067	-.036	-.033	-.006	-.007
Inst. S-G	(35)	.007	.101	.017	.039	.003	.088	.054	.055
Inst. Cal-F	(36)	.024	.070	.023	.027	.010	.057	-.029	.025
Inst. Risk	(37)	-.038	-.081	.025	-.019	.045	-.048	-.050	-.058
Inst. Load	(38)	.047	.019	-.035	.020	.061	-.029	-.028	.012
Inst. Teach	(39)	-.013	.014	.029	.059	-.016	.048	-.023	-.019
Inst. ED200	(40)	-.060	-.027	.029	.059	-.008	.026	.006	-.013

TABLE C1: (continued)

		(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
Learn. Set	(25)	1.000							
Reason En.	(26)	.015	1.000						
Pre-att.	(27)	.024	.394	1.000					
Post-att.	(28)	.050	.174	.391	1.000				
Disc. Att.	(29)	-.084	.091	.121	.161	1.000			
50-50-1	(30)	.185	.074	-.018	-.069	-.103	1.000		
50-50-2	(31)	.189	.067	.074	.072	-.063	.465	1.000	
Inst. Ext.	(32)	-.072	-.001	.004	.020	-.038	.078	.035	1.000
Inst. Neu.	(33)	.123	.055	.028	.096	.085	-.006	.023	-.632
Inst. M-C	(34)	-.031	-.025	-.058	.074	-.078	.050	.054	.432
Inst. S-G	(35)	.083	-.038	.035	-.037	-.022	-.032	-.023	-.565
Inst. Cal-F	(36)	.031	-.056	.011	-.040	-.108	.018	.024	.037
Inst. Risk	(37)	-.076	.010	-.029	.046	-.037	-.032	-.049	.151
Inst. Load	(38)	-.103	-.085	-.052	-.089	-.016	-.012	-.005	.068
Inst. Teach	(39)	-.017	-.029	-.022	-.037	-.112	-.006	-.039	.166
Inst. ED200	(40)	-.059	-.021	-.049	-.072	-.055	-.058	-.003	.166

		(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Inst. Neu.	(33)	1.000							
Inst. M-C	(34)	-.253	1.000						
Inst. S-G	(35)	.493	-.271	1.000					
Inst. Cal-F	(36)	.055	-.012	.528	1.000				
Inst. Risk	(37)	.093	-.388	-.411	-.179	1.000			
Inst. Load	(38)	-.332	-.143	-.004	-.074	-.004	1.000		
Inst. Teach	(39)	-.129	.396	.016	.453	-.227	-.415	1.000	
Inst. ED200	(40)	-.129	-.299	-.096	.453	-.227	-.278	.095	1.000

APPENDIX D

FIGURES D1-D11: FORMATION OF STUDENT SUBGROUPS ON SETS OF PREDICTOR VARIABLES OVER EACH OUTCOME

FIGURE D1

AID I: Explanation of Pre-Test Score by Entering Course Variables

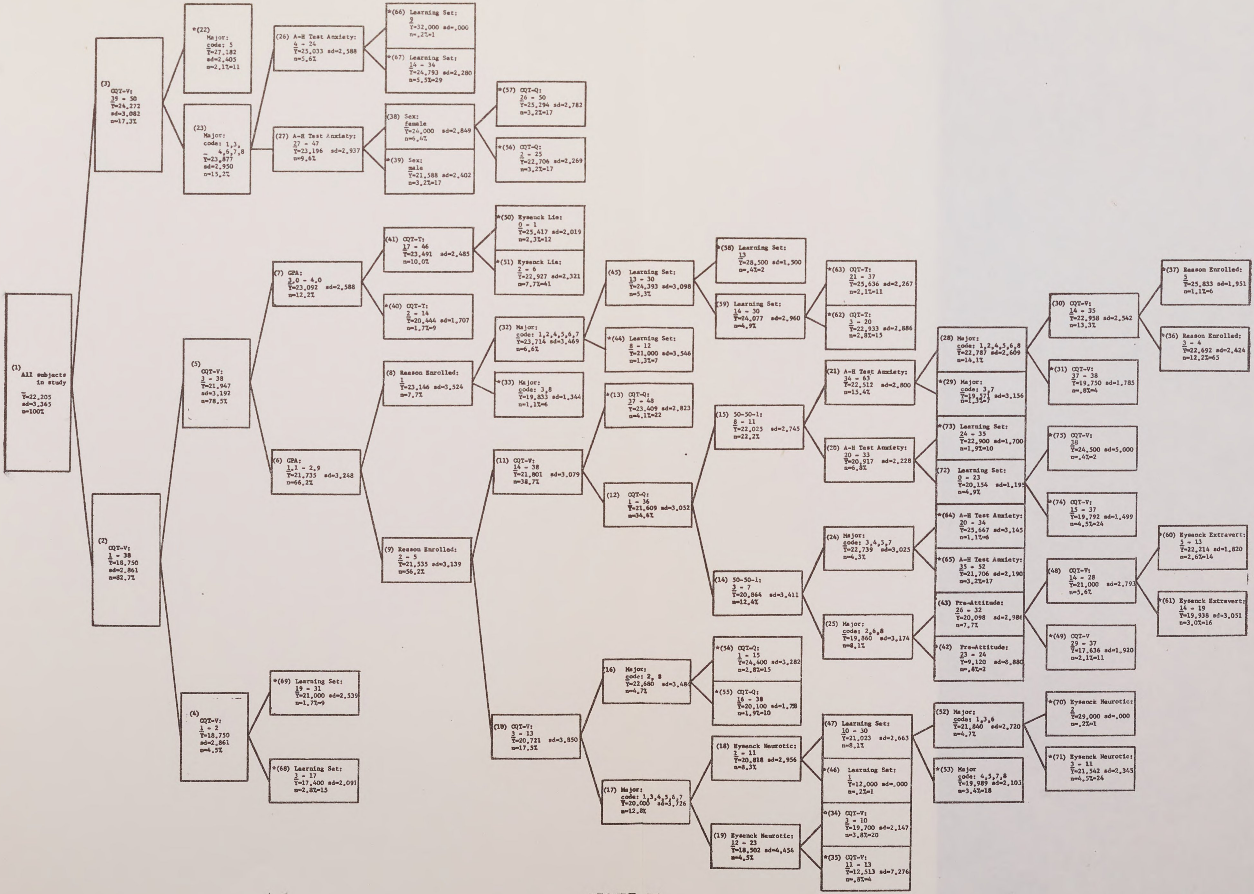


FIGURE D1

FIGURE D2

AID I: Explanation of Final Course Grade by Entering Course Variables

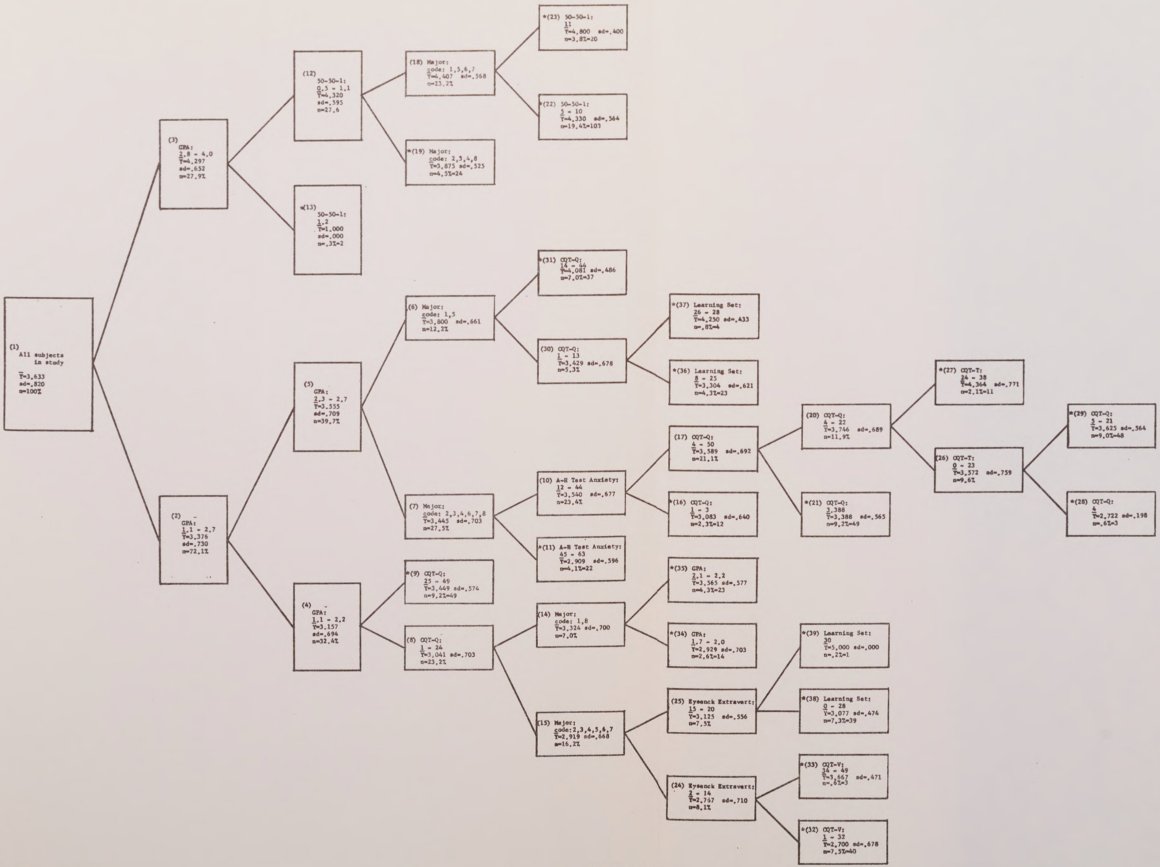

(1) All subjects in study Ȳ=3.633 sd=.820 n=100%
(2) GPA: 1.1 - 2.7 Ȳ=3.376 sd=.730 n=72.1%
(3) GPA: 2.8 - 4.0 Ȳ=4.297 sd=.652 n=27.9%
(4) GPA: 1.1 - 2.2 Ȳ=3.157 sd=.694 n=32.4%
(5) GPA: 2.3 - 2.7 Ȳ=3.555 sd=.709 n=39.7%
(6) Major: code: 1,5 Ȳ=3.800 sd=.661 n=12.2%
(7) Major: code: 2,3,4,6,7,8 Ȳ=3.445 sd=.703 n=27.5%
(8) CQT-Q: 1 - 24 Ȳ=3.041 sd=.703 n=23.2%
*(9) CQT-Q: 25 - 49 Ȳ=3.449 sd=.574 n=9.2%=49
(10) A-H Test Anxiety: 12 - 44 Ȳ=3.540 sd=.677 n=23.4%
*(11) A-H Test Anxiety: 45 - 63 Ȳ=2.909 sd=.596 n=4.1%=22
(12) 50-50-1: 0.5 - 1.1 Ȳ=4.320 sd=.595 n=27.6
*(13) 50-50-1: 1.2 Ȳ=1.000 sd=.000 n=.3%=2
(14) Major: code: 1,8 Ȳ=3.324 sd=.700 n=7.0%
(15) Major: code:2,3,4,5,6,7 Ȳ=2.919 sd=.668 n=16.2%
*(16) CQT-Q: 1 - 3 Ȳ=3.083 sd=.640 n=2.3%=12
(17) CQT-Q: 4 - 50 Ȳ=3.589 sd=.692 n=21.1%
(18) Major: code: 1,5,6,7 Ȳ=4.407 sd=.568 n=23.2%
*(19) Major: code: 2,3,4,8 Ȳ=3.875 sd=.525 n=4.5%=24
(20) CQT-Q: 4 - 22 Ȳ=3.746 sd=.689 n=11.9%
*(21) CQT-Q: 3.388 Ȳ=3.388 sd=.565 n=9.2%=49
*(22) 50-50-1: 5 - 10 Ȳ=4.330 sd=.564 n=19.4%=103
*(23) 50-50-1: 11 Ȳ=4.800 sd=.400 n=3.8%=20
(24) Eysenck Extravert: 2 - 14 Ȳ=2.757 sd=.710 n=8.1%
(25) Eysenck Extravert: 15 - 20 Ȳ=3.125 sd=.556 n=7.5%
(26) CQT-T: 0 - 23 Ȳ=3.572 sd=.759 n=9.6%
*(27) CQT-T: 24 - 38 Ȳ=4.364 sd=.771 n=2.1%=11
*(28) CQT-Q: 4 Ȳ=2.722 sd=.198 n=.6%=3
*(29) CQT-Q: 5 - 21 Ȳ=3.625 sd=.564 n=9.0%=48
(30) CQT-Q: 1 - 13 Ȳ=3.429 sd=.678 n=5.3%
*(31) CQT-Q: 14 - 44 Ȳ=4.081 sd=.486 n=7.0%=37
*(32) CQT-V: 1 - 32 Ȳ=2.700 sd=.678 n=7.5%=40
*(33) CQT-V: 34 - 49 Ȳ=3.667 sd=.471 n=.6%=3
*(34) GPA: 1.7 - 2.0 Ȳ=2.929 sd=.703 n=2.6%=14
*(35) GPA: 2.1 - 2.2 Ȳ=3.565 sd=.577 n=4.3%=23
*(36) Learning Set: 8 - 25 Ȳ=3.304 sd=.621 n=4.3%=23
*(37) Learning Set: 26 - 28 Ȳ=4.250 sd=.433 n=.8%=4
*(38) Learning Set: 0 - 28 Ȳ=3.077 sd=.474 n=7.3%=39
*(39) Learning Set: 30 Ȳ=5.000 sd=.000 n=.2%=1

FIGURE D2

FIGURE D3

AID II: Explanation of Mid-Exam Score by Mid-Course Variables


(1) All subjects in study
Ȳ=30.716
sd=3.363
n=100%
(3) GPA:
2.8 - 4.0
Ȳ=33.534
sd=2.712
n=27.8%
(2) GPA:
1.1 - 2.7
Ȳ=29.630
sd=3.934
n=72.2%
(23) Pretest:
22 - 32
Ȳ=34.075
sd=2.425
n=19.9%
(22) Pretest:
16 - 21
Ȳ=32.098
sd=3.043
n=7.7%
(5) Pretest:
21 - 33
Ȳ=30.357
sd=3.611
n=44.7%
(4) Pretest:
12 - 20
Ȳ=28.283
sd=4.130
n=25.9%
*(39) CQT-V:
24 - 50
Ȳ=34.513
sd=2.236
n=15.0%=80
*(38) CQT-V:
1 - 23
Ȳ=32.731
sd=2.489
n=4.9%=26
*(51) CQT-Q:
22 - 45
Ȳ=33.550
sd=2.418
n=3.8%=20
(50) CQT-Q:
4 - 21
Ȳ=30.714
sd=2.930
n=3.9%
*(56) Major:
code: 1,8
Ȳ=34.000 sd=1.581
n=.8%=4.
*(57) Major:
code: 2,3,4,5,6
Ȳ=29.941 sd=2.623
n=3.2%=17
(6) A-H Test Anxiety:
4 - 45
Ȳ=30.811
sd=3.391
n=35.7%
(7) A-H Test Anxiety:
46 - 63
Ȳ=28.563
sd=3.883
n=9.0%
(11) CQT-T:
3 - 50
Ȳ=30.967 sd=3.289
n=34.4%
*(10) CQT-T:
1 - 2
Ȳ=26.714 sd=3.452
n=1.3%=7
*(34) Major:
code: 1,8
Ȳ=31.111 sd=2.588
n=3.4%=18
(35) Major:
code: 2,4,5,6,7
Ȳ=27.033 sd=3.373
n=5.6%
*(49) Learning Set:
15 - 28
Ȳ=28.368
n=3.6%=19
*(48) Learning Set:
0 - 14
Ȳ=24.142 sd=3.270
n=1.3%=7
(13) GPA:
1.8 - 2.7
Ȳ=31.073 sd=3.230
n=33.6%
*(12) GPA:
1.2 - 1.7
Ȳ=26.250 sd=2.278
n=.8%=4
(14) Major:
code: 3,5,6,7,8
Ȳ=31.073 sd=3.230
n= 22.7%
(15) Major:
code: 1,2,4
Ȳ=31.554 sd=2.998
n= 10.9%
(24) CQT-Q:
1 - 43
Ȳ=31.730 sd=2.935
n=21.6%
*(25) CQT-Q:
44 - 50
Ȳ=28.174 sd=2.034
n=1.1%=6
(37) 50-50-1:
6 - 11
Ȳ=30.389 sd=3.112
n=10.2%
*(36) 50-50-1:
0 - 5
Ȳ=25.750 sd=4.763
n=.8%=4
*(27) Eysenck Extravert:
5 - 21
Ȳ=31.798 sd=2.857
21.4%=114
*(26) Eysenck Extravert:
4
Ȳ=24.000 sd=.000
n=.2%=1
*(45) Sex:
female
Ȳ=30.804 sd=2.946
n=8.6%=46
*(44) Sex:
male
Ȳ=28.000 sd=2.958
n=1.5%=8
(8) Major:
code: 1,2,3,7,8
Ȳ=29.163
sd=4.097
n=16.2%
(9) Major:
code: 4,5,6
Ȳ=26.827
sd=3.756
n=9.8%
*(17) CQT-V:
37 - 49
Ȳ=34.500 sd=1.500
n=.8%=4
(16) CQT-V:
1 - 34
Ȳ=28.902 sd=4.000
n=15.4%
(32) CQT-Q:
1 - 42
Ȳ=27.220 sd=3.239
n=9.4%
*(33) CQT-Q:
47 - 49
Ȳ=17.000 sd=2.000
n=.4%=2
*(18) Instructor Eysenck Extravert:
6
Ȳ=33.000 sd=1.927
n=1.3%=7
(19) Instructor Eysenck Extravert:
8 - 16
Ȳ=28.520 sd=3.934
n=14.1%
(42) Age:
code: 2,3
Ȳ=27.644 sd=3.078
n=8.5%
*(43) Age:
code: 4
Ȳ=23.400 sd=1.855
n=.9%=5
*(21) CQT-V:
29 - 34
Ȳ=29.143 sd=4.454
n=1.3%=7
(20) CQT-V:
1 - 28
Ȳ=28.868 sd=3.706
n=12.8%
(46) Instructor Eysenck Extravert:
6 - 13
Ȳ=28.371 sd=2.879
n=6.6%
*(47) Instructor Eysenck Extravert:
14 - 16
Ȳ=25.100 sd=2.300
n=1.9%=10
(29) Pretest:
15 - 20
Ȳ=29.109 sd=3.597
n=12.%
*(28) Pretest:
12 - 14
Ȳ=25.000 sd=3.240
n=.8%=4
(52) Instructor Sanford-Gough:
3 - 9
Ȳ=29.333 sd=2.809
n=4.5%
*(53) Instructor Sanford-Gough:
10 - 13
Ȳ=26.272 sd=1.656
n=2.1%=11
(30) Eysenck Lie:
0 - 3
Ȳ=29.667 sd=3.484
n=9.0%
*(31) Eysenck Lie:
4 - 7
Ȳ=27.483 sd=3.409
n=3.0%=16
*(55) Pre-Attitude:
29 - 33
Ȳ=31.272 sd=2.430
n=2.1%=11
*(54) Pre-Attitude:
11 - 28
Ȳ=27.692 sd=1.897
n=2.4%=13
*(40) A-H Test Anxiety:
24 - 44
Ȳ=30.655 sd=2.550
n=5.5%=29
*(41) A-H Test Anxiety:
45 - 63
Ȳ=28.158 sd=4.120
n=3.6%=19

FIGURE D3

FIGURE D4

AID II: Explanation of Midterm Exam Grade by Mid-Course Variables

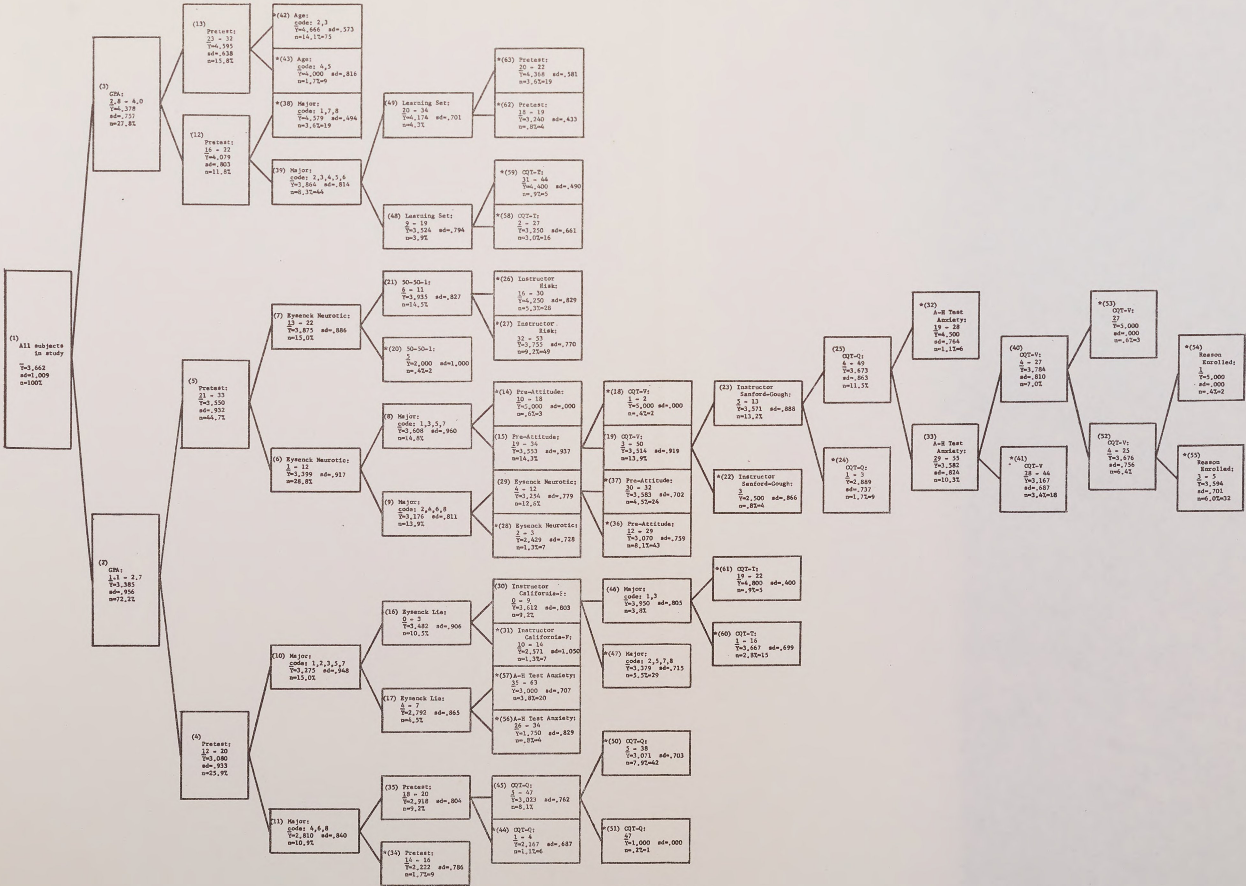

(1) All subjects in study Ȳ=3.662 sd=1.009 n=100%
(3) GPA: 2.8 - 4.0 Ȳ=4.378 sd=.757 n=27.8%
(2) GPA: 1.1 - 2.7 Ȳ=3.385 sd=.956 n=72.2%
(13) Pretest: 23 - 32 Ȳ=4.595 sd=.638 n=15.8%
(12) Pretest: 16 - 22 Ȳ=4.079 sd=.803 n=11.8%
(5) Pretest: 21 - 33 Ȳ=3.550 sd=.932 n=44.7%
(4) Pretest: 12 - 20 Ȳ=3.080 sd=.933 n=25.9%
*(42) Age: code: 2,3 Ȳ=4.666 sd=.573 n=14.1%=75
*(43) Age: code: 4,5 Ȳ=4.000 sd=.816 n=1.7%=9
*(38) Major: code: 1,7,8 Ȳ=4.579 sd=.494 n=3.6%=19
(39) Major: code: 2,3,4,5,6 Ȳ=3.864 sd=.814 n=8.3%=44
(7) Eysenck Neurotic: 13 - 22 Ȳ=3.875 sd=.886 n=15.0%
(6) Eysenck Neurotic: 1 - 12 Ȳ=3.399 sd=.917 n=28.8%
(10) Major: code: 1,2,3,5,7 Ȳ=3.275 sd=.948 n=15.0%
(11) Major: code: 4,6,8 Ȳ=2.810 sd=.840 n=10.9%
(49) Learning Set: 20 - 34 Ȳ=4.174 sd=.701 n=4.3%
(48) Learning Set: 9 - 19 Ȳ=3.524 sd=.794 n=3.9%
(21) 50-50-1: 6 - 11 Ȳ=3.935 sd=.827 n=14.5%
*(20) 50-50-1: 5 Ȳ=2.000 sd=1.000 n=.4%=2
(8) Major: code: 1,3,5,7 Ȳ=3.608 sd=.960 n=14.8%
(9) Major: code: 2,4,6,8 Ȳ=3.176 sd=.811 n=13.9%
(16) Eysenck Lie: 0 - 3 Ȳ=3.482 sd=.906 n=10.5%
(17) Eysenck Lie: 4 - 7 Ȳ=2.792 sd=.865 n=4.5%
(35) Pretest: 18 - 20 Ȳ=2.918 sd=.804 n=9.2%
*(34) Pretest: 14 - 16 Ȳ=2.222 sd=.786 n=1.7%=9
*(63) Pretest: 20 - 22 Ȳ=4.368 sd=.581 n=3.6%=19
*(62) Pretest: 18 - 19 Ȳ=3.240 sd=.433 n=.8%=4
*(59) CQT-T: 31 - 44 Ȳ=4.400 sd=.490 n=.9%=5
*(58) CQT-T: 2 - 27 Ȳ=3.250 sd=.661 n=3.0%=16
*(26) Instructor Risk: 16 - 30 Ȳ=4.250 sd=.829 n=5.3%=28
*(27) Instructor Risk: 32 - 53 Ȳ=3.755 sd=.770 n=9.2%=49
*(14) Pre-Attitude: 10 - 18 Ȳ=5.000 sd=.000 n=.6%=3
(15) Pre-Attitude: 19 - 34 Ȳ=3.553 sd=.937 n=14.3%
(29) Eysenck Neurotic: 4 - 12 Ȳ=3.254 sd=.779 n=12.6%
*(28) Eysenck Neurotic: 2 - 3 Ȳ=2.429 sd=.728 n=1.3%=7
(30) Instructor California-F: 0 - 9 Ȳ=3.612 sd=.803 n=9.2%
*(31) Instructor California-F: 10 - 14 Ȳ=2.571 sd=1.050 n=1.3%=7
*(57) A-H Test Anxiety: 35 - 63 Ȳ=3.000 sd=.707 n=3.8%=20
*(56) A-H Test Anxiety: 26 - 34 Ȳ=1.750 sd=.829 n=.8%=4
(45) CQT-Q: 5 - 47 Ȳ=3.023 sd=.762 n=8.1%
*(44) CQT-Q: 1 - 4 Ȳ=2.167 sd=.687 n=1.1%=6
*(18) CQT-V: 1 - 2 Ȳ=5.000 sd=.000 n=.4%=2
(19) CQT-V: 3 - 50 Ȳ=3.514 sd=.919 n=13.9%
*(37) Pre-Attitude: 30 - 32 Ȳ=3.583 sd=.702 n=4.5%=24
*(36) Pre-Attitude: 12 - 29 Ȳ=3.070 sd=.759 n=8.1%=43
(46) Major: code: 1,3 Ȳ=3.950 sd=.805 n=3.8%
*(47) Major: code: 2,5,7,8 Ȳ=3.379 sd=.715 n=5.5%=29
*(50) CQT-Q: 5 - 38 Ȳ=3.071 sd=.703 n=7.9%=42
*(51) CQT-Q: 47 Ȳ=1.000 sd=.000 n=.2%=1
(23) Instructor Sanford-Gough: 5 - 13 Ȳ=3.571 sd=.888 n=13.2%
*(22) Instructor Sanford-Gough: 3 Ȳ=2.500 sd=.866 n=.8%=4
*(61) CQT-T: 19 - 22 Ȳ=4.800 sd=.400 n=.9%=5
*(60) CQT-T: 1 - 16 Ȳ=3.667 sd=.699 n=2.8%=15
(25) CQT-Q: 4 - 49 Ȳ=3.673 sd=.863 n=11.5%
*(24) CQT-Q: 1 - 3 Ȳ=2.889 sd=.737 n=1.7%=9
*(32) A-H Test Anxiety: 19 - 28 Ȳ=4.500 sd=.764 n=1.1%=6
(33) A-H Test Anxiety: 29 - 55 Ȳ=3.582 sd=.824 n=10.3%
(40) CQT-V: 4 - 27 Ȳ=3.784 sd=.810 n=7.0%
*(41) CQT-V 28 - 44 Ȳ=3.167 sd=.687 n=3.4%=18
*(53) CQT-V: 27 Ȳ=5.000 sd=.000 n=.6%=3
(52) CQT-V: 4 - 25 Ȳ=3.676 sd=.756 n=6.4%
*(54) Reason Enrolled: 1 Ȳ=5.000 sd=.000 n=.4%=2
*(55) Reason Enrolled: 3 - 5 Ȳ=3.594 sd=.701 n=6.0%=32

FIGURE D4

FIGURE D5

AID II: Explanation of Final Course Grade by Mid-Course Variables

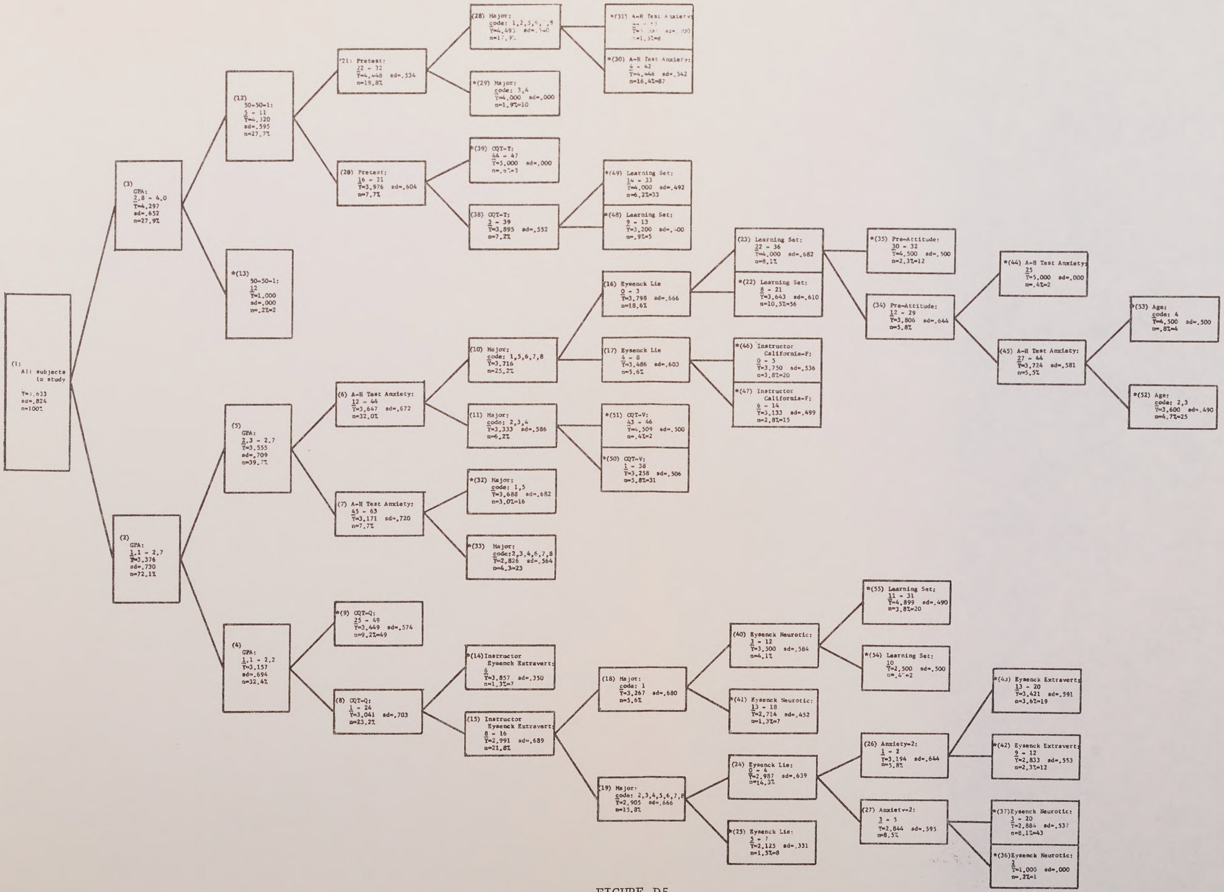
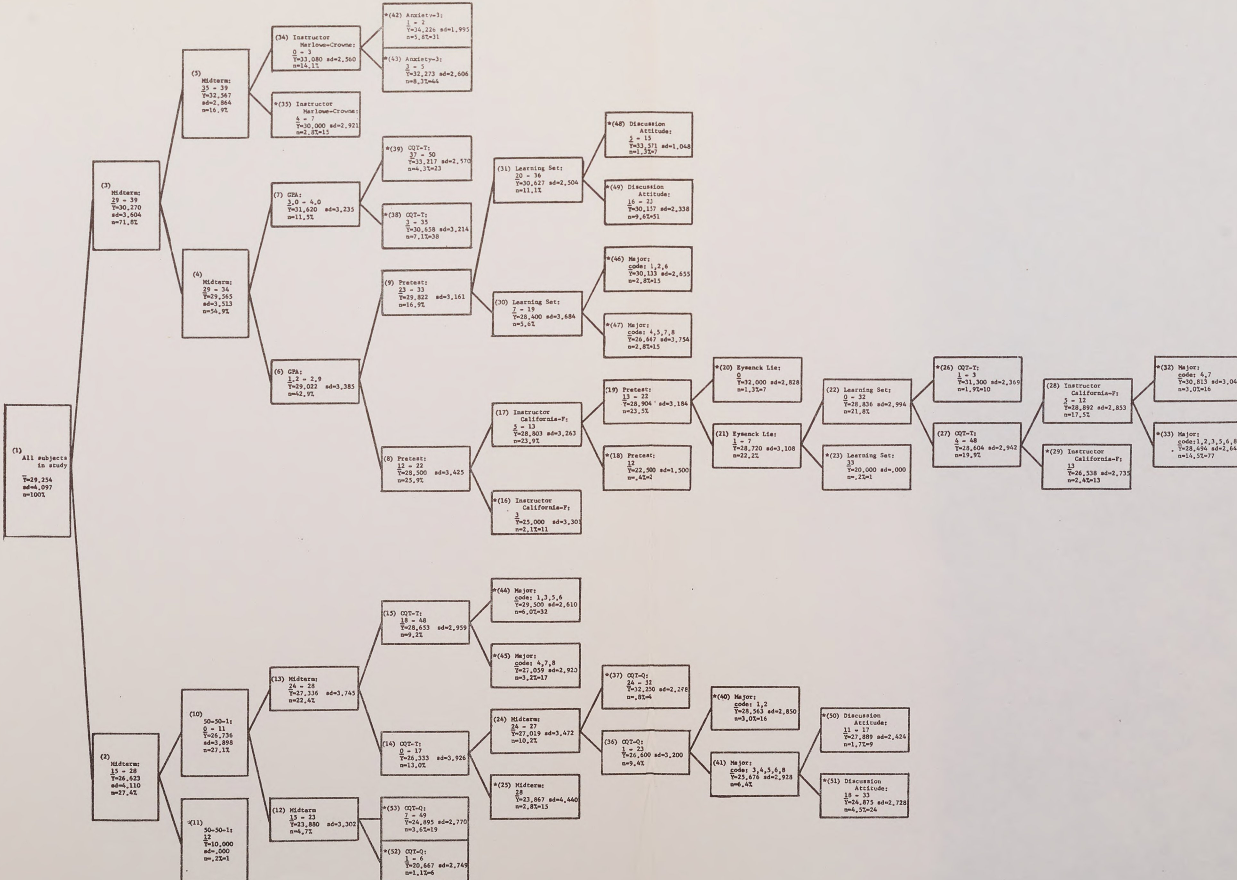

(1) All subjects in study
Y=3.633 sd=.824 n=100%
(3) GPA: 2.8 - 4.0
Y=4.297 sd=.652 n=27.9%
(2) GPA: 1.1 - 2.7
Y=3.376 sd=.730 n=72.1%
(12) 50-50-1: 5 - 11
Y=4.320 sd=.595 n=27.7%
*(13) 50-50-1: 12
Y=1.000 sd=.000 n=.2%=2
(5) GPA: 2.3 - 2.7
Y=3.555 sd=.709 n=39.7%
(4) GPA: 1.1 - 2.2
Y=3.157 sd=.694 n=32.4%
(21) Pretest: 22 - 32
Y=4.448 sd=.534 n=19.8%
(20) Pretest: 16 - 21
Y=3.976 sd=.604 n=7.7%
(6) A-H Test Anxiety: 12 - 44
Y=3.647 sd=.672 n=32.0%
(7) A-H Test Anxiety: 45 - 63
Y=3.171 sd=.720 n=7.7%
*(9) CQT-Q: 25 - 49
Y=3.449 sd=.574 n=9.2%=49
(8) CQT-Q: 1 - 24
Y=3.041 sd=.703 n=23.2%
(28) Major: code: 1,2,5,6,7,8
Y=4.493 sd=.540 n=17.9%
*(29) Major: code: 3,4
Y=4.000 sd=.000 n=1.9%=10
*(39) CQT-T: 44 - 47
Y=5.000 sd=.000 n=.5%=3
(38) CQT-T: 3 - 39
Y=3.895 sd=.552 n=7.2%
(10) Major: code: 1,5,6,7,8
Y=3.716 n=25.2%
(11) Major: code: 2,3,4
Y=3.333 sd=.586 n=6.2%
*(32) Major: code: 1,5
Y=3.688 sd=.682 n=3.0%=16
*(33) Major: code:2,3,4,6,7,8
Y=2.826 sd=.564 n=4.3=23
*(14) Instructor Eysenck Extravert: 6
Y=3.857 sd=.350 n=1.3%=7
(15) Instructor Eysenck Extravert: 8 - 16
Y=2.991 sd=.689 n=21.8%
*(31) A-H Test Anxiety
n=1.5%=8
*(30) A-H Test Anxiety: 4 - 42
Y=4.448 sd=.542 n=16.4%=87
*(49) Learning Set: 14 - 33
Y=4.000 sd=.492 n=6.2%=33
*(48) Learning Set: 9 - 13
Y=3.200 sd=.400 n=.9%=5
(16) Eysenck Lie 0 - 3
Y=3.798 sd=.666 n=18.6%
(17) Eysenck Lie 4 - 8
Y=3.486 sd=.603 n=5.6%
*(51) CQT-V: 43 - 46
Y=4.509 sd=.500 n=.4%=2
*(50) CQT-V: 1 - 38
Y=3.258 sd=.506 n=5.8%=31
(18) Major: code: 1
Y=3.267 sd=.680 n=5.6%
(19) Major: code: 2,3,4,5,6,7,8
Y=2.905 sd=.666 n=15.8%
(23) Learning Set: 22 - 36
Y=4.000 sd=.682 n=8.1%
*(22) Learning Set: 8 - 21
Y=3.643 sd=.610 n=10.5%=56
*(46) Instructor California-F: 0 - 5
Y=3.750 sd=.536 n=3.8%=20
*(47) Instructor California-F: 6 - 14
Y=3.133 sd=.499 n=2.8%=15
(40) Eysenck Neurotic: 3 - 12
Y=3.500 sd=.584 n=4.1%
*(41) Eysenck Neurotic: 13 - 18
Y=2.714 sd=.452 n=1.3%=7
(24) Eysenck Lie: 0 - 4
Y=2.987 sd=.639 n=14.3%
*(25) Eysenck Lie: 5 - 7
Y=2.125 sd=.331 n=1.5%=8
*(35) Pre-Attitude: 30 - 32
Y=4.500 sd=.500 n=2.3%=12
(34) Pre-Attitude: 12 - 29
Y=3.806 sd=.644 n=5.8%
*(55) Learning Set: 11 - 31
Y=4.899 sd=.490 n=3.8%=20
*(54) Learning Set: 10
Y=2.500 sd=.500
(26) Anxiety-2: 1 - 2
Y=3.194 sd=.644 n=5.8%
(27) Anxiety-2: 3 - 5
Y=2.844 sd=.595 n=8.5%
*(44) A-H Test Anxiety: 25
Y=5.000 sd=.000 n=.4%=2
(45) A-H Test Anxiety: 27 - 44
Y=3.724 sd=.581 n=5.5%
*(43) Eysenck Extravert: 13 - 20
Y=3.421 sd=.591 n=3.6%=19
*(42) Eysenck Extravert: 9 - 12
Y=2.833 sd=.553 n=2.3%=12
*(37) Eysenck Neurotic: 3 - 20
Y=2.884 sd=.537 n=8.1%=43
*(36) Eysenck Neurotic: 2
Y=1.000 sd=.000 n=.2%=1
*(53) Age: code: 4
Y=4.500 sd=.500 n=.8%=4
*(52) Age: code: 2,3
Y=3.600 sd=.490 n=4.7%=25

FIGURE D5

FIGURE D6

AID III: Explanation of Final Exam Score-1 by Final Course Variables



(1) All subjects in study Ȳ=29.254 sd=4.097 n=100%
(3) Midterm: 29 - 39 Ȳ=30.270 sd=3.604 n=71.8%
(2) Midterm: 15 - 28 Ȳ=26.623 sd=4.110 n=27.4%
(5) Midterm: 35 - 39 Ȳ=32.567 sd=2.864 n=16.9%
(4) Midterm: 29 - 34 Ȳ=29.565 sd=3.513 n=54.9%
(34) Instructor Marlowe-Crowne: 0 - 3 Ȳ=33.080 sd=2.560 n=14.1%
*(35) Instructor Marlowe-Crowne: 4 - 7 Ȳ=30.000 sd=2.921 n=2.8%=15
*(42) Anxiety-3: 1 - 2 Ȳ=34.226 sd=1.995 n=5.8%=31
*(43) Anxiety-3: 3 - 5 Ȳ=32.273 sd=2.606 n=8.3%=44
(7) GPA: 3.0 - 4.0 Ȳ=31.620 sd=3.235 n=11.5%
(6) GPA: 1.2 - 2.9 Ȳ=29.022 sd=3.385 n=42.9%
*(39) CQT-T: 37 - 50 Ȳ=33.217 sd=2.570 n=4.3%=23
*(38) CQT-T: 3 - 35 Ȳ=30.658 sd=3.214 n=7.1%=38
(9) Pretest: 23 - 33 Ȳ=29.822 sd=3.161 n=16.9%
(8) Pretest: 12 - 22 Ȳ=28.500 sd=3.425 n=25.9%
(31) Learning Set: 20 - 36 Ȳ=30.627 sd=2.504 n=11.1%
(30) Learning Set: 7 - 19 Ȳ=28.400 sd=3.684 n=5.6%
*(48) Discussion Attitude: 5 - 15 Ȳ=33.571 sd=1.048 n=1.3%=7
*(49) Discussion Attitude: 16 - 23 Ȳ=30.157 sd=2.338 n=9.6%=51
*(46) Major: code: 1,2,6 Ȳ=30.133 sd=2.655 n=2.8%=15
*(47) Major: code: 4,5,7,8 Ȳ=26.667 sd=3.754 n=2.8%=15
(17) Instructor California-F: 5 - 13 Ȳ=28.803 sd=3.263 n=23.9%
*(16) Instructor California-F: 3 Ȳ=25.000 sd=3.301 n=2.1%=11
(19) Pretest: 13 - 22 Ȳ=28.904 sd=3.184 n=23.5%
*(18) Pretest: 12 Ȳ=22.500 sd=1.500 n=.4%=2
*(20) Eysenck Lie: 0 Ȳ=32.000 sd=2.828 n=1.3%=7
(21) Eysenck Lie: 1 - 7 Ȳ=28.720 sd=3.108 n=22.2%
(22) Learning Set: 0 - 32 Ȳ=28.836 sd=2.994 n=21.8%
*(23) Learning Set: 33 Ȳ=20.000 sd=.000 n=.2%=1
*(26) CQT-T: 1 - 3 Ȳ=31.300 sd=2.369 n=1.9%=10
(27) CQT-T: 4 - 48 Ȳ=28.604 sd=2.942 n=19.9%
(28) Instructor California-F: 5 - 12 Ȳ=28.892 sd=2.853 n=17.5%
*(29) Instructor California-F: 13 Ȳ=26.538 sd=2.735 n=2.4%=13
*(32) Major: code: 4,7 Ȳ=30.813 sd=3.045 n=3.0%=16
*(33) Major: code:1,2,3,5,6,8 Ȳ=28.494 sd=2.641 n=14.5%=77
(10) 50-50-1: 0 - 11 Ȳ=26.736 sd=3.898 n=27.1%
*(11) 50-50-1: 12 Ȳ=10.000 sd=.000 n=.2%=1
(13) Midterm: 24 - 28 Ȳ=27.336 sd=3.745 n=22.4%
(12) Midterm 15 - 23 Ȳ=23.880 sd=3.302 n=4.7%
(15) CQT-T: 18 - 48 Ȳ=28.653 sd=2.959 n=9.2%
(14) CQT-T: 0 - 17 Ȳ=26.333 sd=3.926 n=13.0%
*(53) CQT-Q: 7 - 49 Ȳ=24.895 sd=2.770 n=3.6%=19
*(52) CQT-Q: 1 - 6 Ȳ=20.667 sd=2.749 n=1.1%=6
*(44) Major: code: 1,3,5,6 Ȳ=29.500 sd=2.610 n=6.0%=32
*(45) Major: code: 4,7,8 Ȳ=27.059 sd=2.920 n=3.2%=17
(24) Midterm: 24 - 27 Ȳ=27.019 sd=3.472 n=10.2%
*(25) Midterm: 28 Ȳ=23.867 sd=4.440 n=2.8%=15
*(37) CQT-Q: 24 - 32 Ȳ=32.250 sd=2.278 n=.8%=4
(36) CQT-Q: 1 - 23 Ȳ=26.600 sd=3.200 n=9.4%
*(40) Major: code: 1,2 Ȳ=28.563 sd=2.850 n=3.0%=16
(41) Major: code: 3,4,5,6,8 Ȳ=25.676 sd=2.928 n=6.4%
*(50) Discussion Attitude: 11 - 17 Ȳ=27.889 sd=2.424 n=1.7%=9
*(51) Discussion Attitude: 18 - 33 Ȳ=24.875 sd=2.728 n=4.5%=24

FIGURE D6

FIGURE D7

AID III: Explanation of Final Exam Score-2 by Final Course Variables

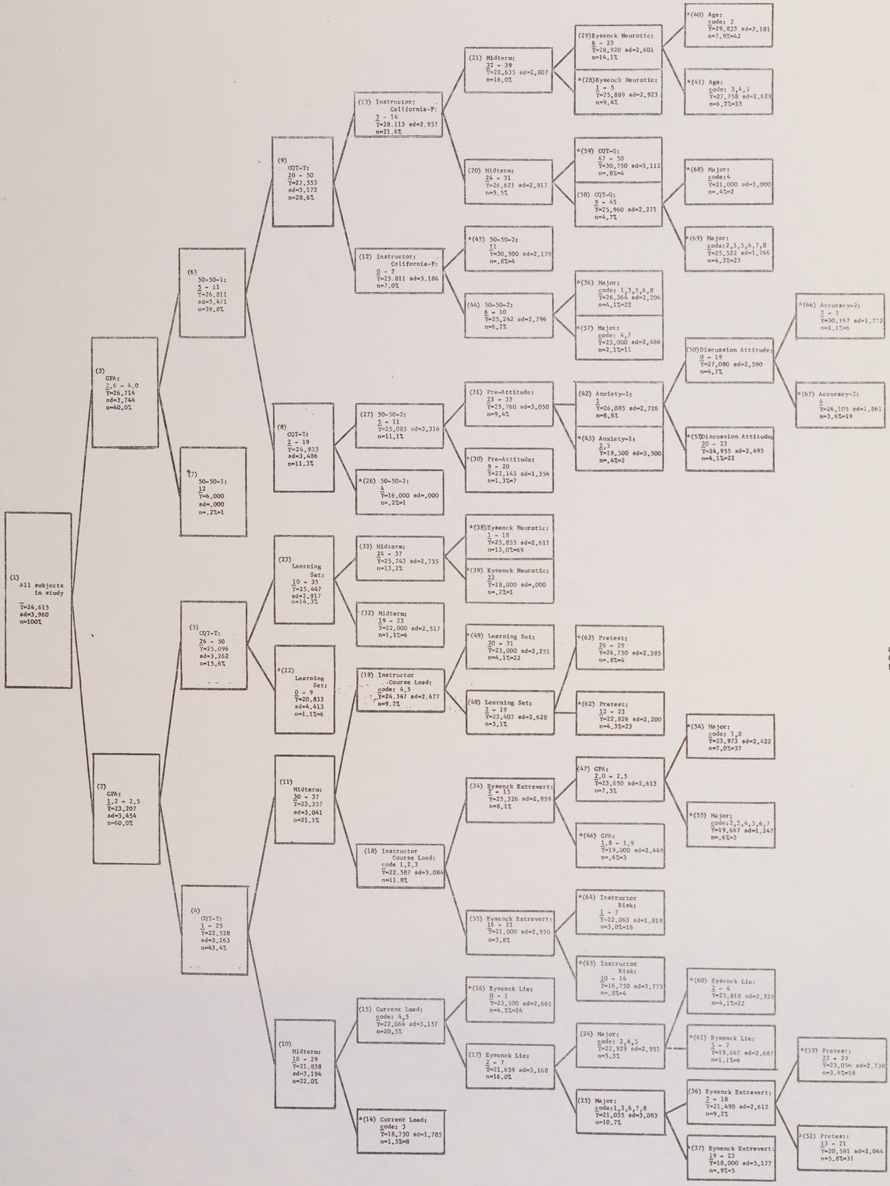

(1) All subjects in study Ȳ=24.615 sd=3.960 n=100%
(2) GPA: 1.2 - 2.5 Ȳ=23.207 sd=3.454 n=60.0%
(3) GPA: 2.6 - 4.0 Ȳ=26.714 sd=3.744 n=40.0%
(4) CQT-T: 1 - 25 Ȳ=22.528 sd=3.263 n=43.4%
(5) CQT-T: 26 - 50 Ȳ=25.096 sd=3.262 n=15.6%
(6) 50-50-1: 5 - 11 Ȳ=26.811 sd=3.471 n=39.8%
*(7) 50-50-1: 12 Ȳ=6.000 sd=.000 n=.2%=1
(8) CQT-T: 2 - 19 Ȳ=24.933 sd=3.486 n=11.3%
(9) CQT-T: 20 - 50 Ȳ=27.553 sd=3.172 n=28.6%
(10) Midterm: 18 - 29 Ȳ=21.838 sd=3.194 n=22.0%
(11) Midterm: 30 - 37 Ȳ=23.357 sd=3.041 n=21.1%
(12) Instructor: California-F: 0 - 2 Ȳ=25.811 sd=3.186 n=7.0%
(13) Instructor: California-F: 3 - 14 Ȳ=28.113 sd=2.957 n=21.6%
*(14) Current Load: code: 3 Ȳ=18.750 sd=1.785 n=1.5%=8
(15) Current Load: code: 4,5 Ȳ=22.064 sd=3.157 n=20.5%
*(16) Eysenck Lie: 0 - 1 Ȳ=23.500 sd=2.661 n=4.5%=24
(17) Eysenck Lie: 2 - 7 Ȳ=21.659 sd=3.168 n=16.0%
(18) Instructor Course Load: code 1,2,3 Ȳ=22.587 sd=3.084 n=11.8%
(19) Instructor Course Load: code: 4,5 Ȳ=24.347 sd=2.677 n=9.2%
(20) Midterm: 24 - 31 Ȳ=26.621 sd=2.917 n=5.5%
(21) Midterm: 32 - 39 Ȳ=28.635 sd=2.807 n=16.0%
*(22) Learning Set: 0 - 9 Ȳ=20.833 sd=4.413 n=1.1%=6
(23) Learning Set: 10 - 35 Ȳ=25.447 sd=2.917 n=14.5%
(24) Major: code: 2,4,5 Ȳ=22.929 sd=2.951 n=5.3%
(25) Major: code:1,3,6,7,8 Ȳ=21.035 sd=3.083 n=10.7%
*(26) 50-50-2: 4 Ȳ=16.000 sd=.000 n=.2%=1
(27) 50-50-2: 5 - 11 Ȳ=25.085 sd=3.316 n=11.1%
*(28) Eysenck Neurotic: 1 - 5 Ȳ=25.889 sd=2.923 n=9.4%
(29) Eysenck Neurotic: 6 - 23 Ȳ=28.920 sd=2.601 n=14.1%
*(30) Pre-Attitude: 9 - 20 Ȳ=22.143 sd=1.356 n=1.3%=7
(31) Pre-Attitude: 23 - 33 Ȳ=25.760 sd=3.050 n=9.4%
*(32) Midterm: 19 - 23 Ȳ=22.000 sd=2.517 n=1.1%=6
(33) Midterm: 24 - 37 Ȳ=25.743 sd=2.755 n=13.2%
(34) Eysenck Extravert: 2 - 15 Ȳ=23.326 sd=2.859 n=8.1%
(35) Eysenck Extravert: 16 - 21 Ȳ=21.000 sd=2.950 n=3.8%
(36) Eysenck Extravert: 7 - 18 Ȳ=21.490 sd=2.612 n=9.2%
*(37) Eysenck Extravert: 19 - 23 Ȳ=18.000 sd=5.177 n=.9%=5
*(38) Eysenck Neurotic: 1 - 18 Ȳ=25.855 sd=2.611 n=13.0%=69
*(39) Eysenck Neurotic: 22 Ȳ=18.000 sd=.000 n=.2%=1
*(40) Age: code: 2 Ȳ=29.833 sd=2.181 n=7.9%=42
*(41) Age: code: 3,4,5 Ȳ=27.758 sd=2.629 n=6.2%=33
(42) Anxiety-1: 1 Ȳ=26.085 sd=2.726 n=8.8%
*(43) Anxiety-1: 2,3 Ȳ=19.500 sd=3.500 n=.4%=2
(44) 50-50-2: 6 - 10 Ȳ=25.242 sd=2.796 n=6.2%
*(45) 50-50-2: 11 Ȳ=30.500 sd=2.179 n=.8%=4
*(46) GPA: 1.8 - 1.9 Ȳ=19.000 sd=2.449 n=.6%=3
(47) GPA: 2.0 - 2.5 Ȳ=23.650 sd=2.613 n=7.5%
(48) Learning Set: 2 - 19 Ȳ=23.407 sd=2.628 n=5.1%
*(49) Learning Set: 20 - 31 Ȳ=25.000 sd=2.251 n=4.1%=22
(50) Discussion Attitude: 0 - 19 Ȳ=27.080 sd=2.590 n=4.7%
*(51) Discussion Attitude: 20 - 23 Ȳ=24.955 sd=2.495 n=4.1%=22
*(52) Pretest: 13 - 21 Ȳ=20.581 sd=2.044 n=5.8%=31
*(53) Pretest: 22 - 29 Ȳ=23.056 sd=2.738 n=3.4%=18
*(54) Major: code: 1,8 Ȳ=23.973 sd=2.422 n=7.0%=37
*(55) Major: code:2,3,4,5,6,7 Ȳ=19.667 sd=1.247 n=.6%=3
*(56) Major: code: 1,3,5,6,8 Ȳ=26.364 sd=2.206 n=4.1%=22
*(57) Major: code: 4,7 Ȳ=23.000 sd=2.486 n=2.1%=11
(58) CQT-Q: 9 - 45 Ȳ=25.960 sd=2.271 n=4.7%
*(59) CQT-Q: 47 - 50 Ȳ=30.750 sd=3.112 n=.8%=4
*(60) Eysenck Lie: 2 - 4 Ȳ=23.818 sd=2.328 n=4.1%=22
*(61) Eysenck Lie: 5 - 7 Ȳ=19.667 sd=2.687 n=1.1%=6
*(62) Pretest: 12 - 23 Ȳ=22.826 sd=2.200 n=4.3%=23
*(63) Pretest: 26 - 29 Ȳ=26.750 sd=2.385 n=.8%=4
*(64) Instructor Risk: 1 - 7 Ȳ=22.063 sd=1.819 n=3.0%=16
*(65) Instructor Risk: 10 - 14 Ȳ=16.750 sd=2.773 n=.8%=4
*(66) Accuracy-2: 2 - 3 Ȳ=30.167 sd=1.772 n=1.1%=6
*(67) Accuracy-2: 4 Ȳ=26.105 sd=1.861 n=3.6%=19
*(68) Major: code:4 Ȳ=31.000 sd=1.000 n=.4%=2
*(69) Major: code:2,3,5,6,7,8 Ȳ=25.522 sd=1.766 n=4.3%=23

FIGURE D7

FIGURE D8

AID III: Explanation of Final Exam Total Score

by Final Course Variables

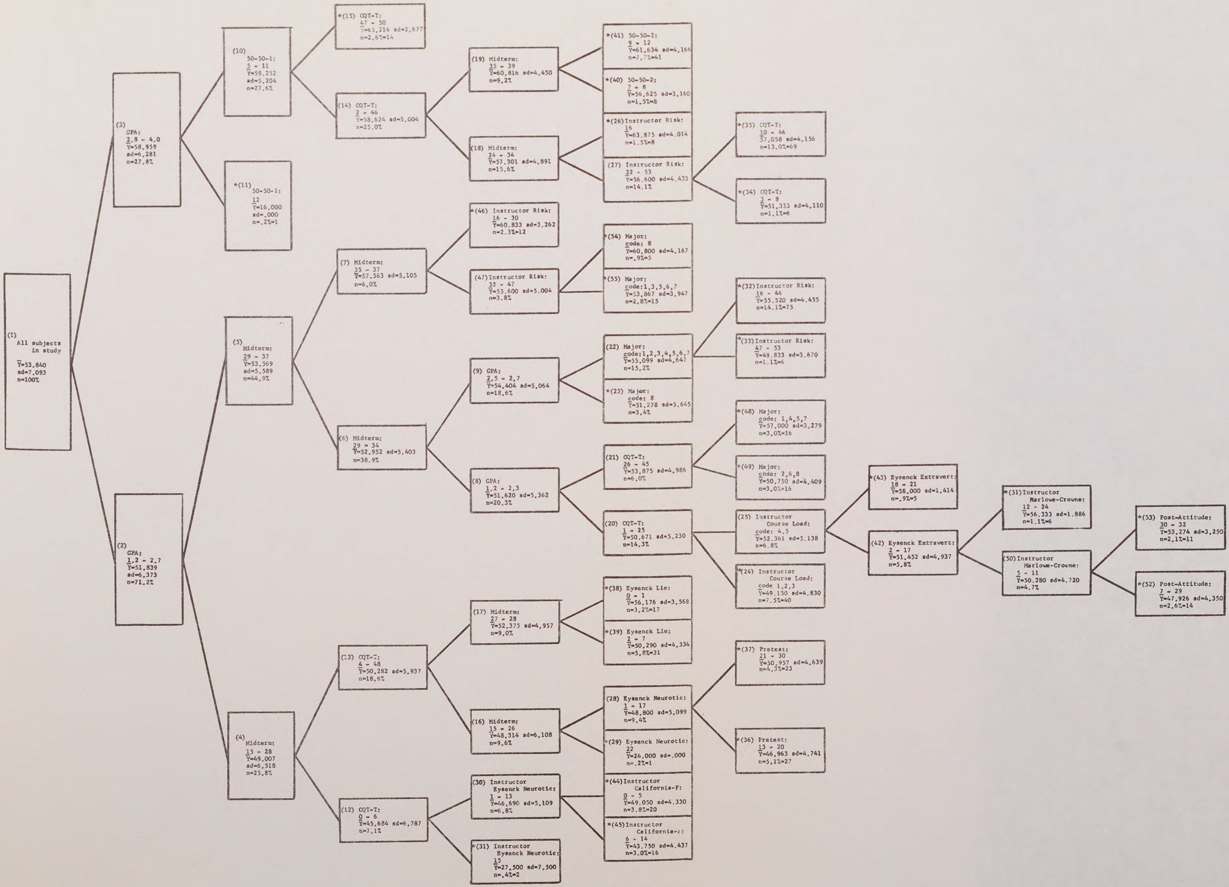

(1) All subjects in study Y=53.840 sd=7.093 n=100%
(3) GPA: 2.8 - 4.0 Y=58.959 sd=6.281 n=27.8%
(2) GPA: 1.2 - 2.7 Y=51.839 sd=6.373 n=71.2%
(10) 50-50-1: 5 - 11 Y=59.252 sd=5.204 n=27.6%
*(11) 50-50-1: 12 Y=16.000 sd=.000 n=.2%=1
(5) Midterm: 29 - 37 Y=53.569 sd=5.589 n=44.9%
(4) Midterm: 15 - 28 Y=49.007 sd=6.518 n=25.8%
*(15) CQT-T: 47 - 50 Y=65.214 sd=2.677 n=2.6%=14
(14) CQT-T: 2 - 46 Y=58.624 sd=5.004 n=25.0%
(7) Midterm: 35 - 37 Y=57.563 sd=5.105 n=6.0%
(6) Midterm: 29 - 34 Y=52.952 sd=5.403 n=38.9%
(13) CQT-T: 4 - 48 Y=50.282 sd=5.937 n=18.6%
(12) CQT-T: 0 - 6 Y=45.684 sd=6.787 n=7.1%
(19) Midterm: 35 - 39 Y=60.816 sd=4.450 n=9.2%
(18) Midterm: 24 - 34 Y=57.301 sd=4.891 n=15.6%
*(46) Instructor Risk: 16 - 30 Y=60.833 sd=3.262 n=2.3%=12
(47) Instructor Risk: 32 - 47 Y=55.600 sd=5.004 n=3.8%
(9) GPA: 2.5 - 2.7 Y=54.404 sd=5.064 n=18.6%
(8) GPA: 1.2 - 2.3 Y=51.620 sd=5.362 n=20.3%
(17) Midterm: 27 - 28 Y=52.375 sd=4.957 n=9.0%
(16) Midterm: 15 - 26 Y=48.314 sd=6.108 n=9.6%
(30) Instructor Eysenck Neurotic: 1 - 13 Y=46.690 sd=5.109 n=6.8%
*(31) Instructor Eysenck Neurotic: 15 Y=27.500 sd=7.500 n=.4%=2
*(41) 50-50-2: 9 - 12 Y=61.634 sd=4.166 n=7.7%=41
*(40) 50-50-2: 7 - 8 Y=56.625 sd=3.160 n=1.5%=8
*(26) Instructor Risk: 16 Y=63.875 sd=4.014 n=1.5%=8
(27) Instructor Risk: 22 - 53 Y=56.600 sd=4.433 n=14.1%
*(54) Major: code: 8 Y=60.800 sd=4.167 n=.9%=5
*(55) Major: code: 1,3,5,6,7 Y=53.867 sd=3.947 n=2.8%=15
(22) Major: code: 1,2,3,4,5,6,7 Y=55.099 sd=4.647 n=15.2%
*(23) Major: code: 8 Y=51.278 sd=5.645 n=3.4%
(21) CQT-T: 26 - 45 Y=53.875 sd=4.986 n=6.0%
(20) CQT-T: 1 - 25 Y=50.671 sd=5.230 n=14.3%
*(38) Eysenck Lie: 0 - 1 Y=56.176 sd=3.568 n=3.2%=17
*(39) Eysenck Lie: 2 - 7 Y=50.290 sd=4.334 n=5.8%=31
(28) Eysenck Neurotic: 1 - 17 Y=48.800 sd=5.099 n=9.4%
*(29) Eysenck Neurotic: 22 Y=24.000 sd=.000 n=.2%=1
*(44) Instructor California-F: 0 - 5 Y=49.050 sd=4.330 n=3.8%=20
*(45) Instructor California-F: 6 - 14 Y=43.750 sd=4.437 n=3.0%=16
*(35) CQT-T: 10 - 46 57.058 sd=4.156 n=13.0%=69
*(34) CQT-T: 3 - 8 Y=51.333 sd=4.110 n=1.1%=6
*(32) Instructor Risk: 16 - 46 Y=55.520 sd=4.455 n=14.1%=75
*(33) Instructor Risk: 47 - 53 Y=49.833 sd=3.670 n=1.1%=6
*(48) Major: code: 1,4,5,7 Y=57.000 sd=3.279 n=3.0%=16
*(49) Major: code: 2,6,8 Y=50.750 sd=4.409 n=3.0%=16
(25) Instructor Course Load: code: 4,5 Y=52.361 sd=5.138 n=6.8%
*(24) Instructor Course Load: code 1,2,3 Y=49.150 sd=4.830 n=7.5%=40
*(37) Pretest: 21 - 30 Y=50.957 sd=4.639 n=4.3%=23
*(36) Pretest: 13 - 20 Y=46.963 sd=4.741 n=5.1%=27
*(43) Eysenck Extravert: 18 - 21 Y=58.000 sd=1.414 n=.9%=5
(42) Eysenck Extravert: 2 - 17 Y=51.452 sd=4.937 n=5.8%
*(51) Instructor Marlowe-Crowne: 12 - 24 Y=56.333 sd=1.886 n=1.1%=6
(50) Instructor Marlowe-Crowne: 5 - 11 Y=50.280 sd=4.720 n=4.7%
*(53) Post-Attitude: 30 - 32 Y=53.274 sd=3.250 n=2.1%=11
*(52) Post-Attitude: 7 - 29 Y=47.926 sd=4.350 n=2.6%=14

FIGURE D8

FIGURE D9

AID III: Explanation of Final Exam Grade by Final Course Variables

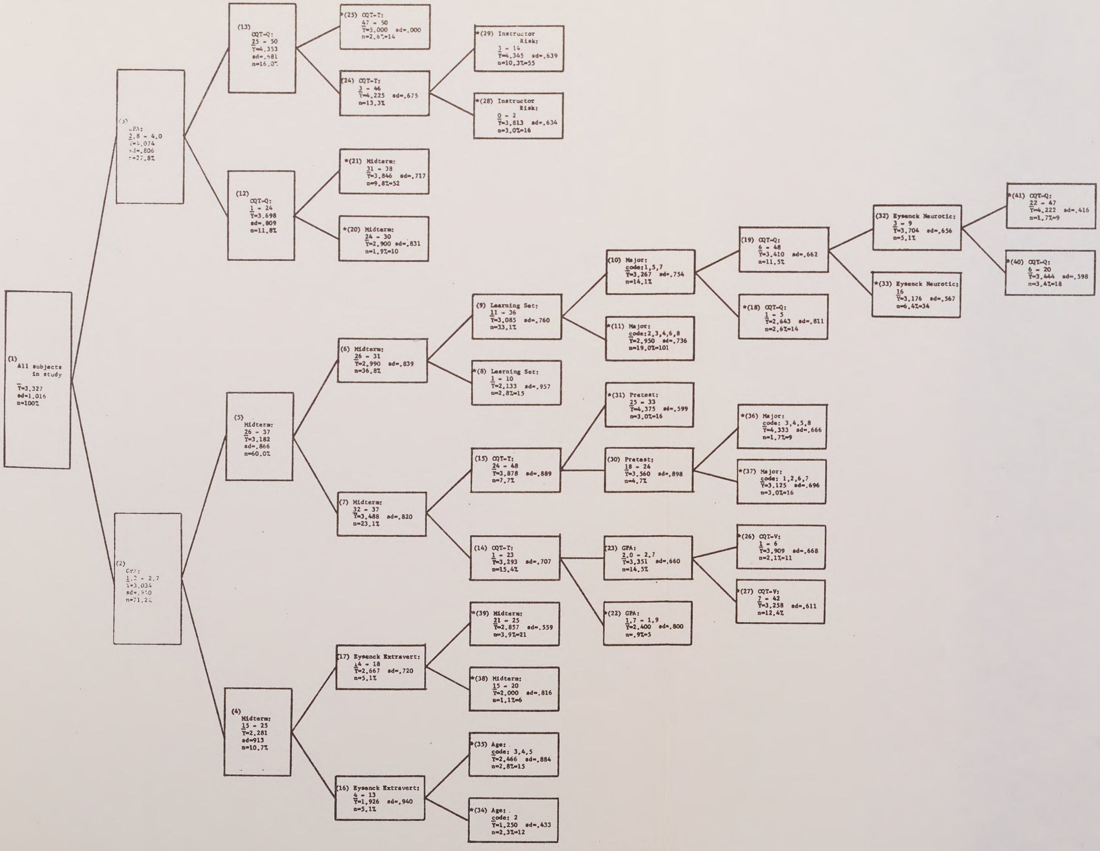

(1) All subjects in study Ȳ=3.327 sd=1.016 n=100%
(3) GPA: 2.8 - 4.0 Ȳ=4.074 sd=.806 n=27.8%
(2) GPA: 1.2 - 2.7 Ȳ=3.034 sd=.940 n=71.2%
(13) CQT-Q: 25 - 50 Ȳ=4.353 sd=.681 n=16.0%
(12) CQT-Q: 1 - 24 Ȳ=3.698 sd=.809 n=11.8%
(5) Midterm: 26 - 37 Ȳ=3.182 sd=.866 n=60.0%
(4) Midterm: 15 - 25 Ȳ=2.281 sd=913 n=10.7%
*(25) CQT-T: 47 - 50 Ȳ=5.000 sd=.000 n=2.6%=14
(24) CQT-T: 3 - 46 Ȳ=4.225 sd=.675 n=13.3%
*(21) Midterm: 31 - 38 Ȳ=3.846 sd=.717 n=9.8%=52
*(20) Midterm: 24 - 30 Ȳ=2.900 sd=.831 n=1.9%=10
(6) Midterm: 26 - 31 Ȳ=2.990 sd=.839 n=36.8%
(7) Midterm: 32 - 37 Ȳ=3.488 sd=.820 n=23.1%
(17) Eysenck Extravert: 14 - 18 Ȳ=2.667 sd=.720 n=5.1%
(16) Eysenck Extravert: 4 - 13 Ȳ=1.926 sd=.940 n=5.1%
*(29) Instructor Risk: 3 - 14 Ȳ=4.345 sd=.639 n=10.3%=55
*(28) Instructor Risk: 0 - 2 Ȳ=3.813 sd=.634 n=3.0%=16
(9) Learning Set: 11 - 36 Ȳ=3.085 sd=.760 n=33.1%
*(8) Learning Set: 1 - 10 Ȳ=2.133 sd=.957 n=2.8%=15
(15) CQT-T: 24 - 48 Ȳ=3.878 sd=.889 n=7.7%
(14) CQT-T: 1 - 23 Ȳ=3.293 sd=.707 n=15.4%
*(39) Midterm: 21 - 25 Ȳ=2.857 sd=.559 n=3.9%=21
*(38) Midterm: 15 - 20 Ȳ=2.000 sd=.816 n=1.1%=6
*(35) Age: code: 3,4,5 Ȳ=2.466 sd=.884 n=2.8%=15
*(34) Age: code: 2 Ȳ=1.250 sd=.433 n=2.3%=12
(10) Major: code:1,5,7 Ȳ=3.267 sd=.754 n=14.1%
*(11) Major: code:2,3,4,6,8 Ȳ=2.950 sd=.736 n=19.0%=101
*(31) Pretest: 25 - 33 Ȳ=4.375 sd=.599 n=3.0%=16
(30) Pretest: 18 - 24 Ȳ=3.560 sd=.898 n=4.7%
(23) GPA: 2.0 - 2.7 Ȳ=3.351 sd=.660 n=14.5%
*(22) GPA: 1.7 - 1.9 Ȳ=2.400 sd=.800 n=.9%=5
(19) CQT-Q: 6 - 48 Ȳ=3.410 sd=.662 n=11.5%
*(18) CQT-Q: 1 - 5 Ȳ=2.643 sd=.811 n=2.6%=14
*(36) Major: code: 3,4,5,8 Ȳ=4.333 sd=.666 n=1.7%=9
*(37) Major: code: 1,2,6,7 Ȳ=3.125 sd=.696 n=3.0%=16
*(26) CQT-V: 1 - 6 Ȳ=3.909 sd=.668 n=2.1%=11
*(27) CQT-V: 7 - 42 Ȳ=3.258 sd=.611 n=12.4%
(32) Eysenck Neurotic: 3 - 9 Ȳ=3.704 sd=.656 n=5.1%
*(33) Eysenck Neurotic: 16 Ȳ=3.176 sd=.567 n=6.4%=34
*(41) CQT-Q: 22 - 47 Ȳ=4.222 sd=.416 n=1.7%=9
*(40) CQT-Q: 6 - 20 Ȳ=3.444 sd=.598 n=3.4%=18

FIGURE D9

FIGURE D9

AID III: Explanation of Final Exam Grade by Final Course Variables

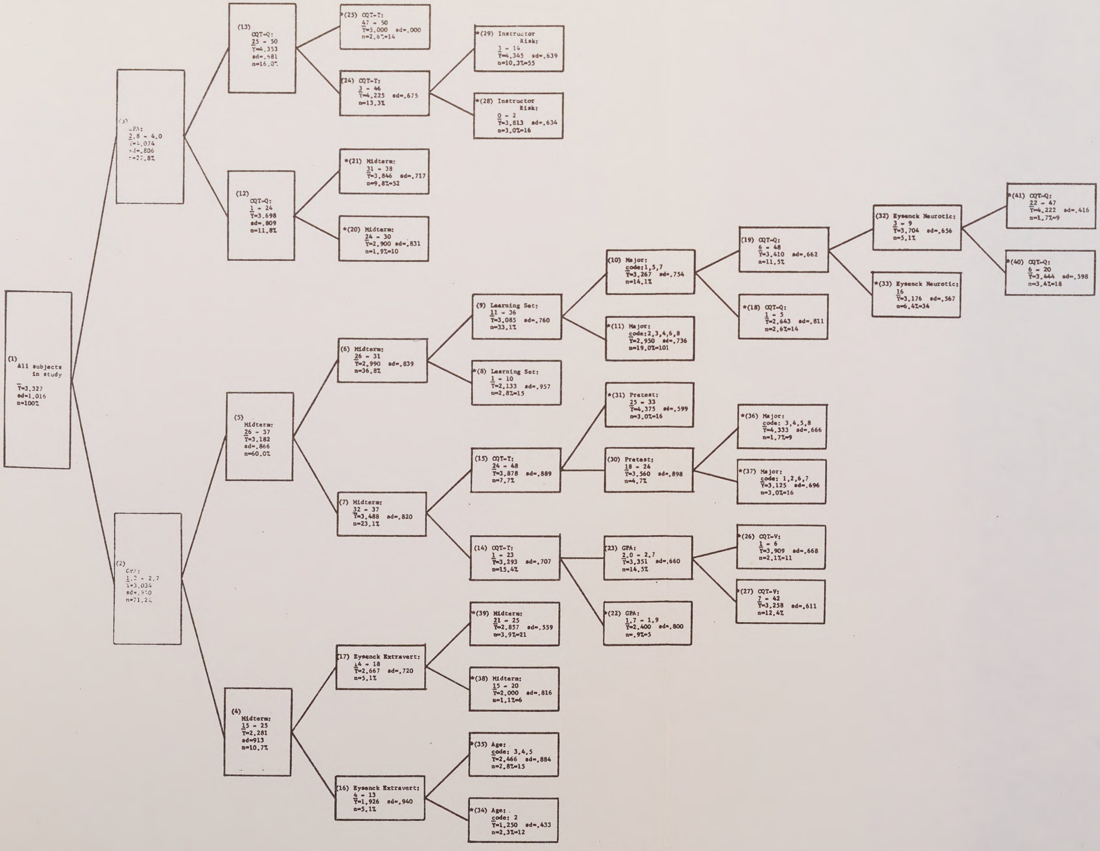

(1) All subjects in study Y=3.327 sd=1.016 n=100%
(3) GPA: 2.8 - 4.0 Y=4.074 sd=.806 n=27.8%
(2) GPA: 1.2 - 2.7 Y=3.034 sd=.940 n=71.2%
(13) CQT-Q: 25 - 50 Y=4.353 sd=.681 n=16.0%
(12) CQT-Q: 1 - 24 Y=3.698 sd=.809 n=11.8%
(5) Midterm: 26 - 37 Y=3.182 sd=.866 n=60.0%
(4) Midterm: 15 - 25 Y=2.281 sd=913 n=10.7%
*(25) CQT-T: 47 - 50 Y=5.000 sd=.000 n=2.6%=14
(24) CQT-T: 3 - 46 Y=4.225 sd=.675 n=13.3%
*(29) Instructor Risk: 3 - 14 Y=4.345 sd=.639 n=10.3%=55
*(28) Instructor Risk: 0 - 2 Y=3.813 sd=.634 n=3.0%=16
*(21) Midterm: 31 - 38 Y=3.846 sd=.717 n=9.8%=52
*(20) Midterm: 24 - 30 Y=2.900 sd=.831 n=1.9%=10
(6) Midterm: 26 - 31 Y=2.990 sd=.839 n=36.8%
(7) Midterm: 32 - 37 Y=3.488 sd=.820 n=23.1%
(9) Learning Set: 11 - 36 Y=3.085 sd=.760 n=33.1%
*(8) Learning Set: 1 - 10 Y=2.133 sd=.957 n=2.8%=15
(10) Major: code:1,5,7 Y=3.267 sd=.754 n=14.1%
*(11) Major: code:2,3,4,6,8 Y=2.950 sd=.736 n=19.0%=101
(19) CQT-Q: 6 - 48 Y=3.410 sd=.662 n=11.5%
*(18) CQT-Q: 1 - 5 Y=2.643 sd=.811 n=2.6%=14
(32) Eysenck Neurotic: 3 - 9 Y=3.704 sd=.656 n=5.1%
*(33) Eysenck Neurotic: 16 Y=3.176 sd=.567 n=6.4%=34
*(41) CQT-Q: 22 - 47 Y=4.222 sd=.416 n=1.7%=9
*(40) CQT-Q: 6 - 20 Y=3.444 sd=.598 n=3.4%=18
(15) CQT-T: 24 - 48 Y=3.878 sd=.889 n=7.7%
(14) CQT-T: 1 - 23 Y=3.293 sd=.707 n=15.4%
*(31) Pretest: 25 - 33 Y=4.375 sd=.599 n=3.0%=16
(30) Pretest: 18 - 24 Y=3.560 sd=.898 n=4.7%
*(36) Major: code: 3,4,5,8 Y=4.333 sd=.666 n=1.7%=9
*(37) Major: code: 1,2,6,7 Y=3.125 sd=.696 n=3.0%=16
(23) GPA: 2.0 - 2.7 Y=3.351 sd=.660 n=14.5%
*(22) GPA: 1.7 - 1.9 Y=2.400 sd=.800 n=.9%=5
*(26) CQT-V: 1 - 6 Y=3.909 sd=.668 n=2.1%=11
*(27) CQT-V: 7 - 42 Y=3.258 sd=.611 n=12.4%
(17) Eysenck Extravert: 14 - 18 Y=2.667 sd=.720 n=5.1%
(16) Eysenck Extravert: 4 - 13 Y=1.926 sd=.940 n=5.1%
*(39) Midterm: 21 - 25 Y=2.857 sd=.559 n=3.9%=21
*(38) Midterm: 15 - 20 Y=2.000 sd=.816 n=1.1%=6
*(35) Age: code: 3,4,5 Y=2.466 sd=.884 n=2.8%=15
*(34) Age: code: 2 Y=1.250 sd=.433 n=2.3%=12

FIGURE D9

FIGURE D10

AID III: Explanation of Instructor Grade by Final Course Variables

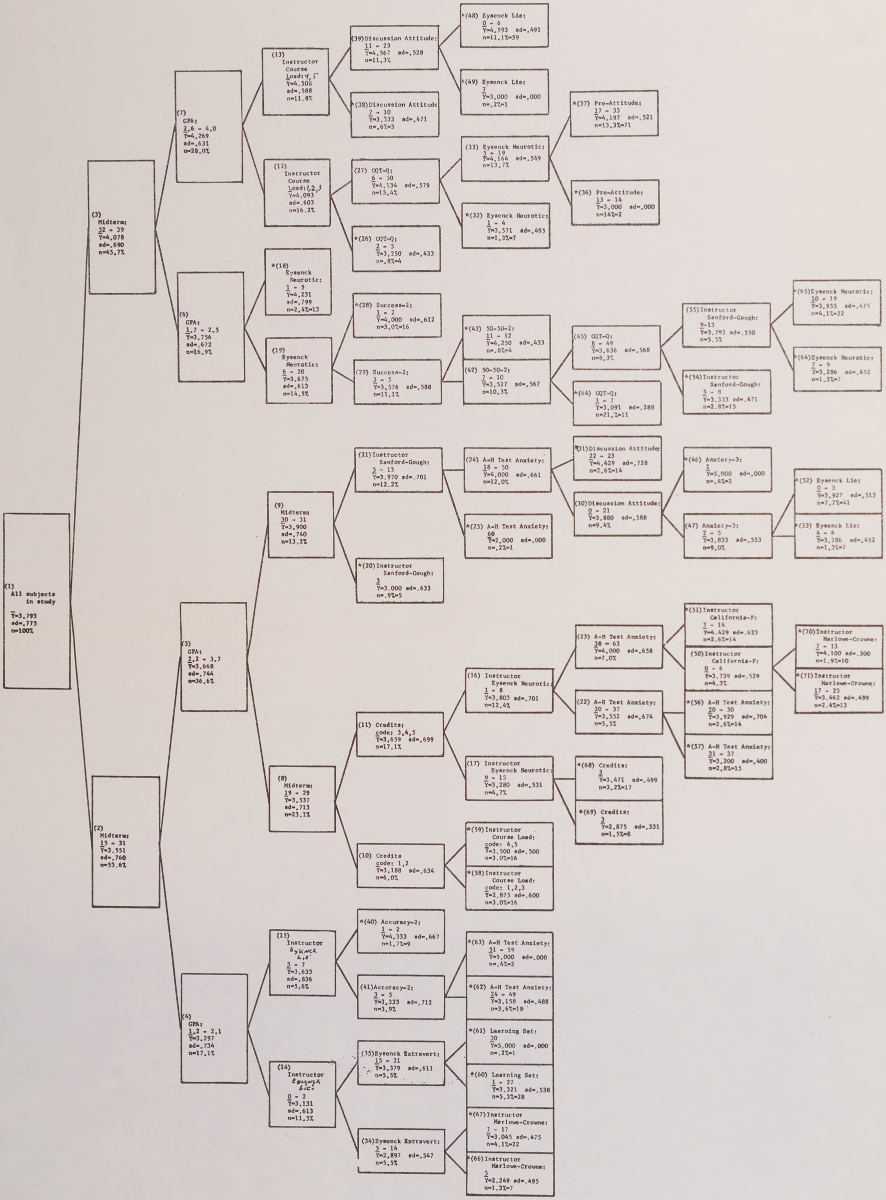

(1) All subjects in study Ȳ=3.793 sd=.775 n=100%
(3) Midterm: 32 - 39 Ȳ=4.078 sd=.690 n=45.7%
(2) Midterm: 15 - 31 Ȳ=3.551 sd=.760 n=53.6%
(7) GPA: 2.6 - 4.0 Ȳ=4.269 sd=.631 n=28.0%
(6) GPA: 1.7 - 2.5 Ȳ=3.756 sd=.672 n=16.9%
(5) GPA: 2.2 - 3.7 Ȳ=3.668 sd=.744 n=36.6%
(4) GPA: 1.2 - 2.1 Ȳ=3.297 sd=.734 n=17.1%
(13) Instructor Course Load: 4,5 Ȳ=4.508 sd=.588 n=11.8%
(12) Instructor Course Load: 1,2,3 Ȳ=4.093 sd=.603 n=16.2%
*(18) Eysenck Neurotic: 1 - 5 Ȳ=4.231 sd=.799 n=2.4%=13
(19) Eysenck Neurotic: 6 - 20 Ȳ=3.675 sd=.613 n=14.5%
(9) Midterm: 30 - 31 Ȳ=3.900 sd=.740 n=13.2%
(8) Midterm: 19 - 29 Ȳ=3.537 sd=.713 n=23.1%
(15) Instructor Eysenck Lie: 3 - 7 Ȳ=3.633 sd=.836 n=5.6%
(14) Instructor Eysenck Lie: 0 - 2 Ȳ=3.131 sd=.613 n=11.5%
(39) Discussion Attitude: 11 - 23 Ȳ=4.567 sd=.528 n=11.3%
*(38) Discussion Attitude: 7 - 10 Ȳ=3.333 sd=.471 n=.6%=3
(27) CQT-Q: 6 - 50 Ȳ=4.134 sd=.579 n=15.4%
*(26) CQT-Q: 2 - 5 Ȳ=3.250 sd=.433 n=.8%=4
*(28) Success-2: 1 - 2 Ȳ=4.000 sd=.612 n=3.0%=16
(29) Success-2: 3 - 5 Ȳ=3.576 sd=.588 n=11.1%
(21) Instructor Sanford-Gough: 5 - 13 Ȳ=3.970 sd=.701 n=12.2%
*(20) Instructor Sanford-Gough: 3 Ȳ=3.000 sd=.633 n=.9%=5
(11) Credits: code: 3,4,5 Ȳ=3.659 sd=.699 n=17.1%
(10) Credits code: 1,2 Ȳ=3.188 sd=.634 n=6.0%
*(40) Accuracy-2: 1 - 2 Ȳ=4.333 sd=.667 n=1.7%=9
(41) Accuracy-2: 3 - 5 Ȳ=3.333 sd=.712 n=3.9%
(35) Eysenck Extravert: 15 - 21 Ȳ=3.379 sd=.611 n=5.5%
(34) Eysenck Extravert: 5 - 14 Ȳ=2.897 sd=.547 n=5.5%
*(48) Eysenck Lie: 0 - 6 Ȳ=4.593 sd=.491 n=11.1%=59
*(49) Eysenck Lie: 7 Ȳ=3.000 sd=.000 n=.2%=1
(33) Eysenck Neurotic: 5 - 19 Ȳ=4.164 sd=.549 n=13.7%
*(32) Eysenck Neurotic: 1 - 4 Ȳ=3.571 sd=.495 n=1.3%=7
*(43) 50-50-2: 11 - 12 Ȳ=4.250 sd=.433 n=.8%=4
(42) 50-50-2: 7 - 10 Ȳ=3.527 sd=.567 n=10.3%
(24) A-H Test Anxiety: 18 - 50 Ȳ=4.000 sd=.661 n=12.0%
*(25) A-H Test Anxiety: 60 Ȳ=2.000 sd=.000 n=.2%=1
(16) Instructor Eysenck Neurotic: 1 - 8 Ȳ=3.803 sd=.701 n=12.4%
(17) Instructor Eysenck Neurotic: 9 - 15 Ȳ=3.280 sd=.531 n=4.7%
*(59) Instructor Course Load: code: 4,5 Ȳ=3.500 sd=.500 n=3.0%=16
*(58) Instructor Course Load: code: 1,2,3 Ȳ=2.875 sd=.600 n=3.0%=16
*(63) A-H Test Anxiety: 51 - 59 Ȳ=5.000 sd=.000 n=.4%=2
*(62) A-H Test Anxiety: 24 - 49 Ȳ=3.158 sd=.488 n=3.6%=19
*(61) Learning Set: 30 Ȳ=5.000 sd=.000 n=.2%=1
*(60) Learning Set: 1 - 27 Ȳ=3.321 sd=.538 n=5.3%=28
*(67) Instructor Marlowe-Crowne: 7 - 17 Ȳ=3.045 sd=.475 n=4.1%=22
*(66) Instructor Marlowe-Crowne: 5 Ȳ=2.249 sd=.495 n=1.3%=7
*(37) Pre-Attitude: 17 - 33 Ȳ=4.197 sd=.521 n=13.3%=71
*(36) Pre-Attitude: 13 - 14 Ȳ=3.000 sd=.000 n=14%=2
(45) CQT-Q: 8 - 49 Ȳ=3.636 sd=.568 n=8.3%
*(44) CQT-Q: 1 - 7 Ȳ=3.091 sd=.288 n=21.%=11
*(31) Discussion Attitude: 22 - 23 Ȳ=4.429 sd=.728 n=2.6%=14
(30) Discussion Attitude: 0 - 21 Ȳ=3.880 sd=.588 n=9.4%
(23) A-H Test Anxiety: 38 - 63 Ȳ=4.000 sd=.658 n=7.0%
(22) A-H Test Anxiety: 20 - 37 Ȳ=3.552 sd=.674 n=5.5%
*(68) Credits: 3 Ȳ=3.471 sd=.499 n=3.2%=17
*(69) Credits: 3 Ȳ=2.875 sd=.331 n=1.5%=8
(55) Instructor Sanford-Gough: 9-13 Ȳ=3.793 sd=.550 n=5.5%
*(54) Instructor Sanford-Gough: 3 - 8 Ȳ=3.333 sd=.471 n=2.8%=15
*(46) Anxiety-3: 1 Ȳ=5.000 sd=.000 n=.4%=2
(47) Anxiety-3: 2 - 5 Ȳ=3.833 sd=.553 n=9.0%
*(51) Instructor California-F: 7 - 14 Ȳ=4.429 sd=.623 n=2.6%=14
(50) Instructor California-F: 0 - 6 Ȳ=3.739 sd=.529 n=4.3%
*(56) A-H Test Anxiety: 20 - 30 Ȳ=3.929 sd=.704 n=2.6%=14
*(57) A-H Test Anxiety: 31 - 37 Ȳ=3.200 sd=.400 n=2.8%=15
*(65) Eysenck Neurotic: 10 - 19 Ȳ=3.955 sd=.475 n=4.1%=22
*(64) Eysenck Neurotic: 7 - 9 Ȳ=3.286 sd=.452 n=1.3%=7
*(52) Eysenck Lie: 0 - 3 Ȳ=3.927 sd=.513 n=7.7%=41
*(53) Eysenck Lie: 4 - 6 Ȳ=3.286 sd=.452 n=1.3%=7
*(70) Instructor Marlowe-Crowne: 7 - 13 Ȳ=4.100 sd=.300 n=1.9%=10
*(71) Instructor Marlowe-Crowne: 17 - 25 Ȳ=3.462 sd=.499 n=2.4%=13

FIGURE D10

FIGURE D11

AID III: Explanation of Final Course Grade by Final Course Variables

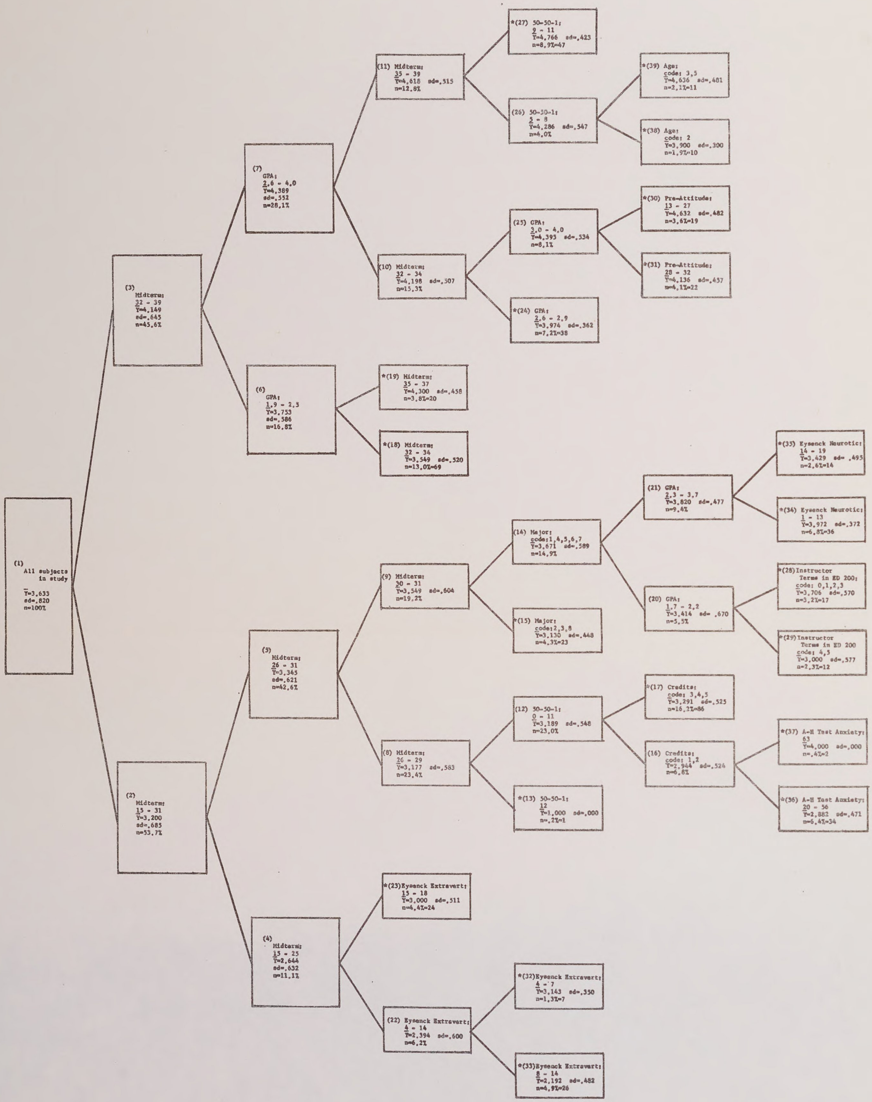

(1) All subjects in study
Ȳ=3,633
sd=,820
n=100%
(3) Midterm: 32 - 39
Ȳ=4,149
sd=,645
n=45,6%
(2) Midterm: 15 - 31
Ȳ=3,200
sd=,685
n=53,7%
(7) GPA: 2,6 - 4,0
Ȳ=4,389
sd=,552
n=28,1%
(6) GPA: 1,9 - 2,5
Ȳ=3,753
sd=,586
n=16,8%
(5) Midterm: 26 - 31
Ȳ=3,345
sd=,621
n=42,6%
(4) Midterm: 15 - 25
Ȳ=2,644
sd=,632
n=11,1%
(11) Midterm: 35 - 39
Ȳ=4,618 sd=,515
n=12,8%
(10) Midterm: 32 - 34
Ȳ=4,198 sd=,507
n=15,3%
*(19) Midterm: 35 - 37
Ȳ=4,300 sd=,458
n=3,8%=20
*(18) Midterm: 32 - 34
Ȳ=3,549 sd=,520
n=13,0%=69
(9) Midterm: 30 - 31
Ȳ=3,549 sd=,604
n=19,2%
(8) Midterm: 26 - 29
Ȳ=3,177 sd=,583
n=23,4%
*(23) Eysenck Extravert: 15 - 18
Ȳ=3,000 sd=,511
n=4,4%=24
(22) Eysenck Extravert: 4 - 14
Ȳ=2,394 sd=,600
n=6,2%
*(27) 50-50-1: 9 - 11
Ȳ=4,766 sd=,423
n=8,9%=47
(26) 50-50-1: 5 - 8
Ȳ=4,286 sd=,547
n=4,0%
(25) GPA: 3,0 - 4,0
Ȳ=4,395 sd=,534
n=8,1%
*(24) GPA: 2,6 - 2,9
Ȳ=3,974 sd=,362
n=7,2%=38
(14) Major: code: 1,4,5,6,7
Ȳ=3,671 sd=,589
n=14,9%
*(15) Major: code: 2,3,8
Ȳ=3,130 sd=,448
n=4,3%=23
(12) 50-50-1: 0 - 11
Ȳ=3,189 sd=,548
n=23,0%
*(13) 50-50-1: 12
Ȳ=1,000 sd=,000
n=,2%=1
*(32) Eysenck Extravert: 4 - 7
Ȳ=3,143 sd=,350
n=1,3%=7
*(33) Eysenck Extravert: 8 - 14
Ȳ=2,192 sd=,482
n=4,9%=26
*(39) Age: code: 3,5
Ȳ=4,636 sd=,481
n=2,1%=11
*(38) Age: code: 2
Ȳ=3,900 sd=,300
n=1,9%=10
*(30) Pre-Attitude: 13 - 27
Ȳ=4,632 sd=,482
n=3,6%=19
*(31) Pre-Attitude: 28 - 32
Ȳ=4,136 sd=,457
n=4,1%=22
(21) GPA: 2,3 - 3,7
Ȳ=3,820 sd=,477
n=9,4%
(20) GPA: 1,7 - 2,2
Ȳ=3,414 sd= ,670
n=5,5%
*(17) Credits: code: 3,4,5
Ȳ=3,291 sd=,525
n=16,2%=86
(16) Credits: code: 1,2
Ȳ=2,944 sd=,524
n=6,8%
*(35) Eysenck Neurotic: 14 - 19
Ȳ=3,429 sd= ,495
n=2,6%=14
*(34) Eysenck Neurotic: 1 - 13
Ȳ=3,972 sd=,372
n=6,8%=36
*(28) Instructor Terms in ED 200: code: 0,1,2,3
Ȳ=3,706 sd=,570
n=3,2%=17
*(29) Instructor Terms in ED 200 code: 4,5
Ȳ=3,000 sd=,577
n=2,3%=12
*(37) A-H Test Anxiety: 63
Ȳ=4,000 sd=,000
n=,4%=2
*(36) A-H Test Anxiety: 20 - 56
Ȳ=2,882 sd=,471
n=6,4%=34

FIGURE D11

APPENDIX E

TABLES E1-E11: PROPORTION OF VARIATION IN EACH OUTCOME BY SUBGROUP WITHIN BRANCH EXPLAINABLE FOR EACH VARIABLE BY PREDICTOR SET

TABLE E1

AID I: Proportion of Variation in Pretest Score by Group within Branch Explainable for Each Entering-Course Variable

Predictor	Group Number											
	1	3	22*	23	26	27	38	39*	56*	57*	66*	67*
Sex	.000	.028		.049	.011	.150	Const.					.002
Age	.003	.004		.004	.061	.046	.044					.029
Major	.023	.121		.041	.025	.050	.107					.019
GPA	.049	.031		.076	.088	.028	.029					.104
CQT-V	.079	.023		.045	.051	.026	.066					.015
CQT-Q	.020	.026		.027	.016	.047	.206					.047
CQT-T	.078	.019		.028	.021	.036	.103					.110
Extraversion	.023	.049	NA	.058	.088	.066	.115	NA	NA	NA	NA	.084
Neuroticism	.010	.045		.032	.065	.090	.140					.103
Eysenck Lie	.017	.013		.039	.073	.048	.167					.073
A-H Test Anxiety	.039	.036		.090	.107	.043	.089					.068
Test Anxiety-1	.008	Const.		Const.	Const.	Const.	Const.					Const.
Learning Set	.032	.034		.028	.250	.043	.134					.090
Reason Enrolled	.027	.056		.070	.042	.094	.106					.008
Pre-attitude	.004	.028		.033	.023	.055	.073					.073
50-50-1 (Asp.-Exp.-1)	.039	.010		.047	.068	.022	.021					.075
N	532	92	11	81	30	51	34	17	17	17	1	29
TSS_i/TSS_T	1.000	.145	.015	.117	.033	.073	.046	.016	.015	.022	.000	.025
MEAN	22.205	24.272	27.182	23.877	25.033	23.196	24.000	21.588	22.706	25.294	32.000	24.793

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E1 (cont'd.)

Predictor	Group Number							
	1	2	5	7	40*	41	50*	51*
Sex	.000	.000	.000	.083		.105		.051
Age	.003	.007	.011	.061		.061		.042
Major	.023	.014	.011	.095		.070		.061
GPA	.049	.028	.024	.036		.033		.097
CQT-V	.079	.050	.013	.083		.028		.017
CQT-Q	.020	.010	.010	.126		.109		.107
CQT-T	.078	.031	.022	.168		.107		.160
Eysenck Ext.	.023	.010	.012	.076	NA	.090	NA	.058
Eysenck Neu.	.010	.007	.006	.035		.044		.032
Eysenck Lie	.017	.020	.014	.120		.176		.008
A-H Test Anx.	.039	.019	.015	.081		.066		.062
Text Anx.-1	.008	.011	.012	.004		.002		.011
Learning Set	.032	.023	.011	.039		.038		.041
Reason Enrol	.027	.017	.021	.013		.028		.032
Pre-attitude	.004	.007	.006	.078		.105		.163
50-50-1	.039	.017	.017	.040		.044		.067
N	532	440	416	65	9	53	12	41
TSS_i/TSS_T	1.000	.776	.705	.072	.004	.054	.008	.037
MEAN	22.205	21.773	21.947	23.092	20.444	23.491	25.417	22.927

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E1 (cont'd.)

Predictor	Group Number												
	1	2	5	6	8	32	33*	44*	45	58*	59	62*	63*
Sex	.000	.000	.000	.001	.000	.018			.012		.001		
Age	.003	.007	.011	.005	.068	.054			.026		.039		
Major	.023	.014	.011	.009	.152	.047			.063		.069		
GPA	.049	.028	.024	.010	.063	.047			.092		.151		
CQT-V	.079	.050	.013	.007	.100	.132			.104		.102		
CQT-Q	.020	.010	.010	.006	.041	.069			.109		.096		
CQT-T	.078	.031	.022	.007	.029	.093			.104		.204		
Eysenck Ext.	.023	.010	.012	.013	.079	.060	NA	NA	.069	NA	.073	NA	NA
Eysenck Neu.	.010	.007	.006	.006	.050	.094			.092		.086		
Eysenck Lie	.017	.020	.014	.012	.047	.045			.050		.070		
A-H Test Anx.	.039	.019	.015	.015	.103	.145			.099		.097		
Text Anx.-1	.008	.011	.012	.014	Const.	Const.			Const.		Const.		
Learning Set	.032	.023	.011	.011	.116	.153			.135		.083		
Reason Enrol	.027	.017	.021	.026	Const.	Const.			Const.		Const.		
Pre-attitude	.004	.007	.006	.013	.097	.093			.125		.094		
50-50-1	.039	.017	.017	.008	.047	.045			.050		.070		
N	532	440	416	351	41	35	6	7	28	2	26	15	11
TSS_i/TSS_T	1.000	.776	.705	.615	.085	.070	.002	.015	.045	.000	.038	.021	.009
MEAN	22.205	21.773	21.947	21.735	23.146	23.714	19.833	21.000	24.393	28.500	24.077	22.933	25.636

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

= Split made on this variable.

xxx = Next best BSS/TSS.

* = Final group.

= Split attempted but not made.

NA = Split not attempted.

TABLE E1 (cont'd.)

TABLE E1 (cont'd.)

Predictor	Group Number																		
	1	2	5	6	9	11	12	13*	14	24	25	42*	43	48	49*	60*	61*	64*	65*
Sex	.000	.000	.000	.001	.001	.000	.003	.000	.002	.050	.000		.001	.014					
Age	.003	.007	.011	.005	.005	.003	.005	.103	.010	.076	.024		.017	.010					
Major	.023	.014	.011	.009	.017	.030	.032	.142	.161	.111	.028		.021	.011					
GPA	.049	.028	.024	.010	.009	.015	.021	.020	.022	.129	.025		.032	.031					
CQT-V	.079	.050	.013	.007	.022	.015	.021	.181	.137	.141	.114		.249	.098					
CQT-Q	.020	.010	.010	.006	.005	.033	.018	.126	.061	.167	.078		.114	.147					
CQT-T	.078	.031	.022	.007	.009	.009	.018	.174	.078	.164	.112		.135	.128					
Extraversion	.023	.010	.012	.013	.012	.010	.014	.120	.033	.298	.118	NA	.044	.165	NA	NA	NA	NA	NA
Neuroticism	.010	.007	.006	.006	.010	.020	.018	.126	.047	.164	.050		.070	.044					
Eysenck Lie	.017	.020	.014	.012	.015	.028	.026	.024	.059	.112	.040		.086	.071					
A-H Test Anxiety	.039	.019	.015	.015	.012	.027	.021	.175	.128	.331	.043		.091	.114					
Test Anxiety-1	.008	.011	.012	.014	.018	.027	.031	Const.	.088	.195	Const.		Const.	Const.					
Learning Set	.032	.023	.011	.011	.013	.020	.027	.126	.030	.094	.087		.029	.071					
Reason Enrolled	.027	.017	.021	.026	.014	.020	.026	.008	.010	.039	.015		.132	.100					
Pre-attitude	.004	.007	.006	.013	.013	.024	.025	.031	.051	.190	.305		.068	.129					
50-50-1 (Asp.-Exp.-1)	.039	.017	.017	.008	.007	.015	.033	.114	.011	.166	.005		.021	.009					
N	532	440	416	351	299	206	184	22	66	23	43	2	41	30	11	14	16	6	17
TSS_i/TSS_T	1.000	.776	.705	.615	.490	.325	.285	.029	.128	.035	.072	.026	.061	.039	.007	.008	.025	.010	.014
MEAN	22.205	21.773	21.947	21.735	21.535	21.801	21.609	23.409	20.864	22.739	19.860	9.120	20.098	21.000	17.636	22.214	19.938	25.667	21.706

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E1 (cont'd.)

TABLE E1 (cont'd.)

Predictor	Group Number																			
	1	2	5	6	9	11	12	13*	15	20	21	28	29*	30	31*	36*	37*	72	73*	74*	75*
Sex	.000	.000	.000	.001	.001	.000	.003	.000	.007	.021	.000	.002		.007		.000		.001		.002	
Age	.003	.007	.011	.005	.005	.003	.005	.103	.020	.081	.020	.020		.019		.029		.086		.073	
Major	.023	.014	.011	.009	.017	.030	.032	.142	.034	.111	.102	.017		.012		.026		.218		.197	
GPA	.049	.028	.024	.010	.009	.015	.021	.020	.044	.139	.059	.045		.054		.059		.188		.278	
CQT-V	.079	.050	.013	.007	.022	.015	.021	.181	.008	.257	.050	.076		.011		.025		.429		.279	
CQT-Q	.020	.010	.010	.006	.005	.033	.018	.126	.010	.021	.011	.019		.033		.032		.021		.115	
CQT-T	.078	.031	.022	.007	.009	.009	.018	.174	.015	.147	.023	.037		.080		.062		.136		.151	
Extravert	.023	.010	.012	.013	.012	.010	.014	.120	.018	.065	.038	.040	NA	.039	NA	.029	NA	.051	NA	.135	NA
Neurotic	.010	.007	.006	.006	.010	.020	.018	.126	.025	.054	.031	.028		.035		.036		.126		.094	
Eys. Lie	.017	.020	.014	.012	.015	.028	.026	.024	.047	.056	.074	.006		.020		.041		.071		.049	
A-H Anx.	.039	.019	.015	.015	.012	.027	.021	.175	.072	.146	.019	.028		.035		.036		.273		.115	
Anx.-1	.008	.011	.012	.014	.018	.027	.031	Const.	.005	Const.	.010	.015		.019		.019		Const.		Const.	
Learn. Set	.032	.023	.011	.011	.013	.020	.027	.126	.036	.305	.028	.025		.036		.090		.428		.044	
Reason	.027	.017	.021	.026	.014	.020	.026	.008	.044	.026	.080	.068		.118		.003		.004		.187	
Pre-att.	.004	.007	.006	.013	.013	.024	.025	.031	.025	.053	.033	.041		.036		.024		.081		.063	
50-50-1	.039	.017	.017	.008	.007	.015	.033	.114	.006	.044	.005	.003		.004		.039		.098		.043	
N	532	440	416	351	299	206	184	22	118	36	82	75	7	71	4	65	6	26	10	24	2
TSS_i/TSS_T	1.000	.776	.705	.615	.490	.325	.285	.029	.148	.030	.107	.085	.012	.076	.002	.063	.004	.016	.005	.009	.000
MEAN	22.205	21.773	21.947	21.735	21.535	21.801	21.609	23.409	22.025	20.917	22.512	22.787	19.571	22.958	19.750	22.692	25.833	20.154	22.900	19.792	24.500

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E1 (cont'd.)

Predictor	Group Number								
	1	2	5	6	9	10	16	54*	55*
Sex	.000	.000	.000	.001	.001	.004	.029		
Age	.003	.007	.011	.005	.005	.016	.069		
Major	.023	.014	.011	.009	.017	.100	.000		
GPA	.049	.028	.024	.010	.009	.029	.215		
CQT-V	.079	.050	.013	.007	.022	.026	.124		
CQT-Q	.020	.010	.010	.006	.005	.074	.366		
CQT-T	.078	.031	.022	.007	.009	.066	.071		
Eysenck Extraversion	.023	.010	.012	.013	.012	.024	.111	NA	NA
Eysenck Neuroticism	.010	.007	.006	.006	.010	.086	.155		
Eysenck Lie Scale	.017	.020	.014	.012	.015	.014	.046		
A-H Test Anxiety	.039	.019	.015	.015	.012	.050	.012		
Test Anxiety-1	.008	.011	.012	.014	.018	.001	Const.		
Learning Set	.032	.023	.011	.011	.013	.056	.079		
Reason Enrolled	.027	.017	.021	.026	.014	.031	.018		
Pre-attitude	.004	.007	.006	.013	.013	.017	.111		
50-50-1 (Asp.-Exp.)	.039	.017	.017	.008	.007	.040	.347		
N	532	440	416	351	299	93	25	15	10
TSS_i/TSS_T	1.000	.776	.705	.615	.490	.229	.050	.027	.005
MEAN	22.205	21.773	21.947	21.735	21.535	20.721	22.680	24.400	20.100

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

= Split made on this variable.

.xxx = Next best BSS/TSS.

* = Final group.

= Split attempted but not made.

NA = Split not attempted.

TABLE E1 (cont'd.)

TABLE E1 (cont'd.)

Predictor	Group Number 1	2	5	6	9	10	17	18	19	34*	35*	46*	47	52	53*	70*	71*
Sex	.000	.000	.000	.001	.001	.004	.005	.103	.023	.005			.064	.040			039
Age	.003	.007	.011	.005	.005	.016	.016	.008	.134	.176			.002	.004			.011
Major	.023	.014	.011	.009	.017	.100	.033	.157	.169	.261			.131	.013			.025
GPA	.049	.028	.024	.010	.009	.029	.012	.036	.039	.203			.105	.192			.162
CQT-V	.079	.050	.013	.007	.022	.026	.072	.035	.362	.059			.019	.021			.068
CQT-Q	.020	.010	.010	.006	.005	.074	.029	.114	.056	.251			.111	.064			.068
CQT-T	.078	.031	.022	.007	.009	.066	.081	.114	.089	.211			.079	.127			.126
Extraversion	.023	.010	.012	.013	.012	.024	.027	.068	.172	.252	NA	NA	.041	.199	NA	NA	.190
Neuroticism	.010	.007	.006	.006	.010	.086	.088	.055	.192	.159			.061	.288			.033
Eysenck Lie	.017	.020	.014	.012	.015	.014	.048	.049	.072	.148			.035	.114			.128
A-H Test Anxiety	.039	.019	.015	.015	.012	.050	.036	.074	.058	.157			.070	.126			.059
Test Anxiety-1	.008	.011	.012	.014	.018	.001	.004	.004	Const.	Const.			.003	Const.			Const.
Learning Set	.032	.023	.011	.011	.013	.056	.069	.207	.055	.122			.110	.116			.127
Reason Enrolled	.027	.017	.021	.026	.014	.031	.036	.150	.025	.119			.128	.126			.091
Pre-attitude	.004	.007	.006	.013	.013	.017	.031	.042	.030	.211			.029	.034			.068
50-50-1 (Asp.-Exp.-1)	.039	.017	.017	.008	.007	.040	.039	.071	.119	.041			.083	.143			.157
N	532	440	416	351	299	93	68	44	24	20	4	1	43	25	18	1	24
TSS_i/TSS_T	1.000	.776	.705	.615	.490	.229	.157	.064	.079	.015	.035	.000	.051	.031	.013	.000	.022
MEAN	22.205	21.773	21.947	21.735	21.535	20.721	20.001	20.818	18.502	19.700	12.513	12.000	21.023	21.840	19.889	29.000	21.542

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E1 (cont'd.)

Predictor	Group Number				
	1	2	4	68*	69*
Sex	.000	.000	.003		
Age	.003	.007	.010		
Major	.023	.014	.318		
GPA	.049	.028	.120		
CQT-V	.079	.050	.049		
CQT-Q	.020	.010	.096		
CQT-T	.078	.031	.084		
Eysenck Extraversion	.023	.010	.088	NA	NA
Eysenck Neuroticism	.010	.007	.261		
Eysenck Lie	.017	.020	.159		
A-H Test Anxiety	.039	.019	.137		
Test Anxiety-1	.008	.011	Cons.		
Learning Set	.032	.023	.371		
Reason Enrolled	.027	.017	.159		
Pre-attitude	.004	.007	.125		
50-50-1 (Asp.-Exp.)	.039	.017	.117		
N	532	440	24	15	9
TSS_i/TSS_T	1.000	.776	.033	.011	.010
MEAN	22.205	21.773	18.750	17.400	21.000

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.
.xxx =Next best BSS/TSS.
* =Final group.
↴ =Split attempted but not made.
NA =Split not attempted.

TABLE E2

AID I: Proportion of Variation in Course Grade by Group within Branch Explainable for Each Entering-Course Variable

The BSS/TSS for each entering-course variable over each subgroup formed in the analysis of final course grade by entering-course variables appears in chapter four, pages 158 to 161.

TABLE E3

AID II: Proportion of Variation in Midterm Exam Score by Group within Branch Explainable for Each Mid-Course Variable

Predictor	Group Number									
	1	3	22	23	38*	39*	50	51*	56*	57*
Sex	.011	.000	.019	.015	.032	.020	.032	.003		
Age	.007	.007	.009	.036	.037	.044	.006	.132		
Major	.017	.060	.195	.025	.142	.048	.296	.194		
Credits	.015	.021	.136	.042	.191	.038	.190	.200		
Current Load	.010	.044	.028	.006	.004	.009	.037	.096		
GPA	.187	.042	.023	.024	.059	.028	.040	.260		
CQT-V	.076	.073	.056	.100	.219	.018	.057	.107		
CQT-Q	.040	.037	.217	.022	.100	.040	.106	.226		
CQT-T	.069	.070	.177	.063	.048	.029	.263	.098		
Eysenck Extraversion	.013	.025	.079	.031	.041	.028	.063	.387		
Eysenck Neuroticism	.007	.009	.070	.012	.062	.032	.195	.121		
Eysenck Lie	.016	.034	.026	.042	.209	.077	.030	.166		
A-H Test Anxiety	.059	.022	.025	.013	.069	.017	.143	.216	NA	NA
Test Anxiety-1	.003	.007	.010	.014	Const.	.016	Const.	.002		
Test Anxiety-2	.014	.051	.136	.092	.246	.042	.190	.021		
Learning Set	.046	.065	.177	.046	.073	.039	.263	.066		
Reason Enrolled	.004	.024	.042	.050	.161	.044	.025	.165		
Pre-attitude	.007	.041	.093	.050	.098	.064	.127	.116		
50-50-1 (Asp.-Exp.)	.058	.054	.031	.060	.144	.043	.058	.083		
Pretest	.090	.103	.020	.021	.068	.019	.054	.107		
Instructor:Eysenck Ext.	.010	.009	.075	.032	.061	.065	.058	.108		
Instructor:Eysenck Neu.	.008	.011	.013	.018	.115	.025	.083	.073		
Instructor:Marlowe-Cne.	.007	.021	.047	.050	.121	.092	.141	.125		
Instructor:Sanford-Ggh.	.009	.004	.059	.016	.022	.036	.065	.386		
Instructor:California-F	.013	.027	.094	.085	.100	.108	.063	.385		
Instructor:Risk	.011	.006	.094	.051	.100	.045	.063	.385		
N	532	148	41	106	26	80	21	20	4	17
TSS_i/TSS_T	1.000	.129	.044	.072	.019	.046	.021	.013	.001	.013
MEAN	30.716	33.534	32.098	34.075	32.731	34.513	30.714	33.550	34.000	29.941

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→=Split made on this variable. *=Final group. NA=Split not attempted.

xxx=Next best BSS/TSS. ↓=Split attempted but not made.

TABLE E3 (cont'd.)

TABLE E3 (cont'd.)

Predictor	Group Number																	
	1	2	5	6	10*	11	12*	13	14	15	24	25*	26*	27*	36*	37	44*	45*
Sex	.001	.015	.004	.002		.007		.006	.013	.057	.014			.009		.103		Const.
Age	.007	.007	.020	.025		.024		.025	.026	.048	.016			.013		.024		.004
Major	.017	.016	.037	.050		.038		.046	.009	.001	.001			.009		.023		.010
Credits	.015	.002	.005	.018		.012		.010	.009	.024	.016			.021		.038		.059
Current Load	.010	.005	.007	.003		.005		.008	.004	.012	.013			.018		.032		.006
GPA	.187	.046	.052	.039		.046		.016	.012	.020	.021			.026		.014		.087
CQT-V	.076	.032	.037	.031		.017		.011	.018	.093	.022			.024		.047		.082
CQT-Q	.040	.026	.030	.045		.024		.029	.067	.106	.033			.041		.046		042
CQT-T	.069	.028	.040	.056		.016		.011	.027	.046	.039			.046		.056		.053
Extraversion	.013	.005	.007	.011		.008		.011	.053	.084	.061			.018		.098		.067
Neuroticism	.007	.007	.042	.046		.039		.033	.033	.024	.033			.027		.038		.059
Eysenck Lie	.016	.018	.009	.008		.011		.013	.016	.094	.023			.022		.074		081
A-H Test Anxiety	.059	.049	.062	.016	NA	.015	NA	.015	.032	.035	.030	NA	NA	.026	NA	.029	NA	.122
Test Anxiety-1	.003	.001	.002	.004		.004		.005	.012	Const.	.014			.016		Const.		Const.
Test Anxiety-2	.014	.007	.013	.003		.001		.001	.006	.048	.010			.007		.082		.011
Learning Set	.046	.035	.032	.021		.021		.020	.027	.035	.028			.029		.014		081
Reason Enrolled	.004	.006	.014	.009		.007		.005	.009	.024	.006			.005		.038		.059
Pre-attitude	.007	.009	.011	.015		.017		.017	.031	.066	.020			.014		.057		.038
50-50-1 (Asp.-Exp.-1)	.058	.017	.031	.049		.026		.030	.013	.116	.012			.012		.063		.026
Pretest	.090	.065	.004	.005		.005		.005	.009	.027	.007			.010		.029		.016
Instructor Extraversion	.010	.018	.009	.007		.009		.011	.042	.022	.045			.051		.010		.010
Instructor Neuroticism	.008	.015	.007	.007		.008		.010	.035	.067	.045			.050		.077		.042
Instructor Marlowe-Crowne	.007	.014	.006	.004		.004		.007	.011	.019	.022			.015		.046		.042
Instructor Sanford-Gough	.009	.016	.021	.018		.011		.006	.022	.032	.033			.040		.011		.014
Instructor California-F	.013	.018	.015	.010		.011		.019	.032	.089	.026			.031		.077		.031
Instructor Risk	.011	.012	.017	.016		.020		.007	.036	.014	.048			.055		.004		.015
N	532	384	238	190	7	183	4	179	121	58	115	6	1	114	4	54	8	46
TSS_i/TSS_T	1.000	.684	.357	.251	.010	.228	.002	.215	.125	080	.114	.003	.000	.107	.010	.060	.008	.046
MEAN	30.716	29.630	30.357	30.811	26.714	30.967	26.250	31.073	31.554	30.069	31.730	28.167	24.000	31.798	25.750	30.389	28.000	30.804

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E3 (cont'd.)

Predictor	Group Number							
	1	2	5	7	34*	35	48*	49*
Sex	.011	.015	.009	.080		.129		
Age	.007	.007	.020	.018		.060		
Major	.017	.016	.037	.258		.122		
Credits	.015	.002	.005	.032		.092		
Current Load	.010	.005	.007	.005		.014		
GPA	.187	.046	.052	.103		.097		
CQT-V	.076	.032	.037	.109		.080		
CQT-Q	.040	.026	.030	.048		.061		
CQT-T	.069	.028	.040	.062		.039		
Eysenck Ext.	.013	.005	.007	.081		.150		
Eysenck Neu.	.007	.007	.042	.240		.225		
Eysenck Lie	.016	.018	.009	.056		.016		
A-H Test Anx.	.059	.049	.062	.019		.127	NA	NA
Test Anx.-1	.003	.001	.002	Cons.		Cons.		
Test Anx.-2	.014	.007	.013	.023		.055		
Learning Set	.046	.035	.032	.117		.226		
Reason Enrolled	.004	.006	.014	.021		.021		
Pre-attitude	.007	.009	.011	.092		.073		
50-50-1	.058	.017	.031	.037		.144		
Pretest	.090	.065	.004	.015		.151		
Inst. Eys. Ext.	.010	.018	.009	.034		.071		
Inst. Eys. Neu.	.008	.015	.007	.027		.043		
Inst. Marlowe-Cne.	.007	.014	.006	.092		.026		
Inst. Sanford-Ggh.	.009	.016	.021	.030		.069		
Inst. California-F	.013	.018	.015	.044		.121		
Inst. Risk	.011	.012	.017	.074		.121		
N	532	384	190	48	18	30	7	19
TSS_i/TSS_T	1.000	.684	.251	.083	.014	.048	.009	.027
MEAN	30.716	29.630	30.811	28.563	31.111	27.033	24.143	28.368

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA = Split not attempted.

TABLE E3 (cont'd.)

TABLE E3 (cont'd.)

Predictor	Group Number															
	1	2	4	8	16	17*	18*	19	20	21*	28*	29	30	31*	40*	41*
Sex	.011	.015	.014	.000	.000			.005	.000			.000	.006		.124	
Age	.007	.007	.012	.001	.001			.000	.003			.009	.027		.196	
Major	.017	.016	.075	.011	.017			.024	.004			.009	.021		.117	
Credits	.015	.002	.001	.005	.007			.007	.006			.009	.022		.047	
Current Load	.010	.005	.011	.014	.032			.028	.006			.005	.023		.061	
GPA	.187	.046	.040	.024	.017			.028	.017			.008	.067		.061	
CQT-V	.076	.032	.033	.083	.046			.076	.066			.053	.067		.075	
CQT-Q	.040	.026	.048	.026	.023			.033	.043			.040	.062		.098	
CQT-T	.069	.028	.023	.062	.048			.037	.032			.030	.058		.119	
Extraversion	.013	.005	.008	.008	.010			.022	.016			.011	.037		.080	
Neuroticism	.007	.007	.022	.036	.025			.035	.040			.030	.032		.061	
Eysenck Lie	.016	.018	.064	.044	.050			.041	.053			.072	.011		.031	
A-H Test Anxiety	.059	.049	.034	.034	.022	NA	NA	.024	.043	NA	NA	.040	.123	NA	.050	NA
Test Anxiety-1	.003	.001	.009	.010	.013			.017	.018			.018	.019		Const.	
Test Anxiety-2	.014	.007	.005	.014	.012			.017	.029			.029	.058		.087	
Learning Set	.046	.035	.024	.040	.026			.038	.038			.030	.027		.081	
Reason Enrolled	.004	.006	.004	.000	.001			.006	.014			.022	.046		.092	
Pre-attitude	.007	.009	.021	.025	.024			.022	.034			.034	.042		.135	
50-50-1 (Asp.-Exp.-1)	.058	.017	.009	.029	.036			.021	.023			.019	.053		.032	
Pretest	.090	.065	.022	.020	.016			.031	.068			.020	.028		.119	
Instructor Extraversion	.010	.018	.047	.078	.098			.014	.008			.019	.016		.021	
Instructor Neuroticism	.008	.015	.031	.023	.022			.005	.020			.025	.028		.071	
Instructor Marlowe-Crowne	.007	.014	.021	.036	.059			.036	.034			.017	.044		.034	
Instructor Sanford-Gough	.009	.016	.012	.010	.020			.009	.037			.042	.076		.098	
Instructor California-F	.013	.018	.035	.032	.026			.017	.037			.045	.096		.098	
Instructor Risk	.011	.012	.014	.019	.040			.027	.037			.049	.069		.098	
N	532	384	138	86	82	4	7	75	68	7	4	64	48	16	29	19
TSS_i/TSS_T	1.000	.684	.271	.166	.151	.001	.003	.134	.107	.016	.005	.095	.067	.021	.022	.037
MEAN	30.716	29.630	28.283	29.163	28.902	34.500	33.000	28.520	28.868	25.143	25.000	29.109	29.667	27.438	30.655	28.158

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E3 (cont'd.)

TABLE E3 (cont'd.)

Predictor	Group Number													
	1	2	4	9	32	33*	42	43*	46	47*	52	53*	54*	55*
Sex	.011	.015	.014	.025	.005		.006		.001		.051			
Age	.007	.007	.012	.089	.155		.046		.051		.101			
Major	.017	.016	.075	.023	.045		.054		.033		.005			
Credits	.015	.002	.001	.012	.009		.040		.033		.016			
Current Load	.010	.005	.011	.018	.022		.040		.016		.015			
GPA	.187	.046	.040	.028	.041		.055		.068		.151			
CQT-V	.076	.032	.033	.021	.040		.067		.033		.076			
CQT-Q	.040	.026	.048	.274	.028		.055		.094		.100			
CQT-T	.069	.028	.023	.039	.025		.057		.039		.062			
Extraversion	.013	.005	.008	.048	.033		.023		.070		.127			
Neuroticism	.007	.007	.022	.105	.040		.098		.096		.082			
Eysenck Lie	.016	.018	.064	.096	.067		.067		.078		.198			
A-H Test Anxiety	.059	.049	.034	.102	.084	NA	.154	NA	.097	NA	.208	NA	NA	NA
Test Anxiety-1	.003	.001	.009	Const.	Const.		Const.		Const.		Const.			
Test Anxiety-2	.014	.007	.005	.020	.007		.006		.028		.014			
Learning Set	.046	.035	.024	.038	.046		.048		.048		.043			
Reason Enrolled	.004	.006	.004	.017	.004		.055		.044		.020			
Pre-attitude	.007	.009	.021	.096	.088		.170		.221		.403			
50-50-1 (Asp.-Exp.-1)	.058	.017	.009	.017	.032		.059		.092		.093			
Pretest	.090	.065	.022	.076	.147		.151		.095		.020			
Instructor Extraversion	.010	.018	.047	.099	.107		.195		.047		.056			
Instructor Neuroticism	.008	.015	.031	.046	.114		.155		.057		.032			
Instructor Marlowe-Crowne	.007	.014	.021	.034	.079		.152		.191		.063			
Instructor Sanford-Gough	.009	.016	.012	.037	.049		.095		.244		.060			
Instructor California-F	.013	.018	.035	.098	.073		.157		.191		.030			
Instructor Risk	.011	.012	.014	.044	.048		.088		.191		.058			
N	532	384	138	52	50	2	45	5	35	10	24	11	13	11
TSS_i/TSS_T	1.000	.684	.271	.084	.060	.001	.049	.002	.033	.006	.022	.003	.005	.008
MEAN	30.716	29.630	28.283	26.827	27.220	17.000	27.644	23.400	28.371	25.100	29.333	26.273	27.692	31.273

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E4

AID II: Proportion of Var. in Midterm Grade by Group within Branch Explainable for Each Mid-Course Variable

Predictor	Group Number													
	1	3	12	13	38*	39	42*	43*	48	49	58*	59*	62*	63*
Sex	.004	.007	.038	.014		.005	.004		.085	.009				
Age	.006	.020	.000	.104		.001	.048		.001	.033				
Major	.012	.085	.167	.024		.109	.040		.184	.046				
Credits	.015	.021	.107	.037		.122	.030		.194	.174				
Current Load	.007	.007	.015	.005		.026	.000		.028	.046				
GPA	.195	.051	.034	.021		.034	.032		.353	.033				
CQT-V	.058	.065	.024	.056		.075	.058		.227	.044				
CQT-Q	.037	.025	.084	.046		.107	.050		.221	.088				
CQT-T	.053	.069	.048	.032		.134	.018		.381	.219				
Eysenck Extraversion	.011	.016	.026	.013		.112	.020		.184	.216				
Eysenck Neuroticism	.007	.006	.043	.021		.093	.046		.120	.132				
Eysenck Lie	.014	.039	.029	.075		.026	.050		.136	.074				
A-H Test Anxiety	.047	.030	.040	.011	NA	.031	.043	NA	.073	.216	NA	NA	NA	NA
Test Anxiety-1	.003	.010	.021	.005		.000	.005		.000	.000				
Test Anxiety-2	.010	.052	.109	.063		.123	.063		.184	.047				
Learning Set	.037	.061	.108	.030		.159	.042		.184	.063				
Reason Enrolled	.007	.019	.024	.080		.034	.064		.173	.021				
Pre-attitude	.006	.024	.071	.076		.042	.083		.173	.097				
50-50-1 (Asp.-Exp.)	.065	.060	.029	.037		.030	.124		.038	.021				
Pretest	.084	.113	.031	.011		.068	.020		.024	.366				
Instructor: Eysenck Ext.	.004	.004	.027	.007		.053	.016		.159	.079				
Instructor: Eysenck Neu.	.008	.012	.025	.015		.053	.016		.159	.097				
Instructor: Marlowe-Cne.	.003	.010	.027	.024		.026	.019		.110	.063				
Instructor: Sanford-Ggh.	.005	.003	.040	.021		.004	.045		.112	.127				
Instructor: California-F	.013	.027	.027	.041		.029	.082		.061	.127				
Instructor: Risk	.007	.016	.020	.063		.022	.043		.197	.195				
N	532	148	63	84	19	44	75	9	21	23	16	5	4	19
TSS_i/TSS_T	1.000	.157	.075	.063	.009	.054	.046	.011	.024	.021	.013	.002	.001	.012
MEAN	3.662	4.378	4.079	4.595	4.579	3.864	4.667	4.000	3.524	4.174	3.250	4.400	3.250	4.368

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable. *=Final group. NA=Split not attempted.

xxx =Next best BSS/TSS. =Split attempted but not made.

TABLE E4 (cont'd.)

Predictor	Group Number							
	1	2	5	7	20*	21	26*	27*
Sex	.004	.008	.008	.004		.014	.003	.010
Age	.006	.006	.015	.030		.037	.030	.076
Major	.012	.019	.018	.074		.054	.120	.100
Credits	.015	.002	.004	.002		.001	.009	.010
Current Load	.007	.004	.004	.012		.017	.051	.020
GPA	.195	.038	.030	.031		.026	.061	.081
CQT-V	.058	.009	.008	.031		.063	.152	.037
CQT-Q	.037	.019	.018	.042		.062	.135	.101
CQT-T	.053	.007	.012	.023		.004	.109	.015
Eysenck Extraversion	.011	.007	.010	.012		.017	.164	.108
Eysenck Neuroticism	.007	.015	.059	.031		.024	.023	.055
Eysenck Lie	.014	.013	.004	.031		.026	.068	.020
A-H Test Anxiety	.047	.030	.031	.042	NA	.067	.082	.067
Test Anxiety-1	.003	.001	.002	.012		.017	.000	.020
Test Anxiety-2	.010	.002	.003	.025		.022	.009	.054
Learning Set	.037	.023	.017	.031		.032	.059	.111
Reason Enrolled	.007	.006	.009	.040		.026	.064	.049
Pre-attitude	.006	.009	.011	.033		.034	.098	.041
50-50-1 (Asp.-Exp.)	.065	.016	.030	.118		.022	.030	.038
Pretest	.084	.056	.003	.010		.020	.069	.063
Instructor: Eys. Ext.	.004	.010	.003	.051		.050	.084	.059
Instructor: Eys. Neu.	.008	.012	.010	.041		.055	.084	.059
Instructor: Marlowe-Cne.	.003	.008	.006	.034		.051	.084	.039
Instructor: Sanford-Ggh.	.005	.004	.008	.015		.024	.084	.059
Instructor: California-F	.013	.014	.011	.027		.047	.059	.024
Instructor: Risk	.007	.004	.006	.039		.083	.059	.090
N	532	384	238	80	2	77	28	49
TSS_i/TSS_T	1.000	.649	.382	.116	.004	.097	.036	.054
MEAN	3.662	3.385	3.550	3.875	2.000	3.935	4.250	3.755

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E4 (cont'd.)

Predictor	Group Number							
	1	2	5	6	8	14*	15	18*
Sex	.004	.004	.008	.004	.002		.003	
Age	.006	.006	.015	.017	.016		.014	
Major	.012	.019	.018	.055	.024		.009	
Credits	.015	.002	.004	.005	.022		.028	
Current Load	.007	.004	.004	.002	.012		.010	
GPA	.195	.038	.030	.031	.024		.019	
CQT-V	.058	.009	.008	.012	.055		.064	
CQT-Q	.037	.019	.018	.028	.066		.038	
CQT-T	.053	.007	.012	.009	.019		.021	
Eysenck Extraversion	.011	.007	.010	.024	.043		.041	
Eysenck Neuroticism	.007	.015	.059	.020	.075		.058	
Eysenck Lie	.014	.013	.004	.019	.061		.056	
A-H Test Anxiety	.047	.030	.031	.029	.027	NA	.014	NA
Test Anxiety-1	.003	.001	.002	.003	.002		.003	
Test Anxiety-2	.010	.002	.003	.003	.013		.020	
Learning Set	.037	.023	.017	.033	.067		.059	
Reason Enrolled	.007	.006	.009	.004	.011		.017	
Pre-attitude	.006	.009	.011	.020	.083		.033	
50-50-1 (Asp.-Exp.)	.065	.016	.030	.012	.033		.041	
Pretest	.084	.056	.003	.002	.032		.035	
Instructor: Eys. Ext.	.004	.010	.003	.028	.029		.021	
Instructor: Eys. Neu.	.008	.012	.010	.010	.014		.016	
Instructor: Marlowe-Cne.	.003	.008	.006	.005	.017		.014	
Instructor: Sanford-Ggh.	.005	.004	.008	.017	.027		.024	
Instructor: California-F	.013	.014	.011	.010	.027		.031	
Instructor: Risk	.007	.004	.006	.008	.027		.024	
N	532	384	238	153	79	3	76	2
TSS_i/TSS_T	1.000	.649	.382	.238	.135	.000	.123	.000
MEAN	3.662	3.385	3.550	3.399	3.608	5.000	3.553	5.000

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E4 (cont'd.)

TABLE E4 (cont'd.)

Predictor	Group Number																	
	1	2	5	6	8	15	19	22*	23	24*	25	32*	33	40	41*	52	53*	54*	55*
Sex	.004	.008	.008	.004	.002	.003	.005		.000		.001		.017	.053		.015			.061
Age	.006	.006	.015	.017	.016	.014	.013		.019		.010		.016	.041		.083			.002
Major	.012	.019	.018	.055	.024	.009	.011		.032		.069		.047	.095		.157			.015
Credits	.015	.002	.004	.005	.022	.028	.032		.032		.038		.052	.098		.119			.111
Current Load	.007	.004	.004	.002	.012	.010	.018		.025		.021		.009	.026		.024			.023
GPA	.195	.038	.030	.031	.024	.019	.018		.026		.027		.093	.088		.098			.080
CQT-V	.058	.009	.008	.012	.055	.064	.018		.025		.052		.123	.199		.024			.038
CQT-Q	.037	.019	.018	.028	.066	.038	.064		.087		.016		.026	.027		.024			.032
CQT-T	.053	.007	.012	.009	.019	.021	.015		.020		.060		.055	.081		.068			.058
Extraversion	.011	.007	.010	.024	.043	.041	.039		.052		.070		.113	.060		.082			.143
Neuroticism	.007	.015	.059	.020	.075	.058	.067		.068		.081		.100	.105		.074			.111
Eysenck Lie	.014	.013	.004	.019	.061	.056	.059		.051		.093		.085	.107		.144			.153
A-H Test Anxiety	.047	.030	.031	.029	.027	.014	.016	NA	.039	NA	.100	NA	.055	.114	NA	.107	NA	NA	.103
Test Anxiety-1	.003	.001	.002	.003	.002	.003	.004		.003		.002		.005	.002		.006			.011
Test Anxiety-2	.010	.002	.003	.003	.013	.020	.028		.034		.034		.044	.026		.039			.023
Learning Set	.037	.023	.017	.033	.067	.059	.054		.076		.080		.055	.075		.093			.130
Reason Enrolled	.007	.006	.009	.004	.011	.017	.008		.012		.007		.016	.129		.191			.138
Pre-attitude	.006	.009	.011	.020	.083	.033	.023		.012		.045		.036	.040		.077			.023
50-50-1 (Asp.-Exp.-1)	.065	.016	.030	.012	.033	.041	.039		.047		.070		.071	.054		.040			.018
Pretest	.084	.056	.003	.002	.032	.035	.045		.038		.019		.054	.090		.158			.061
Inst. Extraversion	.004	.010	.003	.028	.029	.021	.032		.012		.021		.019	.046		.024			.039
Inst. Neuroticism	.008	.012	.010	.010	.014	.016	.013		.019		.045		.027	.040		.049			.032
Inst. Marlowe-Crowne	.003	.008	.006	.005	.017	.014	.008		.010		.026		.006	.061		.021			.018
Inst. Sanford-Gough	.005	.004	.008	.017	.027	.024	.071		.010		.029		.011	.090		.018			.050
Inst. California-F	.013	.014	.011	.010	.027	.031	.070		.035		.031		.022	.077		.093			.130
Inst. Risk	.007	.004	.006	.008	.027	.024	.069		.020		.029		.027	.026		.024			.023
N	532	384	238	153	79	76	74	4	70	9	61	6	55	37	18	34	3	2	32
TSS_i/TSS_T	1.000	.649	.382	.238	.135	.123	.115	.006	.102	.009	.084	.006	.070	.045	.016	.036	.000	.000	.029
MEAN	3.662	3.385	3.550	3.399	3.608	3.553	3.514	2.500	2.571	2.889	3.672	4.500	3.582	3.784	3.167	3.676	5.000	5.000	3.594

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↲ =Split attempted but not made.

NA=Split not attempted.

TABLE E4 (cont'd.)

Predictor	Group Number								
	1	2	5	6	9	28*	29	36*	37*
Sex	.004	.008	.008	.004	.006		.121	.005	.042
Age	.006	.006	.015	.017	.052		.031	.051	.030
Major	.012	.019	.018	.055	.030		.030	.129	.063
Credits	.015	.002	.004	.005	.013		.006	.021	.177
Current Load	.007	.004	.004	.002	.003		.007	.031	.056
GPA	.195	.038	.030	.031	.062		.080	.097	.050
CQT-V	.058	.009	.008	.012	.009		.035	.029	.114
CQT-Q	.037	.019	.018	.028	.017		.027	.038	.095
CQT-T	.053	.007	.012	.009	.046		.038	.027	.114
Eysenck Extraversion	.011	.007	.010	.024	.061		.057	.073	.183
Eysenck Neuroticism	.007	.015	.059	.020	.089		.019	.070	.045
Eysenck Lie	.014	.013	.014	.019	.016		.006	.052	.177
A-H Test Anxiety	.047	.030	.031	.029	.038	NA	.032	.064	.068
Test Anxiety-1	.003	.001	.002	.003	.000		.000	.000	.000
Test Anxiety-2	.010	.002	.003	.003	.034		.061	.075	.008
Learning Set	.037	.023	.017	.033	.041		.046	.080	.099
Reason Enrolled	.007	.006	.009	.004	.000		.018	.001	.018
Pre-attitude	.006	.009	.011	.020	.059		.100	.017	.014
50-50-1 (Asp.-Exp.)	.065	.016	.030	.012	.034		.030	.018	.018
Pretest	.084	.056	.003	.002	.024		.010	.020	.086
Instructor: Eysenck Ext.	.004	.010	.003	.028	.013		.019	.015	.177
Instructor: Eysenck Neu.	.008	.012	.010	.010	.029		.036	.078	.182
Instructor: Marlowe-Crowne	.003	.008	.006	.005	.037		.046	.075	.045
Instructor: Sanford-Gough	.005	.004	.008	.017	.023		.039	.047	.045
Instructor: California-F	.013	.014	.011	.010	.053		.058	.078	.163
Instructor: Risk	.007	.004	.006	.008	.044		.043	.110	.068
N	532	384	238	153	74	7	67	43	24
TSS_i/TSS_T	1.000	.649	.382	.238	.090	.007	.075	.046	.022
MEAN	3.662	3.385	3.550	3.399	3.176	2.429	3.254	3.070	3.583

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable. *=Final group. NA=Split not attempted.

.xxx=Next best BSS/TSS. =Split attempted but not made.

TABLE E4 (cont'd.)

Predictor	Group Number										
	1	2	4	10	16	30	31*	46	47*	60*	61*
Sex	.004	.008	.001	.001	.000	.009		.000	.035		
Age	.006	.006	.012	.002	.014	.038		.032	.062		
Major	.012	.019	.060	.016	.028	.122		.015	.040		
Credits	.015	.002	.002	.005	.024	.010		.189	.043		
Current Load	.007	.004	.003	.001	.010	.010		.090	.010		
GPA	.195	.038	.037	.054	.106	.112		.189	.056		
CQT-V	.058	.009	.022	.049	.047	.052		.218	.070		
CQT-Q	.037	.019	.033	.035	.049	.090		.097	.115		
CQT-T	.053	.007	.026	.033	.026	.057		.372	.047		
Eysenck Ext.	.011	.007	.012	.010	.051	.062		.090	.032		
Eysenck Neu.	.007	.015	.016	.036	.049	.053		.090	.056		
Eysenck Lie	.014	.013	.045	.111	.039	.038		.155	.156		
A-H Test Anx.	.047	.030	.031	.017	.099	.081	NA	.186	.059	NA	NA
Test Anx.-1	.003	.001	.007	.007	.006	.000		.000	.000		
Test Anx.-2	.010	.002	.006	.024	.050	.040		.189	.197		
Learning Set	.037	.023	.020	.035	.037	.043		.073	.157		
Reason Enrol	.007	.006	.004	.023	.056	.070		.094	.045		
Pre-attitude	.006	.009	.015	.019	.020	.028		.104	.040		
50-50-1	.065	.016	.011	.009	.028	.030		.155	.013		
Pretest	.084	.056	.025	.019	.029	.052		.046	.127		
Inst: Eysenck Ext.	.004	.010	.039	.039	.032	.040		.156	.106		
Inst: Eysenck Neu.	.008	.012	.020	.056	.102	.090		.208	.050		
Inst: Marlowe-Cne.	.003	.008	.017	.016	.047	.040		.246	.121		
Inst: Sanford-Ggh.	.005	.004	.006	.028	.054	.030		.155	.087		
Inst: California-F	.013	.014	.023	.076	.144	.026		.208	.087		
Inst: Risk	.007	.004	.007	.028	.056	.026		.078	.087		
N	532	384	138	80	56	49	7	20	29	15	5
TSS_i/TSS_T	1.000	.649	.222	.133	.085	.058	.014	.024	.027	.014	.001
MEAN	3.662	3.385	3.080	3.275	3.482	3.612	2.571	3.950	3.379	3.667	4.800

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable. *=Final group. NA=Split not attempted.

.xxx =Next best BSS/TSS. ↓=Split attempted but not made.

TABLE E4 (cont'd.)

Predictor	Group Number						
	1	2	4	10	17	56*	57*
Sex	.004	.008	.001	.001	.114		.180
Age	.006	.006	.012	.002	.016		.020
Major	.012	.019	.060	.016	.262		.198
Credits	.015	.002	.002	.005	.131		.107
Current Load	.007	.004	.003	.001	.061		.056
GPA	.195	.038	.037	.054	.120		.105
CQT-V	.058	.009	.022	.049	.085		.198
CQT-Q	.037	.019	.033	.035	.245		.221
CQT-T	.053	.007	.026	.033	.085		.157
Eysenck Extraversion	.011	.007	.012	.010	.101		.095
Eysenck Neuroticism	.007	.015	.016	.036	.187		.125
Eysenck Lie	.014	.013	.045	.111	.123		.000
A-H Test Anxiety	.047	.030	.031	.017	.290	NA	.095
Test Anxiety-1	.003	.001	.007	.007	.000		.000
Test Anxiety-2	.010	.002	.006	.024	.076		.125
Learning Set	.037	.023	.020	.035	.085		.105
Reason Enrolled	.007	.006	.004	.023	.040		.000
Pre-attitude	.006	.009	.015	.019	.061		.083
50-50-1 (Asp.-Exp.)	.065	.016	.011	.009	.247		.214
Pretest	.084	.056	.025	.019	.012		.022
Instructor: Eysenck Ext.	.004	.010	.039	.039	.076		.223
Instructor: Eysenck Neu.	.008	.012	.020	.056	.078		.222
Instructor: Marlowe-Crowne	.003	.008	.017	.016	.015		.198
Instructor: Sanford-Gough	.005	.004	.006	.028	.056		.088
Instructor: California-F	.013	.014	.023	.076	.058		.095
Instructor: Risk	.007	.004	.007	.028	.056		.107
N	532	384	138	80	24	4	20
TSS_i/TSS_T	1.000	.649	.222	.133	.033	.005	.018
MEAN	3.662	3.385	3.080	3.275	2.792	1.750	3.000

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$
→ =Split made on this variable.
.xxx =Next best BSS/TSS.
* =Final group.
↓ =Split attempted but not made.
NA =Split not attempted.

TABLE E4 (cont'd.)

Predictor	Group Number									
	1	2	4	11	34*	35	44*	45	50*	51*
Sex	.004	.008	.001	.006		.011		.024	.010	
Age	.006	.006	.012	.050		.024		.048	.069	
Major	.012	.019	.060	.027		.033		.068	.040	
Credits	.015	.002	.002	.031		.038		.047	.048	
Current Load	.007	.004	.003	.051		.056		.010	.037	
GPA	.195	.038	.037	.044		.063		.077	.059	
CQT-V	.058	.009	.022	.082		.077		.080	.087	
CQT-Q	.037	.019	.033	.087		.122		.168	.085	
CQT-T	.053	.007	.026	.066		.069		.041	.019	
Eysenck Extraversion	.011	.007	.012	.014		.041		.047	.086	
Eysenck Neuroticism	.007	.015	.016	.058	NA	.104	NA	.119	.105	NA
Eysenck Lie	.014	.013	.045	.016		.023		.024	.019	
A-H Test Anxiety	.047	.030	.031	.078		.101		.124	.084	
Test Anxiety-1	.003	.001	.007	.000		.000		.000	.000	
Test Anxiety-2	.010	.002	.006	.010		.008		.003	.000	
Learning Set	.037	.023	.020	.053		.053		.036	.027	
Reason Enrolled	.007	.006	.004	.023		.015		.009	.007	
Pre-attitude	.006	.009	.015	.035		.040		.047	.029	
50-50-1 (Asp.-Exp.)	.065	.016	.011	.033		.026		.050	.084	
Pretest	.084	.056	.025	.090		.002		.002	.000	
Instructor:Eysenck Ext.	.004	.010	.039	.050		.047		.040	.039	
Instructor:Eysenck Neu.	.008	.012	.020	.022		.041		.035	.029	
Instructor:Marlowe-Cne.	.003	.008	.017	.058		.040		.049	.061	
Instructor:Sanford-Ggh.	.005	.004	.006	.044		.036		.083	.068	
Instructor:California-F	.013	.014	.023	.012		.024		.055	.052	
Instructor:Risk	.007	.004	.007	.014		.024		.023	.030	
N	532	384	138	58	9	49	6	43	42	1
TSS_i/TSS_T	1.000	.649	.222	.076	.010	.059	.005	.046	.038	.000
MEAN	3.662	3.385	3.080	2.810	2.222	2.918	2.167	3.023	3.071	1.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable. *=Final group. NA=Split not attempted.

.xxx =Next best BSS/TSS. =Split attempted but not made.

TABLE E5

AID II: Prop. of Var. in Final Course Grade by Group within Branch Explainable for Each Mid-Course Variable

Predictor	Group Number													
	1	3	12	13*	20	21	28	29*	30*	31*	38	39*	48*	49*
Sex	.004	.024	.021		.047	.005	.005		.000		.008			.000
Age	.002	.003	.003		.040	.030	.034		.033		.033			.061
Major	.038	.080	.108		.196	.074	.037		.017		.141			.244
Credits	.038	.020	.008		.067	.005	.005		.005		.071			.142
Current Load	.007	.001	.001		.065	.005	.006		.015		.071			.102
GPA	.254	.080	.084		.081	.048	.039		.041		.045			.062
CQT-V	.087	.065	.056		.177	.022	.019		.028		.049			.076
CQT-Q	.070	.103	.102		.159	.045	.035		.041		.060			.036
CQT-T	.100	.091	.085		.227	.056	.047		.055		.071			.068
Eysenck Extraversion	.027	.030	.029		.106	.035	.037		.033		.113			.129
Eysenck Neuroticism	.003	.008	.018		.079	.034	.035		.033		.145			.061
Eysenck Lie	.013	.020	.027		.065	.027	.027		.024		.096			.129
A-H Test Anxiety	.054	.028	.030	NA	.083	.064	.080	NA	.023	NA	.193	NA	NA	.262
Test Anxiety-1	.001	.002	.002		.000	.011	.010		.012		.010			.000
Test Anxiety-2	.020	.016	.010		.065	.043	.037		.033		.071			.129
Learning Set	.041	.048	.054		.106	.071	.065		.077		.240			.036
Reason Enrolled	.004	.010	.009		.068	.009	.005		.009		.049			.183
Pre-attitude	.005	.017	.008		.041	.013	.020		.023		.036			.061
50-50-1 (Asp.-Exp.)	.085	.174	.103		.226	.068	.054		.070		.108			.129
Pretest	.083	.106	.128		.016	.036	.046		.050		.028			.029
Instructor: Eysenck Ext.	.011	.006	.005		.032	.031	.026		.037		.028			.016
Instructor: Eysenck Neu.	.020	.018	.010		.014	.015	.017		.026		.019			.016
Instructor: Marlowe-Cne.	.010	.009	.005		.041	.023	.030		.021		.048			.046
Instructor: Sanford-Ggh.	.022	.023	.037		.097	.055	.069		.079		.062			.065
Instructor: California-F	.022	.023	.032		.067	.038	.055		.056		.062			.046
Instructor: Risk	.024	.023	.030		.041	.028	.037		.033		.015			.046
N	532	148	147	2	41	105	95	10	87	8	38	3	5	33
TSS_i/TSS_T	1.000	.176	.145	.000	.042	.084	.078	.000	.071	.000	.032	.000	.002	.022
MEAN	3.633	4.297	4.320	1.000	3.976	4.448	4.495	4.000	4.448	5.000	3.895	5.000	3.200	4.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable. * =Final group. NA = Split not attempted.

.xxx =Next best BSS/TSS. =Split attempted but not made.

TABLE E5 (cont'd.)

TABLE E5 (cont'd.)

Predictor	Group Number																
	1	2	5	6	10	16	17	22*	23	34	35*	44*	45	46*	47*	52*	53*
Sex	.004	.013	.008	.012	.014	.011	.001	.030	.005	.008			.000	.020		.020	
Age	.002	.002	.006	.011	.009	.047	.037	.001	.055	.172			.285	.024		.028	
Major	.038	.025	.043	.052	.012	.009	.081	.047	.132	.117			.138	.209		.259	
Credits	.038	.019	.008	.007	.008	.003	.037	.002	.051	.013			.026	.117		.028	
Current Load	.007	.007	.015	.008	.015	.028	.039	.020	.042	.030			.036	.026		.028	
GPA	.254	.073	.032	.040	.038	.046	.095	.031	.042	.074			.052	.289		.053	
CQT-V	.087	.028	.030	.031	.015	.036	.045	.073	.063	.058			.064	.209		.063	
CQT-Q	.070	.038	.039	.028	.040	.040	.134	.020	.137	.130			.118	.209		.130	
CQT-T	.100	.036	.042	.034	.020	.042	.096	.031	.124	.164			.132	.145		.097	
Extraversion	.027	.008	.005	.008	.011	.018	.185	.051	.051	.052			.055	.216		.099	
Neuroticism	.003	.009	.009	.006	.018	.063	.045	.051	.132	.198			.139	.217		.087	
Eysenck Lie	.013	.028	.022	.041	.043	.013	.027	.026	.044	.022			.059	.020		.003	
A-H Test Anxiety	.054	.049	.071	.021	.023	.028	.123	.030	.105	.237	NA	NA	.139	.103	NA	.097	NA
Test Anxiety-1	.001	.002	.007	.011	.009	.015	.000	.020	.000	.000			.000	.000		.000	
Test Anxiety-2	.020	.009	.028	.010	.011	.015	.014	.088	.019	.057			.050	.038		.037	
Learning Set	.041	.029	.028	.043	.039	.071	.068	.085	.055	.034			.023	.038		.057	
Reason	.004	.002	.005	.002	.003	.012	.044	.007	.045	.054			.047	.072		.021	
Pre-attitude	.005	.006	.010	.007	.019	.060	.069	.026	.208	.062			.055	.036		.063	
50-50-1 (Asp.-Exp.-1)	.085	.012	.008	.007	.008	.015	.150	.020	.051	.107			.113	.215		.150	
Pretest	.083	.048	.044	.035	.032	.015	.224	.027	.051	.052			.064	.093		.097	
Instructor Extraversion	.011	.027	.008	.007	.007	.020	.066	.027	.105	.090			.194	.103		.065	
Instructor Neuroticism	.020	.017	.018	.007	.012	.008	.173	.047	.099	.060			.133	.054		.089	
Instructor Marlowe-Crowne	.010	.008	.017	.008	.011	.006	.242	.013	.055	.047			.249	.103		.229	
Instructor Sanford-Gough	.022	.031	.012	.017	.015	.055	.192	.049	.105	.088			.138	.026		.065	
Instructor California-F	.022	.019	.011	.010	.015	.019	.256	.085	.085	.080			.132	.026		.111	
Instructor Risk	.024	.026	.014	.008	.007	.019	.037	.072	.105	.108			.115	.103		.130	
N	532	383	211	170	134	99	35	56	43	31	12	2	29	20	15	25	4
TSS_i/TSS_T	1.000	.570	.297	.215	.166	.123	.036	.058	.056	.036	.008	.000	.028	.017	.010	.017	.003
MEAN	3.633	3.376	3.555	3.647	3.716	3.798	3.486	3.643	4.000	3.806	4.500	5.000	3.724	3.750	3.133	3.600	4.500

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E5 (cont'd.)

Predictor	Group Number						
	1	2	5	6	11	50*	51*
Sex	.004	.013	.008	.012	.023	.006	
Age	.002	.006	.006	.011	.076	.074	
Major	.038	.025	.043	.052	.078	.109	
Credits	.038	.019	.008	.007	.069	.046	
Current Load	.007	.007	.015	.008	.013	.002	
GPA	.254	.073	.032	.040	.109	.090	
CQT-V	.087	.028	.030	.031	.256	.033	
CQT-Q	.070	.038	.039	.028	.129	.146	
CQT-T	.100	.036	.042	.034	.162	.062	
Eysenck Extraversion	.027	.008	.005	.008	.032	.018	
Eysenck Neuroticism	.003	.009	.009	.006	.254	.094	
Eysenck Lie	.013	.028	.022	.041	.162	.034	
A-H Test Anxiety	.054	.049	.071	.021	.087	.076	NA
Test Anxiety-1	.001	.002	.007	.011	.010	.009	
Test Anxiety-2	.020	.009	.028	.010	.045	.083	
Learning Set	.041	.029	.028	.043	.083	.148	
Reason Enrolled	.004	.002	.005	.002	.021	.021	
Pre-attitude	.005	.006	.010	.007	.054	.154	
50-50-1 (Asp.-Exp.)	.085	.012	.008	.007	.080	.222	
Pretest	.083	.048	.044	.035	.114	.094	
Instructor: Eysenck Ext.	.011	.027	.008	.007	.021	.034	
Instructor: Eysenck Neu.	.020	.017	.018	.007	.021	.019	
Instructor: Marlowe-Crowne	.010	.008	.017	.008	.032	.028	
Instructor: Sanford-Gough	.022	.031	.012	.017	.072	.083	
Instructor: California-F	.022	.019	.011	.010	.021	.037	
Instructor: Risk	.024	.026	.014	.008	.045	.076	
N	532	383	211	170	33	31	2
TSS_i/TSS_T	1.000	.570	.297	.215	.032	.022	.001
MEAN	3.633	3.376	3.555	3.647	3.333	3.258	4.500

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E5 (cont'd.)

Predictor	Group Number					
	1	2	5	7	32*	33*
Sex	.004	.013	.008	.007		.010
Age	.002	.002	.006	.147		.182
Major	.038	.025	.043	.322		.220
Credits	.038	.019	.008	.005		.068
Current Load	.007	.007	.015	.007		.012
GPA	.254	.073	.032	.005		.017
CQT-V	.087	.028	.030	.038		.122
CQT-Q	.070	.038	.039	.160		.205
CQT-T	.100	.036	.042	.074		.122
Eysenck Extraversion	.027	.008	.005	.032		.270
Eysenck Neuroticism	.003	.009	.009	.079		.245
Eysenck Lie	.013	.028	.022	.079		.136
A-H Test Anxiety	.054	.049	.071	.036	NA	.182
Test Anxiety-1	.001	.002	.007	.000		.000
Test Anxiety-2	.020	.009	.028	.028		.068
Learning Set	.041	.029	.028	.093		.064
Reason Enrolled	.004	.002	.005	.003		.042
Pre-attitude	.005	.006	.010	.094		.046
50-50-1 (Asp.-Exp.)	.085	.012	.008	.064		.098
Pretest	.083	.048	.044	.082		.118
Instructor: Eysenck Ext.	.011	.027	.008	.067		.098
Instructor: Eysenck Neu.	.020	.017	.018	.085		.098
Instructor: Marlowe-Crowne	.010	.008	.017	.138		.150
Instructor: Sanford-Gough	.022	.031	.012	.013		.045
Instructor: California-F	.022	.019	.011	.082		.045
Instructor: Risk	.024	.026	.014	.173		.020
N	532	383	211	41	16	23
TSS_i/TSS_T	1.000	.570	.297	.061	.021	.020
MEAN	3.633	3.376	3.555	3.171	3.688	2.826

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E5 (cont'd.)

Predictor	Group Number											
	1	2	4	8	9*	14*	15	18	40	41*	54*	55*
Sex	.004	.013	.023	.051			.037	.005	.035			.079
Age	.002	.002	.014	.016			.010	.010	.024			.002
Major	.038	.025	.045	.067			.054	.000	.000			.000
Credits	.038	.019	.026	.011			.017	.177	.236			.127
Current Load	.007	.007	.010	.015			.019	.005	.035			.079
GPA	.254	.073	.033	.031			.036	.120	.220			.141
CQT-V	.087	.028	.036	.027			.033	.060	.077			.079
CQT-Q	.070	.038	.071	.020			.021	.154	.163			.167
CQT-T	.100	.036	.046	.020			.026	.089	.122			.097
Eysenck Extraversion	.027	.008	.025	.018			.026	.094	.116			.264
Eysenck Neuroticism	.003	.009	.009	.009			.007	.269	.035			.097
Eysenck Lie	.013	.028	.031	.015			.012	.174	.220			.222
A-H Test Anxiety	.054	.049	.019	.043	NA	NA	.041	.120	.163	NA	NA	.265
Test Anxiety-1	.001	.002	.000	.000			.000	.008	.000			.000
Test Anxiety-2	.020	.009	.004	.010			.013	.008	.041			.023
Learning Set	.041	.029	.032	.033			.043	.116	.293			.167
Reason Enrolled	.004	.002	.002	.004			.002	.035	.073			.082
Pre-attitude	.005	.006	.010	.006			.005	.064	.163			.052
50-50-1 (Asp.-Exp.)	.085	.012	.009	.015			.019	.040	.116			.167
Pretest	.083	.048	.040	.038			.040	.097	.073			.074
Instructor: Eysenck Ext.	.011	.027	.061	.081			.026	.121	.078			.128
Instructor: Eysenck Neu.	.020	.017	.026	.031			.026	.032	.116			.108
Instructor: Marlowe-Cne.	.010	.008	.007	.010			.013	.061	.116			.097
Instructor: Sanford-Ggh.	.022	.031	.032	.046			.031	.110	.078			.222
Instructor: California-F	.022	.019	.050	.080			.047	.117	.152			.167
Instructor: Risk	.024	.026	.039	.047			.035	.102	.073			.167
N	532	383	172	123	49	7	116	30	22	7	2	20
TSS_i/TSS_T	1.000	.570	.232	.170	.045	.002	.154	.039	.021	.004	.001	.013
MEAN	3.633	3.376	3.517	3.041	3.449	3.857	2.991	3.267	3.500	2.714	2.500	3.600

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable. * =Final group. NA =Split not attempted.

.xxx =Next best BSS/TSS. =Split attempted but not made.

TABLE E5 (cont'd.)

Predictor	Group Number													
	1	2	4	8	15	19	24	25*	26	27	36*	37*	42*	43*
Sex	.004	.013	.023	.051	.037	.019	.005		.024	.002		.013		
Age	.002	.002	.014	.016	.010	.012	.004		.004	.025		.013		
Major	.038	.025	.045	.067	.054	.025	.040		.111	.048		.046		
Credits	.038	.019	.026	.011	.017	.035	.029		.038	.039		.025		
Current Load	.007	.007	.010	.015	.019	.033	.034		.052	.020		.006		
GPA	.254	.073	.033	.031	.036	.022	.017		.052	.016		.025		
CQT-V	.087	.028	.036	.027	.033	.066	.068		.130	.053		.102		
CQT-Q	.070	.038	.071	.020	.021	.015	.015		.187	.101		.114		
CQT-T	.100	.036	.046	.020	.026	.040	.036		.092	.107		.106		
Eysenck Extraversion	.027	.008	.025	.018	.026	.099	.071		.198	.094		.074		
Eysenck Neuroticism	.003	.009	.009	.009	.007	.056	.039		.079	.218		.048		
Eysenck Lie	.013	.028	.031	.015	.012	.144	.047		.058	.050		.047		
A-H Test Anxiety	.054	.049	.019	.043	.041	.037	.047	NA	.074	.086	NA	.103	NA	NA
Test Anxiety-1	.001	.002	.000	.000	.000	.000	.000		.000	.000		.000		
Test Anxiety-2	.020	.009	.004	.010	.013	.037	.072		.006	.034		.025		
Learning Set	.041	.029	.032	.033	.043	.043	.037		.039	.032		.037		
Reason Enrolled	.004	.002	.002	.004	.002	.002	.011		.030	.003		.003		
Pre-attitude	.005	.006	.010	.006	.005	.038	.023		.049	.049		.052		
50-50-1 (Asp.-Exp.)	.085	.012	.009	.015	.019	.019	.011		.022	.045		.048		
Pretest	.083	.048	.040	.038	.040	.050	.032		.043	.053		.064		
Instructor: Eysenck Ext.	.011	.027	.061	.081	.026	.039	.006		.077	.033		.052		
Instructor: Eysenck Neu.	.020	.017	.026	.031	.026	.039	.014		.052	.039		.052		
Instructor: Marlowe-Cne.	.010	.008	.007	.010	.013	.013	.014		.049	.045		.049		
Instructor: Sanford-Ggh.	.022	.031	.032	.046	.031	.011	.006		.052	.011		.037		
Instructor: California-F	.022	.019	.050	.080	.047	.036	.020		.062	.060		.048		
Instructor: Risk	.024	.026	.039	.047	.035	.017	.019		.077	.053		.049		
N	532	383	172	123	116	84	76	8	31	45	1	43	12	19
TSS_i/TSS_T	1.000	.570	.232	.170	.154	.104	.087	.002	.036	.045	.000	.035	.010	.019
MEAN	3.633	3.376	3.517	3.041	2.991	2.905	2.987	2.125	3.194	2.844	1.000	2.884	2.833	3.421

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ = Split made on this variable. * = Final group. NA = Split not attempted.

.xxx = Next best BSS/TSS ↓ = Split attempted but not made.

TABLE E6

AID III: Proportion of Variation in Final Exam Score-1 by Group within Branch Explainable for Each Final-Course Variable

Predictor	Group Number						
	1	3	5	34	35*	42*	43*
Sex	.002	.002	.000	.015		.007	.034
Age	.002	.008	.008	.022		.082	.012
Major	.027	.039	.053	.010		.091	.021
Credits	.025	.023	.050	.054		.063	.097
Current Load	.003	.002	.019	.040		.041	.063
GPA	.132	.121	.063	.087		.330	.017
CQT-V	.063	.064	.062	.071		.244	.046
CQT-Q	.054	.040	.040	.050		.239	.092
CQT-T	.065	.065	.087	.077		.316	.044
Eysenck Extraversion	.019	.024	.058	.034		.083	.102
Eysenck Neuroticism	.006	.003	.020	.021		.090	.048
Eysenck Lie	.014	.008	.014	.045		.063	.036
A-H Test Anxiety	.047	.050	.029	.036		.131	.102
Test Anxiety-1	.001	.000	.000	.000		.000	.002
Test Anxiety-2	.021	.011	.021	.033		.125	.077
Test Anxiety-3	.016	.019	.050	.141		.021	.002
Accuracy	.003	.005	.015	.005		.026	.062
Success	.011	.005	.038	.040		.039	.051
Learning Set	.038	.016	.030	.029	NA	.116	.115
Reason Enrolled	.001	.002	.013	.014		.028	.015
Pre-attitude	.004	.006	.072	.062		.070	.058
Post-attitude	.013	.010	.039	.018		.066	.024
Discussion Attitude	.012	.014	.019	.014		.153	.047
50-50-1 (Asp.-Exp.-1)	.054	.070	.101	.030		.153	.009
50-50-2 (Asp.-Exp.-2)	.113	.071	.078	.069		.184	.063
Pretest	.071	.062	.048	.062		.129	.029
Midterm	.159	.125	.059	.056		.147	.037
Instructor Eysenck Ext.	.008	.007	.071	.012		.084	.072
Instructor Eysenck Neu.	.006	.005	.135	.021		.150	.045
Instructor Marlowe-Cne.	.002	.004	.161	.010		.026	.020
Instructor Sanford-Ggh.	.005	.009	.046	.006		.052	.020
Instructor California-F	.021	.030	.026	.007		.095	.060
Instructor Risk	.021	.030	.034	.024		.054	.022
Instructor Course Load	.023	.030	.021	.015		.041	.034
Instructor Teaching Exp.	.008	.006	.013	.010		.117	.058
Instructor ED 200	.013	.009	.092	.015		.150	.027
N	532	382	90	75	15	31	44
TSS_i/TSS_T	1.000	.556	.083	.055	.014	.014	.033
MEAN	29.254	30.272	32.567	33.080	30.000	34.226	32.273

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E6 (cont'd.)

Predictor	Group Number					
	1	3	4	7	38*	39*
Sex	.002	.002	.004	.003	.001	.049
Age	.002	.008	.011	.015	.018	.075
Major	.027	.039	.034	.042	.032	.165
Credits	.025	.023	.015	.065	.038	.024
Current Load	.003	.002	.003	.031	.082	.009
GPA	.132	.121	.091	.021	.042	.326
CQT-V	.063	.064	.038	.077	.074	.176
CQT-Q	.054	.040	.036	.124	.084	.207
CQT-T	.065	.065	.045	.147	.040	.076
Eysenck Extraversion	.019	.024	.024	.037	.078	.265
Eysenck Neuroticism	.006	.003	.006	.066	.079	.161
Eysenck Lie	.014	.008	.011	.049	.041	.098
A-H Test Anxiety	.047	.050	.040	.095	.037	.176
Test Anxiety-1	.001	.000	.000	.003	.014	.000
Test Anxiety-2	.021	.011	.014	.018	.049	.053
Test Anxiety-3	.016	.019	.006	.019	.084	.062
Accuracy	.003	.005	.008	.017	.025	.112
Success	.011	.005	.004	.020	.049	.026
Learning Set	.038	.016	.017	.034	.043	.093
Reason Enrolled	.001	.002	.009	.094	.083	.136
Pre-attitude	.004	.006	.013	.092	.132	.102
Post-attitude	.013	.010	.015	.072	.088	.293
Discussion Attitude	.012	.014	.016	.059	.018	.266
50-50-1 (Asp.-Exp.-1)	.054	.070	.038	.061	.105	.055
50-50-2 (Asp.-Exp.-2)	.113	.071	.020	.032	.050	.102
Pretest	.071	.062	.044	.065	.049	.106
Midterm	.159	.125	.028	.011	.038	.088
Instructor Eysenck Ext.	.008	.007	.023	.022	.030	.060
Instructor Eysenck Neu.	.006	.005	.011	.070	.084	.042
Instructor Marlowe-Crowne	.002	.004	.011	.026	.017	.044
Instructor Sanford-Gough	.005	.009	.024	.073	.053	.076
Instructor California-F	.021	.030	.032	.018	.019	.044
Instructor Risk	.021	.030	.032	.036	.069	.028
Instructor Course Load	.023	.030	.038	.077	.068	.136
Instructor Teaching Exp.	.008	.006	.007	.070	.084	.006
Instructor Education 200	.013	.009	.003	.044	.056	.044
N	532	382	292	61	38	23
TSS_i/TSS_T	1.000	.556	.404	.071	.044	.017
MEAN	29.254	30.272	29.565	31.623	30.658	33.217

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.
.xxx =Next best BSS/TSS.
* =Final group.

=Split attempted but not made.
NA =Split not attempted

TABLE E6 (cont'd.)

TABLE E6 (cont'd.)

Predictor	Group Number										
	1	3	4	6	9	30	31	46*	47*	48*	49*
Sex	.002	.002	.004	.016	.007	.006	.038				.007
Age	.002	.008	.011	.006	.007	.007	.007				.005
Major	.027	.039	.034	.026	.101	.221	.070				.091
Credits	.025	.023	.015	.019	.052	.188	.023				.011
Current Load	.003	.002	.003	.005	.008	.004	.007				.015
GPA	.132	.121	.091	.033	.044	.173	.043				.034
CQT-V	.063	.064	.038	.016	.045	.078	.053				.038
CQT-Q	.054	.040	.036	.007	.026	.191	.025				.038
CQT-T	.065	.065	.045	.013	.031	.041	.053				.025
Extraversion	.019	.024	.024	.020	.025	.135	.023				.034
Neuroticism	.006	.003	.006	.009	.023	.100	.027				.035
Eysenck Lie	.014	.008	.011	.007	.024	.046	.034				.031
A-H Test Anxiety	.047	.050	.040	.015	.040	.021	.098				.072
Test Anxiety-1	.001	.000	.000	.003	.000	.000	.000				.000
Test Anxiety-2	.021	.011	.014	.013	.039	.073	.058				.023
Test Anxiety-3	.016	.019	.006	.005	.022	.039	.048				.092
Accuracy	.003	.005	.008	.015	.056	.026	.078				.044
Success	.011	.005	.040	.004	.012	.035	.011				.018
Learning Set	.038	.016	.017	.019	.113	.058	.020	NA	NA	NA	.041
Reason Enrolled	.001	.002	.009	.001	.008	.023	.028				.048
Pre-attitude	.004	.006	.013	.014	.031	.137	.011				.014
Post-attitude	.013	.010	.015	.023	.051	.197	.017				.038
Discussion Attitude	.012	.014	.016	.018	.046	.045	.200				.017
50-50-1 (Asp.-Exp.-1)	.054	.070	.038	.010	.033	.050	.095				.100
50-50-2 (Asp.-Exp.-2)	.113	.071	.020	.010	.038	.074	.078				.067
Pretest	.071	.062	.044	.036	.013	.168	.078				.101
Midterm	.159	.125	.028	.020	.023	.116	.169				.190
Instructor Extraversion	.008	.007	.023	.016	.050	.061	.047				.032
Instructor Neuroticism	.006	.005	.011	.006	.050	.061	.076				.059
Instructor Marlowe-Crowne	.002	.004	.011	.008	.024	.047	.039				.036
Instructor Sanford-Gough	.005	.009	.024	.015	.033	.008	.039				.042
Instructor California-F	.021	.030	.032	.032	.023	.016	.025				.053
Instructor Risk	.021	.030	.032	.032	.030	.019	.025				.005
Instructor Course Load	.023	.030	.038	.032	.015	.044	.025				.036
Instructor Teaching Experience	.008	.006	.007	.009	.022	.006	.025				.059
Instructor ED 200	.013	.009	.003	.002	.022	.016	.025				.011
N	532	382	292	228	90	30	59	15	15	7	51
TSS_i/TSS_T	1.000	.556	.404	.293	.101	.046	.041	.012	.024	.001	.031
MEAN	29.254	30.272	29.565	29.022	29.822	28.400	30.627	30.133	26.667	33.571	30.157

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable. =Split attempted but not made.

.xxx =Next best BSS/TSS. NA =Split not attempted.

* =Final group.

TABLE E6 (cont'd.)

TABLE E6 (cont'd.)

Predictor	Group Number																	
	1	3	4	6	8	16*	17	18*	19	20*	21	22	23*	26*	27	28	29*	32*	33*
Sex	.002	.002	.004	.016	.020		.025		.025		.032	.016			.007	.002			007
Age	.002	.008	.011	.006	.008		.008		.010		.010	.010			.013	.013			.004
Major	.027	.039	.034	.026	.052		.046		.044		.046	.045			.062	.094			.047
Credits	.025	.023	.015	.019	.012		.014		.019		.017	.014			.032	.027			.045
Current Load	.003	.002	.003	.005	.015		.004		.002		.003	.003			.010	.023			.024
GPA	.132	.121	.091	.033	.034		.026		.030		.024	.036			.047	.047			.078
CQT-V	.063	.064	.038	.016	.025		.035		.038		.059	.052			.029	.036			.048
CQT-Q	.054	.040	.036	.007	.021		.040		.036		.031	.028			.031	.051			.071
CQT-T	.065	.065	.045	.013	.028		.050		.049		.064	.064			.038	.049			.071
Extraversion	.019	.024	.024	.020	.041		.037		.050		.032	.036			.036	.052			.061
Neuroticism	.006	.003	.006	.009	.022		.017		.019		.019	.019			.021	.024			.042
Eysenck Lie	.014	.008	.011	.007	.011		.021		.056		.016	.011			.030	.023			.032
A-H Test Anxiety	.047	.050	.040	.015	.034		.021		.011		.010	.015			.031	.016			.027
Test Anxiety-1	.001	.000	.000	.003	.003		.005		.006		.005	.007			.006	.010			.008
Test Anxiety-2	.021	.011	.014	.013	.029		.029		.013		.014	.020			.026	.023			034
Test Anxiety-3	.016	.019	.006	.005	.005		.003		.003		.007	.002			.000	.003			.026
Accuracy	.003	.005	.008	.015	.006		.003		.008		.010	.010			.008	.009			.018
Success	.011	.005	.004	.004	.001		.002		.006		.015	.030			.019	.024			.032
Learning Set	.038	.016	.017	.019	.026	NA	.036	NA	.040	NA	.069	.011	NA	NA	.010	.019	NA	NA	.052
Reason Enrolled	.001	.002	.009	.001	.004		.006		.005		.008	.007			.004	.005			.024
Pre-attitude	.004	.006	.013	.014	.026		.026		.025		.020	.023			.026	.031			.047
Post-attitude	.013	.010	.015	.023	.014		.018		.023		.017	.020			.030	.038			.024
Discussion Attitude	.012	.014	.016	.018	.017		.021		.018		.011	.009			.017	.010			.038
50-50-1 (Asp.-Exp.-1)	.054	.070	.038	.010	.013		.017		.019		.020	.023			.036	.032			.038
50-50-2 (Asp.-Exp.-2)	.113	.071	.020	.010	.002		.010		.003		.001	.001			.002	.007			.011
Pretest	.071	.062	.044	.036	.045		.060		.022		.029	.028			.015	.010			.046
Midterm	.159	.125	.028	.020	.016		.013		.017		.028	.019			.036	.019			.019
Inst. Extraversion	.008	.007	.023	.016	.070		.027		.015		.022	.032			.033	.029			.044
Inst. Neuroticism	.006	.005	.011	.006	.047		.039		.027		.037	.055			.048	.026			.021
Inst. Marlowe-Crowne	.002	.004	.011	.008	.016		.010		.008		.015	.022			.016	.035			.040
Inst. Sanford-Gough	.005	.009	.024	.015	.033		.018		.020		.027	.031			.030	.035			.019
Inst. California-F	.021	.030	.032	.032	.092		.047		.042		.038	.048			.069	.018			.034
Inst. Risk	.021	.030	.032	.032	.091		.039		.039		.045	.054			.055	.023			.032
Inst. Course Load	.023	.030	.038	.032	.090		.012		.010		.018	.038			.054	.081			.077
Inst. Teaching Exp.	.008	.006	.007	.009	.010		.012		.015		.012	.016			.024	.004			.007
Inst. ED 200	.013	.009	.003	.002	.000		.011		.012		.014	.018			.036	.016			.012
N	532	382	292	228	138	11	127	2	125	7	118	116	1	10	106	93	13	16	77
TSS_i/TSS_T	1.000	.556	.404	.293	.181	.013	.152	.001	.142	.006	.128	.116	.000	.006	.103	.085	.011	.017	.060
MEAN	29.254	30.272	29.565	29.022	28.500	25.000	28.803	22.500	28.904	32.000	28.720	28.836	20.000	31.300	28.604	28.892	26.538	30.813	28.494

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↕ =Split attempted but not made.

NA =Split not attempted.

TABLE E6 (cont'd.)

TABLE E6 (cont'd).

Predictor	Group Number																		
	1	2	10	12	13	14	15	24	25*	36	37*	40*	41	44*	45*	50*	51*	52*	53*
Sex	.002	.009	.006	.011	.003	.004	.021	.021		.034			.003	.032			.002		
Age	.002	.012	.007	.142	.004	.028	.008	.023		.048			.052	.093			.041		
Major	.027	.026	.025	.141	.032	.047	.154	.022		.177			.041	.022			.085		
Credits	.025	.025	.030	.145	.029	.068	.045	.077		.086			.114	.057			.139		
Current Load	.003	.004	.005	.079	.017	.013	.017	.031		.023			.003	.017			.066		
GPA	.132	.017	.030	.186	.041	.046	.054	.114		.111			.115	.096			.043		
CQT-V	.063	.032	.031	.151	.023	.109	.076	.129		.086			.047	.202			.262		
CQT-Q	.054	.079	.059	.299	.050	.044	.052	.182		.031			.099	.049			.071		
CQT-T	.065	.099	.083	.291	.094	.027	.043	.039		.065			.128	.131			.187		
Extraversion	.019	.017	.022	.250	.044	.048	.100	.048		.075			.134	.235			.220		
Neuroticism	.006	.037	.041	.125	.047	.091	.092	.126		.070			.022	.083			.081		
Eysenck Lie	.014	.044	.074	.033	.089	.092	.131	.091		.091			.157	.159			.131		
A-H Test Anxiety	.047	.030	.030	.143	.027	.037	.039	.061		.021			.045	.039			.062		
Test Anxiety-1	.001	.008	.008	.000	.008	.000	.013	.000		.000			.000	.010			.000		
Test Anxiety-2	.021	.045	.042	.167	.034	.051	.028	.030		.040			.026	.134			.051		
Test Anxiety-3	.016	.004	.009	.140	.006	.027	.052	.039		.062			.056	.046			.127		
Accuracy	.003	.002	.006	.005	.006	.025	.026	.029		.028			.036	.018			.139		
Success	.011	.009	.008	.067	.008	.021	.006	.026		.038			.008	.012			.006		
Learning Set	.038	.043	.043	.091	.068	.057	.113	.144	NA	.159	NA	NA	.124	.075	NA	NA	.098	NA	NA
Reason Enrolled	.001	.006	.009	.198	.011	.013	.041	.001		.011			.045	.186			.022		
Pre-attitude	.004	.029	.029	.034	.020	.062	.030	.086		.037			.037	.103			.031		
Post-attitude	.013	.052	.056	.147	.060	.097	.057	.133		.037			.100	.118			.218		
Discussion Attitude	.012	.013	.033	.034	.042	.066	.040	.090		.147			.204	.069			.194		
50-50-1 (Asp.-Exp.-1)	.054	.113	.013	.040	.013	.010	.054	.034		.040			.074	.098			.094		
50-50-2 (Asp.-Exp.-2)	.113	.034	.035	.146	.049	.061	.027	.105		.164			.115	.039			.219		
Pretest	.071	.040	.047	.090	.035	.026	.031	.028		.047			.100	.070			.030		
Midterm	.159	.092	.113	.037	.020	.110	.057	.070		.062			.060	.122			.127		
Inst. Extraversion	.008	.008	.006	.190	.010	.024	.128	.018		.057			.055	.199			.139		
Inst. Neuroticism	.006	.003	.004	.190	.008	.014	.042	.025		.057			.052	.054			.139		
Inst. Marlowe-Crowne	.002	.011	.011	.106	.017	.019	.052	.022		.026			.099	.058			105		
Inst. Sanford-Gough	.005	.011	.011	.066	.009	.033	.060	.036		.038			.148	.070			.159		
Inst. California-F	.021	.002	.002	.081	.005	.021	.081	.007		.053			.044	.120			.039		
Inst. Risk	.021	.007	.011	.106	.028	.011	.061	.029		.043			.070	.076			.058		
Instructor Course Load	.023	.010	.009	.099	.011	.018	.031	.011		.063			.133	.162			.123		
Instructor Teaching Exp.	.008	.002	.003	.063	.003	.010	.127	.008		.021			.052	.201			.043		
Instructor ED 200	.013	.002	.003	.021	.005	.018	.077	.039		.042			.048	.105			.048		
N	532	146	144	25	119	69	49	54	15	50	4	16	34	32	17	9	24	6	19
TSS_i/TSS_T	1.000	.276	.245	.031	.187	.119	.048	.073	.033	.057	.002	.015	.032	.024	.016	.006	.020	.005	.016
MEAN	29.254	26.623	26.736	23.880	27.336	26.333	28.653	27.019	23.867	26.600	32.250	28.563	25.676	29.500	27.059	27.889	24.875	20.667	24.895

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E6 (cont'd.)

Predictor	Group Number		
	1	2	11*
Sex	.002	.009	
Age	.002	.012	
Major	.027	.026	
Credits	.025	.025	
Current Load	.003	.004	
GPA	.132	.017	
CQT-V	.063	.032	
CQT-Q	.054	.079	
CQT-T	.065	.099	
Eysenck Extraversion	.019	.017	
Eysenck Neuroticism	.006	.037	
Eysenck Lie	.014	.042	
A-H Test Anxiety	.047	.030	
Test Anxiety-1	.001	.008	
Test Anxiety-2	.021	.045	
Test Anxiety-3	.016	.004	
Accuracy	.003	.002	
Success	.011	.009	
Learning Set	.038	.043	NA
Reason Enrolled	.001	.006	
Pre-attitude	.004	.029	
Post-attitude	.013	.052	
Discussion Attitude	.012	.013	
50-50-1 (Asp.-Exp.-1)	.054	.113	
50-50-2 (Asp.-Exp.-2)	.113	.034	
Pretest	.071	.040	
Midterm	.159	.092	
Instructor Eysenck Ext.	.008	.008	
Instructor Eysenck Neu.	.006	.003	
Instructor Marlowe-Crowne	.002	.011	
Instructor Sanford-Gough	.005	.011	
Instructor California-F	.021	.002	
Instructor Risk	.021	.007	
Instructor Course Load	.023	.010	
Instructor Teaching Experience	.008	.002	
Instructor Education 200	.013	.002	
N	532	146	1
TSS_i/TSS_T	1.000	.276	.000
MEAN	29.254	26.623	10.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E7

AID III: Proportion of Variation in Final Exam Score-2 by Group within Branch Explainable for Each Final-Course Variable

TABLE E7 (cont'd.)

Predictor	Group Number														
	1	3	6	9	13	20	21	28*	29	40*	41*	58	59*	68*	69*
Sex	.000	.010	.007	.003	.002	.000	.000		.002	.064	.017	.003			.012
Age	.006	.024	.039	.039	.058	.007	.088		.157	.000	.003	.061			.093
Major	.017	.021	.027	.053	.028	.253	.058		.055	.172⇩	.079	.428			.104
Credits	.006	.012	.012	.020	.057	.055	.072		.112	.024	.125	.071			.092
Current Load	.006	.008	.009	.012	.006	.056	.023		.034	.022	.096	.021			.003
GPA	.188	.071	.100	.064	.067	.085	.052		.050	.137	.185⇩	.065			.110
CQT-V	.101	.100	.070	.018	.025	.059	.027		.041	.054	.150	.071			.093
CQT-Q	.090	.093	.074	.053	.054	.321	.030		.022	.072	.150	.054			.147
CQT-T	.139	.134	.116	.092	.072	.228	.044		.046	.070	.092	.108			.188
Extraversion	.015	.008	.010	.022	.014	.123	.010		.041	.057	.116	.142			.093
Neuroticism	.009	.012	.022	.040	.067	.175	.112		.031	.022	.022	.069			.093
Eysenck Lie	.016	.013	.018	.020	.041	.104	.090		.041	.022	.120	.216			.128
A-H Test Anxiety	.055	.028	.028	.022	.058	.252	.029		.037	.062	.070	.053			.067
Test Anxiety-1	.002	.025	.030	.006	.010	.000	.020		.031	.120	.000	.000			.000
Test Anxiety-2	.011	.010	.012	.024	.033	.009	.063		.030	.036	.057	.076			.029
Test Anxiety-3	.006	.003	.005	.011	.008	.016	.014		.015	.008	.054	.047			.063
Accuracy	.010	.004	.005	.008	.015	.052	.025		.035	.008	.029	.064			.158
Success	.012	.007	.007	.010	.008	.029	.035		.038	.089	.116	.091			.101
Learning Set	.049	.040	.030	.029	.051	.056	.087	NA	.032	.049	.144	.177	NA	NA	.099
Reason Enrolled	.006	.009	.008	.006	.008	.053	.006		.006	.076	.013	.004			.034
Pre-attitude	.001	.015	.022	.016	.038	.071	.089		.059	.109	.132	.265			.197
Post-attitude	.006	.034	.030	.026	.053	.065	.093		.053	.030	.099	.040			.108
Discussion Attitude	.004	.020	.013	.030	.070	.185	.037		.050	.129	.169	.202			.279⇩
50-50-1 (Asp.-Exp.-1)	.049	.144	.032	.057	.053	.085	.036		.029	.089	.047	.037			.067
50-50-2 (Asp.-Exp.-2)	.089	.057	.053	.054	.027	.011	.003		.016	.101	.047	.071			.093
Pretest	.049	.037	.034	.029	.054	.154	.028		.033	.164	.099	.100			.108
Midterm	.126	.070	.060	.071	.087	.055	.013		.017	.029	.036	.071			.128
Instructor Extraversion	.003	.004	.003	.015	.005	.028	.005		.017	.058	.042	.065			.090
Instructor Neuroticism	.010	.009	.005	.027	.015	.085	.011		.014	.092	.027	.138			.125
Instructor Marlowe-Crowne	.006	.011	.007	.013	.025	.053	.014		.013	.034	.020	.102			.083
Instructor Sanford-Gough	.005	.007	.008	.014	.013	.129	.004		.022	.048	.018	.142			.156
Instructor California-F	.005	.010	.007	.033	.010	.070	.029		.026	.051	.005	.174			.128
Instructor Risk	.011	.013	.019	.097	.030	.128	.018		.015	.044	.027	.262			.208
Instructor Course Load	.014	.035	.035	.048	.012	.101	.003		.026	.058	.063	.099			.128
Instructor Teaching Experience	.003	.003	.003	.025	.011	.066	.007		.017	.058	.063	.078			.090
Instructor ED 200	.015	.010	.003	.013	.033	.139	.006		.012	.044	.020	.239			.225
N	532	213	212	152	115	29	85	9	75	42	33	25	4	2	23
TSS_i/TSS_T	1.000	.358	.306	.183	.121	.030	.080	.009	.061	.024	.027	.015	.005	.000	.009
MEAN	24.615	26.714	26.811	27.552	28.113	26.621	28.635	25.899	28.920	29.833	27.758	25.960	30.750	31.000	25.522

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

⟶ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

⇩ =Split attempted but not made.

NA =Split not attempted.

TABLE E7 (cont'd.)

Predictor	Group Number							
	1	3	6	9	12	44	45*	56*	57*

Predictor	1	3	6	9	12	44	45*	56*	57*
Sex	.000	.010	.007	.003	.110	.046		.072	
Age	.006	.024	.039	.039	.024	.026		.044	
Major	.017	.021	.027	.053	.190	.322		.058	
Credits	.006	.012	.012	.020	.013	.013		.210	
Curr. Ld.	.006	.008	.009	.012	.022	.020		.018	
GPA	.188	.071	.100	.064	.170	.143		.060	
CQT-V	.101	.100	.070	.018	.069	.064		.307	
CQT-Q	.090	.093	.074	.073	.057	.131		.129	
CQT-T	.139	.134	.116	.092	.216	.041		.119	
Extravert	.015	.008	.010	.022	.096	.118		.038	
Neurotic	.009	.012	.022	.040	.062	.050		.115	
Eys. Lie	.016	.013	.018	.020	.013	.156		.093	
A-H Anx.	.055	.028	.028	.022	.096	.205		.221	
Anx.-1	.002	.025	.030	.006	.000	.002		.000	
Anx.-2	.011	.010	.012	.024	.051	.110		.134	
Anx.-3	.006	.003	.005	.011	.088	.030		.082	
Accuracy	.010	.004	.005	.008	.019	.021		.039	
Success	.012	.007	.007	.010	.011	.010		.137	
Learn. Set.	.049	.040	.030	.029	.106	.171	NA	.087	NA
Reason En.	.006	.009	.008	.006	.032	.036		.041	
Pre-att.	.001	.015	.022	.016	.080	.098		.091	
Post-att.	.006	.034	.030	.026	.060	.083		.056	
Disc. Att.	.004	.020	.013	.030	.080	.091		.171	
50-50-1	.049	.144	.032	.057	.205	.033		.072	
50-50-2	.089	.057	.053	.054	.263	.028		.034	
Pretest	.049	.037	.034	.029	.021	.073		.178	
Midterm	.126	.070	.060	.071	.127	.156		.134	
Inst. Ext.	.003	.004	.003	.015	.005	.004		.143	
Inst. Neu.	.010	.009	.005	.027	.003	.023		.138	
Inst. M-C	.006	.011	.007	.013	.005	.004		.143	
Inst. S-G	.005	.007	.008	.014	.003	.023		.138	
Inst. Cal-F	.005	.010	.007	.033	.005	.023		.143	
Inst. Risk	.011	.013	.019	.097	.005	.004		.143	
Inst. Load	.014	.035	.035	.048	.005	.005		.143	
Inst. Teach	.003	.003	.003	.025	.005	.010		.143	
Inst. ED200	.015	.010	.003	.013	.003	.023		.059	
N	532	213	212	152	37	33	4	22	11
TSS_i/TSS_T	1.000	.358	.306	.183	.045	.031	.002	.013	.008
MEAN	24.615	26.714	26.811	27.552	25.811	25.242	30.500	26.364	23.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

=Split attempted but not made.

* =Final group.

NA =Split not attempted.

TABLE E7 (cont'd.)

TABLE E7 (cont'd.)

Predictor	Group Number 1	3	6	7*	8	26*	27	30*	31	42	43*	50	51*	66*	67*
Sex	.000	.010	.007		.007		.004		.028	.017		.015	.003		
Age	.006	.024	.039		.023		.024		.037	.035		.116	.033		
Major	.017	.021	.027		.025		.044		.082	.101		.108	.178		
Credits	.006	.012	.012		.038		.059		.037	.012		.024	.067		
Current Load	.006	.008	.009		.033		.041		.050	.076		.030	.120		
GPA	.188	.071	.100		.062		.053		.024	.014		.226	.242		
CQT-V	.101	.100	.070		.062		.087		.064	.041		.100	.043		
CQT-Q	.090	.093	.074		.073		.053		.029	.028		.153	.055		
CQT-T	.139	.134	.116		.102		.071		.038	.019		.049	.079		
Extraversion	.015	.008	.010		.042		.052		.017	.028		.108	.162		
Neuroticism	.009	.012	.022		.028		.042		.065	.098		.124	.120		
Eysenck Lie	.016	.013	.018		.060		.010		.005	.023		.056	.056		
A-H Test Anxiety	.055	.028	.028		.054		.052		.067	.072		.212	.133		
Test Anxiety-1	.002	.024	.030		.085		.102		.182	.000		.000	.000		
Test Anxiety-2	.011	.010	.012		.068		.083		.076	.108		.100	.188		
Test Anxiety-3	.006	.003	.005		.039		.039		.088	.097		.159	.071		
Accuracy	.010	.004	.005		.025		.027		.071	.076		.471	.274		
Success	.012	.007	.007		.012		.015		.033	.049		.011	.140		
Learning Set	.049	.040	.030	NA	.039	NA	.027	NA	.023	.045	NA	.062	.126	NA	NA
Reason Enrolled	.006	.009	.008		.012		.003		.028	.025		.080	.040		
Pre-attitude	.001	.015	.022		.110		.144		.023	.025		.035	.192		
Post-attitude	.006	.034	.030		.043		.054		.076	.043		.091	.096		
Discussion Attitude	.004	.020	.013		.086		.117		.177	.151		.138	.075		
50-50-1 (Asp.-Exp.-1)	.049	.144	.032		.058		.067		.100	.027		.016	.251		
50-50-2 (Asp.-Exp.-2)	.089	.057	.053		.111		.026		.050	.076		.101	.032		
Pretest	.049	.037	.034		.061		.075		.023	.025		.074	.120		
Midterm	.126	.070	.060		.048		.046		.037	.035		.159	.075		
Instructor Extraversion	.003	.004	.003		.029		.054		.104	.071		.108	.040		
Instructor Neuroticism	.010	.009	.005		.021		.032		.084	.089		.108	.100		
Instructor Marlowe-Crowne	.006	.011	.007		.060		.060		.054	.100		.108	.043		
Instructor Sanford-Gough	.005	.007	.008		.060		.060		.058	.050		.108	.115		
Instructor California-F	.005	.010	.007		.045		.036		.077	.074		.090	.029		
Instructor Risk	.011	.013	.019		.033		.048		.045	.046		.110	.188		
Instructor Course Load	.014	.035	.035		.076		.076		.064	.070		.108	.079		
Instructor Teaching Experience	.003	.003	.003		.054		.097		.093	.068		.100	.041		
Instructor ED 200	.015	.010	.003		.032		.032		.044	.082		.030	.187		
N	532	213	212	1	60	1	59	7	50	47	2	25	22	6	19
TSS_i/TSS_T	1.000	.358	.306	.000	.087	.000	.078	.002	.056	.042	.003	.020	.016	.002	.008
MEAN	24.615	26.714	26.811	6.000	24.933	16.000	25.085	22.143	25.760	26.085	19.500	27.080	24.954	30.167	26.105

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E7 (cont'd.)

Predictor	Group Number								
	1	2	5	22	23	32*	33	38*	39*
Sex	.000	.000	.012		.000		.000	.000	
Age	.006	.001	.002		.009		.008	.012	
Major	.017	.017	.101		.101		.089	.074	
Credits	.006	.001	.015		.010		.024	.010	
Curr. Ld.	.006	.004	.013		.028		.026	.013	
GPA	.188	.024	.029		.080		.076	.068	
CQT-V	.101	.061	.057		.057		.054	.055	
CQT-Q	.090	.068	.022		.049		.051	.037	
CQT-T	.139	.108	.059		.061		.057	.057	
Extravert	.015	.022	.015		.010		.010	.010	
Neurotic	.009	.013	.058		.087		.114	.140	
Eys. Lie	.016	.029	.015		.029		.043	.051	
A-H Anx.	.055	.024	.027		.025		.022	.021	
Anx.-1	.002	.000	.000		.000		.000	.000	
Anx.-2	.011	.008	.005		.010		.024	.017	
Anx.-3	.049	.009	.013		.009		.062	.088	
Accuracy	.010	.011	.027		.047		.068	.031	
Success	.012	.005	.006		.010		.004	.018	
Learn. Set	.049	.058	.134	NA	.026	NA	.041	.049	NA
Reason En.	.006	.003	.003		.013		.030	.008	
Pre-att.	.001	.013	.030		.020		.014	.011	
Post-att.	.006	.010	.052		.031		.049	.047	
Disc. Att.	.004	.007	.007		.020		.014	.030	
50-50-1	.049	.009	.013		.009		.017	.020	
50-50-2	.089	.036	.074		.076		.056	.056	
Pretest	.049	.034	.047		.030		.040	.035	
Midterm	.126	.051	.116		.120		.057	.056	
Inst. Ext.	.003	.004	.006		.033		.033	.031	
Inst. Neu.	.010	.015	.016		.010		.008	.005	
Inst. M-C	.006	.010	.045		.052		.055	.058	
Inst. S-G	.005	.003	.045		.052		.055	.058	
Inst. Cal-F.	.005	.006	.064		.052		.052	.040	
Inst. Risk	.011	.019	.039		.014		.017	.008	
Inst. Load	.014	.004	.026		.022		.025	.032	
Inst. Teach	.003	.007	.008		.007		.022	.018	
Inst. ED200	.015	.025	.016		.015		.020	.018	
N	532	314	83	6	76	6	70	69	1
TSS_i/TSS_T	1.000	.449	.106	.014	.078	.005	.063	.056	.000
MEAN	24.615	23.207	25.096	20.833	25.447	22.000	25.742	25.855	18.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E7 (cont'd.)

Predictor	Group Number							
	1	2	4	11	19	48	49*	62*	63*
Sex	.000	.000	.004	.013	.013	.002	.051	.026	
Age	.006	.001	.005	.004	.009	.067	.020	.091	
Major	.017	.017	.010	.027	.083	.114	.209	.159	
Credits	.006	.001	.008	.035	.027	.036	.190	.033	
Curr. Ld.	.006	.004	.008	.022	.079	.015	.123	.026	
GPA	.188	.024	.027	.026	.104	.128	.086	.095	
CQT-V	.101	.061	.010	.015	.081	.221	.059	.251	
CQT-Q	.090	.068	.023	.015	.036	.155	.284	.095	
CQT-T	.139	.108	.010	.058	.100	.169	.122	.251	
Extravert	.015	.022	.031	.043	.009	.018	.057	.125	
Neurotic	.009	.013	.017	.049	.054	.074	.079	.075	
Eys. Lie	.016	.029	.039	.007	.042	.149	.070	.054	
A-H Anx.	.055	.024	.007	.028	.049	.192	.095	.070	
Anx.-1	.002	.000	.001	.000	.000	.000	.000	.000	
Anx.-2	.011	.008	.017	.002	.020	.025	.052	.029	
Anx.-3	.006	.001	.002	.003	.026	.042	.134	.035	
Accuracy	.010	.011	.007	.019	.016	.010	.008	.033	
Success	.012	.005	.007	.008	.039	.019	.059	.008	
Learn. Set.	.049	.058	.051	.052	.151	.117	.190	.112	NA
Reason En.	.006	.003	.004	.020	.055	.108	.042	.062	
Pre-att.	.001	.013	.018	.036	.077	.043	.134	.055	
Post-att.	.006	.010	.009	.034	.093	.050	.178	.075	
Disc. Att.	.004	.007	.010	.021	.028	.250	.059	.152	
50-50-1	.049	.009	.022	.015	.015	.024	.021	.036	
50-50-2	.089	.036	.020	.019	.068	.065	.063	.075	
Pretest	.049	.034	.034	.022	.123	.281	.115	.193	
Midterm	.126	.051	.056	.020	.086	.070	.237	.035	
Inst. Ext.	.003	.004	.005	.004	.048	.134	.059	.324	
Inst. Neu.	.010	.015	.013	.025	.048	.034	.059	.121	
Inst. M-C	.006	.010	.006	.044	.048	.134	.007	.320	
Inst. S-G	.005	.003	.014	.022	.060	.181	.012	.271	
Inst. Cal-F	.005	.006	.007	.022	.014	.222	.015	.194	
Inst. Risk	.011	.019	.017	.035	.048	.134	.059	.321	
Inst. Load	.014	.004	.010	.040	.043	.110	.015	.120	
Inst. Teach	.003	.007	.027	.082	.009	.034	.009	.014	
Inst. Ed200	.015	.025	.023	.045	.048	.178	.059	.188	
N	532	314	231	112	49	27	22	23	4
TSS_i/TSS_T	1.000	.449	.295	.124	.042	.022	.013	.013	.003
MEAN	24.615	23.207	22.528	23.357	24.347	23.407	25.500	22.826	26.750

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E7 (cont'd.)

TABLE E7 (cont'd.)

Predictor	Group Number												
	1	2	4	11	18	34	35	46*	47	54*	55*	64*	65*
Sex	.000	.000	.004	.013	.016	.000	.221		.007	.000			
Age	.006	.001	.005	.004	.008	.020	.024		.082	.037			
Major	.017	.017	.010	.027	.040	.168	.221		.188	.120			
Credits	.006	.001	.008	.035	.081	.055	.080		.081	.117			
Current Load	.006	.004	.008	.022	.013	.027	.051		.018	.003			
GPA	.188	.024	.027	.026	.069	.172	.102		.018	.042			
CQT-V	.101	.061	.010	.015	.023	.066	.043		.103	.154			
CQT-Q	.090	.068	.023	.015	.028	.035	.098		.063	.084			
CQT-T	.139	.108	.010	.058	.040	.094	.088		.088	.077			
Extraversion	.015	.022	.031	.043	.123	.025	.074		.020	.030			
Neuroticism	.009	.013	.017	.049	.093	.044	.125		.059	.080			
Eysenck Lie	.016	.029	.039	.007	.013	.032	.077		.015	.062			
A-H Test Anxiety	.055	.024	.007	.028	.032	.036	.054		.035	.048			
Test Anxiety-1	.002	.000	.001	.000	.003	.001	.000		.000	.000			
Test Anxiety-2	.011	.008	.017	.002	.010	.047	.022		.035	.054			
Test Anxiety-3	.006	.001	.002	.003	.040	.090	.115		.090	.085			
Accuracy	.010	.011	.007	.019	.013	.032	.029		.054	.042			
Success	.012	.005	.007	.008	.058	.008	.460		.018	.003			
Learning Set	.049	.058	.051	.052	.036	.039	.055	NA	.036	.060	NA	NA	NA
Reason Enrolled	.006	.003	.004	.020	.029	.037	.051		.032	.015			
Pre-attitude	.001	.013	.018	.036	.020	.104	.115		.114	.121			
Post-attitude	.006	.010	.009	.034	.044	.112	.065		.081	.117			
Discussion Attitude	.004	.007	.010	.021	.059	.066	.115		.057	.045			
50-50-1 (Asp.-Exp.-1)	.049	.009	.022	.015	.038	.025	.014		.047	.085			
50-50-2 (Asp.-Exp.-2)	.089	.036	.020	.019	.027	.082	.029		.131	.199			
Pretest	.049	.034	.034	.022	.044	.130	.149		.085	.052			
Midterm	.126	.051	.056	.020	.065	.067	.093		.055	.038			
Instructor Extraversion	.003	.004	.005	.004	.015	.047	.080		.084	.108			
Instructor Neuroticism	.010	.015	.013	.025	.032	.046	.067		.072	.072			
Instructor Marlowe-Crowne	.006	.010	.006	.044	.016	.027	.080		.057	.108			
Instructor Sanford-Gough	.005	.003	.014	.022	.023	.055	.080		.075	.122			
Instructor California-F	.005	.006	.007	.022	.008	.048	.350		.079	.108			
Instructor Risk	.011	.019	.017	.035	.020	.049	.519		.079	.078			
Instructor Course Load	.014	.004	.010	.040	.032	.034	.167		.088	.184			
Instructor Teaching Experience	.003	.007	.027	.082	.025	.010	.057		.037	.052			
Instructor ED 200	.015	.025	.023	.045	.006	.013	.097		.050	.129			
N	532	314	231	112	63	43	20	3	40	37	3	16	4
TSS_i/TSS_T	1.000	.449	.295	.124	.072	.042	.021	.002	.032	.026	.001	.006	.004
MEAN	24.615	23.207	22.528	23.357	22.587	23.326	21.000	19.000	23.650	23.973	19.667	22.063	16.750

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E7 (cont'd.)

TABLE E7 (cont'd.)

Predictor	Group Number															
	1	2	4	10	14*	15	16*	17	24	25	36	37*	52*	53*	60*	61*
Sex	.000	.000	.004	.000		.000	.028	.000	.000	.005	.002		.000		.005	
Age	.006	.001	.005	.002		.008	.186	.013	.010	.000	.002		.033		.029	
Major	.017	.017	.010	.036		.040	.208	.079	.009	.003	.010		.064		.011	
Credits	.006	.001	.008	.020		.018	.086	.034	.086	.068	.102		.208		.089	
Current Load	.006	.004	.008	.069		.000	.018	.008	.022	.042	.011		.026		.027	
GPA	.188	.024	.027	.038		.015	.186	.023	.136	.014	.038		.057		.059	
CQT-V	.101	.061	.010	.010		.011	.082	.019	.213	.018	.031		.112		.187	
CQT-Q	.090	.068	.023	.038		.037	.176	.032	.146	.017	.051		.061		.187	
CQT-T	.139	.108	.010	.028		.027	.154	.027	.164	.025	.077		.148		.289	
Extraversion	.015	.022	.031	.043		.052	.134	.049	.073	.106	.013		.051		.050	
Neuroticism	.009	.013	.017	.028		.028	.143	.052	.310	.082	.050		.093		.142	
Eysenck Lie	.016	.029	.039	.068		.058	.084	.041	.333	.009	.011		.028		.101	
A-H Test Anxiety	.055	.024	.007	.030		.033	.040	.046	.050	.057	.062		.041		.128	
Test Anxiety-1	.002	.000	.001	.000		.000	.000	.000	.000	.000	.000		.000		.000	
Test Anxiety-2	.011	.008	.017	.018		.017	.019	.029	.104	.053	.035		.006		.105	
Test Anxiety-3	.006	.001	.002	.011		.013	.056	.020	.297	.031	.066		.017		.092	
Accuracy	.010	.011	.007	.031		.025	.086	.041	.096	.043	.013		.094		.070	
Success	.012	.005	.007	.015		.046	.201	.022	.040	.001	.012		.044		.166	
Learning Set	.049	.058	.051	.036	NA	.053	.185	.048	.081	.079	.087	NA	.102	NA	.049	NA
Reason Enrolled	.006	.003	.004	.004		.002	.075	.001	.080	.001	.021		.001		.089	
Pre-attitude	.001	.013	.018	.032		.029	.067	.052	.165	.059	.082		.084		.187	
Post-attitude	.006	.010	.009	.014		.029	.047	.037	.044	.044	.055		110		.116	
Discussion Attitude	.004	.007	.010	.017		.015	.124	.013	.115	.029	.037		.091		.085	
50-50-1 (Asp.-Exp.-1)	.049	.009	.022	.036		.031	.077	.033	.146	.006	.020		.104		.070	
50-50-2 (Asp.-Exp.-2)	.089	.036	.020	.018		.025	.048	.025	.052	.019	.052		.048		.070	
Pretest	.049	.034	.034	.032		.036	.106	.031	.193	.079	.209		.053		.236	
Midterm	.126	.051	.056	.024		.017	.188	.019	.067	.016	.022		.057		.135	
Instructor Extraversion	.003	.004	.005	.012		.029	.022	.026	.076	.063	.097		.136		.213	
Instructor Neuroticism	.010	.015	.013	.015		.019	.035	.027	.076	.093	.045		.041		.100	
Instructor Marlowe-Crowne	.006	.010	.006	.023		.030	.065	.040	.035	.052	.063		.052		.012	
Instructor Sanford-Gough	.005	.003	.014	.056		.051	.064	.076	.096	.057	.056		.035		.084	
Instructor California-F	.005	.006	.007	.007		.015	.076	.076	.086	.043	.012		.020		.215	
Instructor Risk	.011	.019	.017	.052		.055	.047	.068	.060	.054	.027		.041		.126	
Instructor Course Load	.014	.004	.010	.032		.028	.029	.043	.192	.019	.095		.041		.228	
Instructor Teaching Experience	.003	.007	.027	.026		.038	.014	.033	.040	.089	.045		.041		.100	
Instructor ED 200	.015	.025	.023	.010		.017	.175	.019	.033	.039	.082		.097		.118	
N	532	314	231	117	8	109	24	85	28	57	49	5	31	18	22	6
TSS_i/TSS_T	1.000	.449	.295	.143	.003	.130	.020	.102	.029	.065	.040	.016	.016	.016	.014	.005
MEAN	24.615	23.207	22.528	21.838	18.750	22.064	23.500	21.658	22.929	21.035	21.490	18.000	20.581	23.056	23.818	19.667

Proportion of variation in that group explainable for each predictor. $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA=Split not attempted.

TABLE E8

AID III: Proportion of Variation in Final Exam Total Score by Group within Branch Explainable for Each Final-Course Variable

TABLE E8 (cont'd.)

Predictor	Group Number													
	1	3	10	11*	14	15	18	19	26*	27	34*	35*	40*	41*
Sex	.000	.013	.010		.000		.003	.005		.017		.047		.015
Age	.001	.008	.027		.021		.019	.081		.020		.017		.080
Major	.027	.042	.070		.055		.087	.105		.063		.061		.060
Credits	.019	.016	.006		.012		.030	.083		.005		.012		.085
Current Load	.005	.006	.003		.005		.007	.057		.018		.032		.074
GPA	.203	.042	.075		.070		.085	.032		.071		.071		.058
CQT-V	.094	.135	.066		.061		.101	.049		.090		.031		.038
CQT-Q	.088	.171	.123		.080		.086	.038		.090		.031		.040
CQT-T	.121	.160	.138		.074		.116	.054		.123		.066		.049
Extraversion	.021	.016	.014		.017		.052	.084		.095		.095		.053
Neuroticism	.004	.010	.025		.040		.043	.094		.036		.023		.070
Eysenck Lie	.012	.015	.018		.010		.063	.062		.095		.083		.117
A-H Test Anxiety	.061	.042	.044		.034		.044	.089		.051		.084		.113
Test Anxiety-1	.000	.000	.000		.000		.001	.008		.004		.003		.019
Test Anxiety-2	.020	.019	.002		.007		.014	.049		.027		.016		.065
Test Anxiety-3	.015	.009	.017		.012		.027	.062		.012		.030		.045
Accuracy	.008	.018	.014		.010		.012	.035		.018		.026		.034
Success	.016	.009	.011		.018		.011	.055		.021		.021		.058
Learning Set	.051	.030	.035	NA	.057	NA	.047	.090	NA	.055	NA	.041	NA	.077
Reason Enrolled	.004	.003	.020		.005		.098	.045		.122		.116		.007
Pre-attitude	.002	.036	.038		.037		.065	.120		.066		.018		.210
Post-attitude	.005	.047	.026		.061		.048	.146		.057		.062		.113
Discussion Attitude	.007	.044	.017		.022		.014	.088		.064		.021		.072
50-50-1 (Asp.-Exp.-1)	.067	.318	.054		.019		.031	.061		.048		.078		.056
50-50-2 (Asp.-Exp.-2)	.132	.118	.083		.073		.017	.175		.014		.020		.032
Pretest	.069	.074	.075		.080		.058	.070		.070		.073		.029
Midterm	.187	.123	.115		.114		.043	.172		.041		.027		.042
Instructor Extraversion	.005	.009	.005		.004		.027	.039		.015		.014		.010
Instructor Neuroticism	.009	.053	.038		.035		.035	.084		.036		.023		.118
Instructor Marlowe-Crowne	.004	.050	.030		.032		.018	.084		.020		.013		.074
Instructor Sanford-Gough	.006	.022	.006		.008		.027	.040		.037		.018		.061
Instructor California-F	.012	.017	.039		.031		.032	.033		.025		.005		.027
Instructor Risk	.015	.026	.028		.035		.051	.034		.021		.016		.025
Instructor Course Load	.017	.026	.026		.047		.193	.059		.009		.005		.148
Instructor Teaching Experience	.005	.009	.011		.018		.040	.015		.032		.007		.004
Instructor ED 200	.016	.039	.025		.044		.056	.026		.018		.009		.027
N	532	148	147	1	133	14	83	49	8	75	6	69	8	41
TSS_i/TSS_T	1.000	.218	.149	.000	.124	.004	.074	.036	.005	.055	.004	.045	.003	.003
MEAN	53.838	58.959	59.252	16.000	58.624	65.214	57.301	60.816	63.875	56.600	51.333	57.058	56.625	61.634

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↷ =Split attempted but not made.

NA =Split not attempted.

TABLE E8 (cont'd.)

Predictor	Group Number						
	1	2	5	7	46*	47	54*	55*
Sex	.000	.002	.014	.001		.014		
Age	.001	.001	.005	.030		.148		
Major	.027	.014	.015	.101		.360		
Credits	.019	.005	.008	.068		.148		
Current Load	.005	.005	.003	.091		.092		
GPA	.203	.068	.065	.032		.096		
CQT-V	.094	.044	.049	.210		.232		
CQT-Q	.088	.044	.021	.054		.148		
CQT-T	.121	.052	.048	.119		.181		
Extraversion	.012	.026	.014	.228		.283		
Neuroticism	.004	.006	.017	.132		.115		
Eysenck Lie	.012	.026	.014	.019		.006		
A-H Anxiety	.061	.029	.028	.051		.148		
Test Anxiety-1	.000	.001	.012	.000		.100		
Test Anxiety-2	.020	.014	.020	.113		.136		
Test Anxiety-3	.015	.009	.003	.020		.012		
Accuracy	.018	.011	.006	.166		.165		
Success	.016	.011	.006	.106		.120		
Learning Set	.051	.051	.037	.111	NA	.115	NA	NA
Reason Enrolled	.004	.004	.003	.018		.021		
Pre-attitude	.002	.005	.006	.079		.282		
Post-attitude	.005	.014	.030	.116		.027		
Discussion Att.	.007	.005	.007	.054		.128		
50-50-1 (Asp.-Exp.)	.067	.011	.026	.028		.280		
50-50-2 (Asp.-Exp.)	.132	.061	.023	.091		.092		
Pretest	.069	.044	.043	.027		.125		
Midterm	.187	.120	.079	.007		.086		
Inst. Extravert	.005	.015	.017	.105		.129		
Inst. Neurotic	.009	.008	.014	.049		.129		
Inst. Marlowe-Cne.	.004	.003	.006	.135		.132		
Inst. Sanford-Ggh.	.006	.004	.006	.123		.067		
Inst. California-F	.012	.008	.014	.082		.129		
Inst. Risk	.015	.017	.016	.074		.084		
Inst. Load	.017	.013	.018	.247		.235		
Inst. Teaching	.005	.015	.017	.148		.034		
Inst. ED 200	.016	.015	.015	.136		.044		
N	532	379	239	32	12	20	5	15
TSS_i/TSS_T	1.000	.575	.279	.031	.005	.019	.003	.009
MEAN	53.838	51.839	53.569	57.563	60.833	55.600	60.800	53.867

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E8 (cont'd.)

Predictor	Group Number								
	1	2	5	6	9	22	23*	32*	33*
Sex	.001	.002	.014	.019	.009	.002		.001	
Age	.001	.001	.005	.002	.016	.014		.011	
Major	.027	.014	.015	.036	.085	.012		.003	
Credits	.019	.005	.008	.009	.027	.059		.020	
Curr. Ld	.005	.005	.003	.001	.012	.022		.029	
GPA	.203	.068	.065	.066	.020	.021		.006	
CQT-V	.094	.044	.049	.029	.027	.025		.014	
CQT-Q	.088	.044	.021	.026	.018	.033		.035	
CQT-T	.121	.052	.048	.040	.029	.046		.044	
Extravert	.021	.008	.018	.024	.052	.041		.025	
Neurotic	.004	.006	.017	.012	.022	.009		.015	
Eys. Lie	.012	.026	.014	.015	.040	.035		.045	
A-H Anx.	.061	.029	.028	.030	.047	.043		.038	
Anx.-1	.000	.001	.012	.012	.052	.086		.109	
Anx.-2	.020	.040	.020	.027	.067	.044		.059	
Anx.-3	.015	.009	.003	.008	.006	.021		.031	
Accuracy	.008	.011	.006	.012	.042	.032		.045	
Success	.016	.011	.006	.008	.014	.015		.014	
Learn. Set	.051	.051	.037	.043	.083	.077	NA	.057	NA
Reason En.	.004	.004	.003	.002	.012	.005		.011	
Pre-att.	.002	.005	.006	.008	.019	.014		.017	
Post-att.	.005	.014	.030	.036	.065	.035		.050	
Disc. Att.	.007	.005	.007	.007	.030	.062		.105	
50-50-1	.067	.011	.026	.019	.017	.023		.035	
50-50-2	.132	.061	.023	.016	.074	.093		.099	
Pretest	.069	.044	.043	.044	.084	.093		.062	
Midterm	.187	.120	.079	.020	.029	.027		.032	
Inst. Ext.	.005	.015	.017	.011	.042	.043		.039	
Inst. Neu.	.009	.008	.014	.011	.048	.030		.016	
Inst. M-C	.004	.003	.006	.011	.021	.005		.022	
Inst. S-G	.006	.004	.006	.011	.007	.021		.033	
Inst. Cal-F	.012	.008	.014	.013	.052	.098		.027	
Inst. Risk	.015	.017	.016	.034	.052	.099		.007	
Inst. Load	.017	.013	.018	.023	.080	.103		.018	
Inst. Teach	.005	.015	.017	.006	.042	.043		.039	
Inst. ED200	.016	.015	.015	.012	.005	.005		.003	
N	532	379	239	207	99	81	18	75	6
TSS_i/TSS_T	1.000	.575	.279	.226	.095	.065	.021	.056	.003
MEAN	53.838	51.839	53.569	52.952	54.404	55.099	51.278	55.520	49.833

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E8 (cont'd.)

TABLE E8 (cont'd.)

Predictor	Group Number																
	1	2	5	6	8	20	21	24*	25	42	43*	48*	49*	50	51*	52*	53*
Sex	.000	.002	.014	.019	.027	.015	.106	.059	.001	.001				003			
Age	.001	.001	.005	.002	.007	.013	.022	.017	.008	.017				.013			
Major	.027	.014	.015	.036	.047	.060	.393	.011	.138	.181				.240			
Credits	.019	.005	.008	.009	.022	.032	.032	.013	.048	.021				.069			
Current Load	.005	.005	.003	.001	.001	.002	.025	.016	.008	.024				.006			
GPA	.203	.068	.065	.066	.013	.029	.146	.031	.051	.086				089			
CQT-V	.094	.044	.049	.029	.034	.028	.035	.043	.064	.087				042			
CQT-Q	.088	.044	.021	.026	.053	.038	.114	.089	.047	.074				.161			
CQT-T	.121	.052	.048	.040	.074	.051	.133	.120	.078	.087				.054			
Extraversion	.021	.008	.018	.024	.025	.026	.045	.052	.194	.037				.015			
Neuroticism	.004	.006	.017	.012	.031	.029	.049	.042	.077	.073				.103			
Eysenck Lie	.012	.026	.014	.015	.008	.009	.080	.053	.053	.165				.150			
A-H Test Anxiety	.061	.029	.028	.030	.030	.048	.080	.052	.058	.041				.082			
Test Anxiety-1	.000	.001	.012	.012	.000	.000	.000	.004	.000	.000				.000			
Test Anxiety-2	.020	.014	.020	.027	.030	.025	.026	.022	.024	.007				.017			
Test Anxiety-3	.015	.009	.003	.008	.016	.026	.026	.043	.072	.026				.069			
Accuracy	.008	.011	.006	.012	.010	.016	.071	.017	.062	.040				.072			
Success	.016	.011	.006	.008	.016	.017	.091	.030	.011	.033				.049			
Learning Set	.051	.051	.037	.043	.046	.038	.093	.101	.046	.044	NA	NA	NA	049	NA	NA	NA
Reason Enrolled	.004	.004	.003	.002	.020	.007	.040	.024	.022	.040				.013			
Pre-attitude	.002	.005	.006	.008	.064	.053	.026	.118	.048	.075				.045			
Post-attitude	.005	.014	.030	.036	.052	.056	.113	.098	.120	.170				.316			
Discussion Attitude	.007	.005	.007	.007	.031	.057	.032	.026	.150	.184				.126			
50-50-1 (Asp.-Exp.-1)	.067	.011	.026	.019	.027	.008	.043	.025	.030	.030				.109			
50-50-2 (Asp.-Exp.-2)	.132	.061	.023	.016	.038	.029	.166	.067	.107	.163				.075			
Pretest	.069	.044	.043	.044	.055	.066	.101	.056	.095	.098				.099			
Midterm	.187	.120	.079	.020	.044	.017	.153	.062	.040	.142				.283			
Instructor Extraversion	.005	.015	.017	.011	.025	.028	.061	.034	.051	.046				.009			
Instructor Neuroticism	.009	.008	.014	.011	.011	.033	.061	.018	.020	.033				.009			
Instructor Marlowe-Crowne	.004	.003	.006	.011	.014	.023	.127	.026	.097	.170				.000			
Instructor Sanford-Gough	.006	.004	.006	.011	.015	.022	.108	.024	.120	.235				.009			
Instructor California-F	.012	.008	.014	.013	.060	.052	.074	.040	.036	.055				.003			
Instructor Risk	.015	.017	.016	.034	.069	.059	.146	.063	.017	.033				.009			
Instructor Course Load	.017	.013	.018	.023	.017	.028	.050	.025	.036	.071				.003			
Instructor Teaching Experience	.005	.015	.017	.006	.020	.094	.031	.005	.020	.020				.000			
Instructor ED 200	.016	.016	.015	.012	.039	.043	.022	.009	.011	.033				.009			
N	532	379	239	207	108	76	32	40	36	31	5	16	16	25	6	14	11
TSS_i/TSS_T	1.000	.575	.279	.226	.116	.078	.030	.035	.036	.028	.004	.006	.012	.021	.001	.010	.004
MEAN	53.838	51.839	53.569	52.952	51.620	50.671	53.875	49.150	52.361	51.452	58.000	57.000	50.750	50.280	56.333	47.929	53 273

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

↷ =Split made on this variable.

(.xxx) =Next best BSS/TSS.

* =Final group.

↴ =Split attempted but not made.

NA =Split not attempted.

TABLE E8 (cont'd.)

TABLE E8 (cont'd.)

Predictor	Group Number											
	1	2	4	13	16	17	28	29*	36*	37*	38*	39*
Sex	.000	.002	.036	.023	.063	.032	.037		.005	.128		.061
Age	.001	.001	.007	.002	.021	.003	.059		.039	.016		.029
Major	.027	.014	.033	.091	.134	.081	.141		.207	.134		.140
Credits	.019	.005	.026	.031	.032	.132	.048		.043	.209		.269
Current Load	.005	.005	.013	.021	.041	.064	.021		.028	.209		.019
GPA	.203	.068	.039	.059	.044	.065	.074		.123	.209		.139
CQT-V	.094	.044	.058	.053	.091	.090	.082		.143	.189		.184
CQT-Q	.088	.044	.090	.020	.032	.071	.036		.047	.139		.057
CQT-T	.121	.052	.100	.023	.041	.111	.057		.111	.084		.145
Extraversion	.021	.008	.036	.024	.119	.037	.147		.205	.114		.081
Neuroticism	.004	.006	.042	.043	.317	.061	.021		.034	.159		.079
Eysenck Lie	.012	.026	.063	.090	.056	.323	.066		.083	.065		.250
A-H Test Anxiety	.061	.029	.035	.043	.049	.064	.054		.071	.316		.080
Test Anxiety-1	.000	.001	.004	.004	.000	.000	.000		.000	.000		.000
Test Anxiety-2	.020	.014	.017	.027	.033	.036	.043		.024	.054		.120
Test Anxiety-3	.015	.009	.021	.033	.063	.016	.060		.216	.036		.112
Accuracy	.008	.011	.047	.064	.280	.043	.049		.037	.209		.050
Success	.016	.011	.006	.032	.045	.008	.043		.022	.090		.016
Learning Set	.051	.051	.051	.042	.022	.071	.046	NA	.027	.167	NA	.209
Reason Enrolled	.004	.004	.009	.054	.130	.064	.053		.141	.027		.100
Pre-attitude	.002	.005	.033	.057	.056	.055	.071		.050	.112		.118
Post-attitude	.005	.014	.017	.020	.029	.073	.057		.043	.083		.078
Discussion Attitude	.007	.005	.011	.025	.085	.141	.027		.026	.195		191
50-50-1 (Asp.-Exp.-1)	.067	.011	.012	.008	.001	.035	.002		.071	.039		.058
50-50-2 (Asp.-Exp.-2)	.132	.061	.028	.075	.043	.109	.060		.045	.121		.123
Pretest	.069	.044	.036	.072	.109	.179	.150		.021	.074		.267
Midterm	.187	.120	.084	.117	.058	.134	.130		.119	.178		.031
Instructor Extraversion	.005	.015	.008	.026	.079	.081	.087		.067	.274		.112
Instructor Neuroticism	.009	.008	.007	.016	.063	.138	.069		.192	.255		.165
Instructor Marlowe-Crowne	.004	.003	.006	.034	.049	.040	.054		.023	.137		.053
Instructor Sanford-Gough	.006	.004	.006	.024	.025	.084	.024		.079	.137		.045
Instructor California-F	.012	.008	.007	.019	.057	.117	.054		.152	.109		.083
Instructor Risk	.015	.017	.010	.022	.017	.074	.025		.152	.153		.046
Instructor Course Load	.017	.013	.010	.015	.031	.035	.046		.152	.137		.049
Instructor Teaching Experience	.005	.015	.016	.021	.076	.067	.034		.192	.068		.126
Instructor ED 200	.016	.015	.006	.019	.025	.095	.045		.081	.023		.208
N	532	379	137	99	51	48	50	1	27	23	17	31
TSS_i/TSS_T	1.000	.575	.217	.130	.071	.044	.049	.000	.023	.018	.008	.022
MEAN	53.838	51.839	49.007	50.283	48.314	52.375	48.800	24.000	46.963	50.957	56.177	50.290

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E8 (cont'd.)

Predictor	Group Number							
	1	2	4	12	30	31*	44*	45*
Sex	.000	.002	.036	.002	.003		.039	
Age	.001	.001	.007	.030	.031		.052	
Major	.027	.014	.033	.011	.117		.176	
Credits	.019	.005	.026	.051	.076		.099	
Current Load	.005	.005	.013	.035	.106		.103	
GPA	.203	.068	.039	.067	.076		.099	
CQT-V	.094	.044	.058	.164	.055		.219	
CQT-Q	.088	.044	.090	.113	.125		.115	
CQT-T	.121	.052	.100	.142	.139		.193	
Extraversion	.021	.008	.036	.136	.086		.066	
Neuroticism	.004	.006	.042	.121	.081		.337	
Eysenck Lie	.012	.026	.063	.064	.038		.352	
A-H Anxiety	.061	.029	.035	.124	.149		.109	
Test Anxiety-1	.000	.001	.004	.000	.000		.000	
Test Anxiety-2	.020	.014	.017	.149	.180		.224	
Test Anxiety-3	.015	.009	.021	.007	.093		.052	
Accuracy	.008	.011	.047	.044	.103		.102	
Success	.016	.011	.006	.025	.049		.003	
Learning Set	.051	.051	.051	.105	.088	NA	.099	NA
Reason Enrolled	.004	.004	.009	.050	.142		.100	
Pre-attitude	.002	.005	.033	.079	.157		.140	
Post-attitude	.005	.014	.017	.088	.128		.182	
Discussion Att.	.007	.005	.011	.079	.099		.327	
50-50-1(Asp.-Exp.)	.067	.011	.012	.024	.092		.125	
50-50-2(Asp.-Exp.)	.132	.061	.028	.070	.025		.024	
Pretest	.069	.044	.036	.105	.155		.263	
Midterm	.187	.120	.084	.132	.100		.209	
Inst. Extravert	.005	.015	.008	.121	.125		.089	
Inst. Neurotic	.009	.008	.007	.399	.125		.099	
Inst. Marlowe-Cne.	.004	.003	.006	.142	.115		.089	
Inst. Sanford-Ggh.	.006	.004	.006	.142	.130		.097	
Inst. California-F	.010	.008	.007	.215	.013		.090	
Inst. Risk	.015	.017	.010	.273	.266		.099	
Inst. Load	.017	.013	.010	.090	.099		.090	
Inst. Teaching	.005	.015	.016	.332	.044		.039	
Inst. ED 200	.016	.015	.006	.064	.027		.039	
N	532	379	137	38	36	2	20	16
TSS_i/TSS_T	1.000	.575	.217	.065	.035	.004	.014	.012
MEAN	53.838	51.839	49.007	45.684	46.694	27.500	49.050	43.750

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

xxx=Next best BSS/TSS.

=Split attempted but not made.

* =Final group.

NA =Split not attempted.

TABLE E9

AID III: Proportion of Variation in Final Exam Grade by Group within Branch Explainable for Each Final-Course Variable

Predictor	Group Number									
	1	3	12	13	20*	21*	24	25*	28*	29*
Sex	.001	.015	.004	.005		.004	.002			.009
Age	.001	.011	.012	.050		.006	.038			.052
Major	.023	.050	.113	.057		.094	.081			.108
Credits	.014	.015	.035	.033		.017	.058			.040
Curr. Ld.	.006	.005	.002	.030		.016	.043			.037
GPA	.211	.051	.020	.047		.051	.047			.026
CQT-V	.085	.079	.171	.002		.056	.047			.082
CQT-Q	.096	.161	.120	.019		.053	.059			.138
CQT-T	.128	.138	.159	.178		.056	.036			.050
Extraversion	.018	.019	.071	.030		.059	.029			.100
Neuroticism	.005	.023	.042	.018		.051	.029			.079
Eys. Lie	.013	.023	.023	.012		.031	.036			.043
A-H Anxiety	.061	.054	.083	.043		.058	.019			.019
Anxiety-1	.000	.000	.000	.006		.000	.003			.005
Anxiety-2	.017	.012	.007	.055		.096	.036			.036
Anxiety-3	.018	.019	.050	.077		.027	.045			.071
Accuracy	.007	.014	.049	.010		.056	.005			.019
Success	.018	.009	.042	.020		.051	.022			.034
Learning Set	.050	.041	.072	.030	NA	.104	.058	NA	NA	.087
Reason Enrol	.003	.002	.003	.001		.014	.008			.058
Pre-attitude	.003	.045	.088	.022		.066	.066			.123
Post-attitude	.008	.024	.111	.024		.063	.013			.041
Discussion At.	.009	.025	.032	.025		.033	.039			.031
50-50-1	.072	.099	.179	.067		.033	.029			.105
50-50-2	.137	.088	.097	.070		.058	.084			.038
Pretest	.080	.063	.025	.049		.027	.075			.144
Midterm	.199	.089	.182	.039		.070	.043			.047
Inst. Ext.	.006	.009	.028	.067		.027	.068			.052
Inst. Neu.	.008	.033	.051	.094		.095	.094			.074
Inst. M-C	.004	.029	.039	.007		.041	.019			.036
Inst. S-G	.012	.012	.029	.014		.042	.010			.041
Inst. Cal-F	.017	.019	.113	.064		.086	.088			.063
Inst. Risk	.017	.023	.119	.077		.095	.109			.019
Inst. Load	.021	.029	.031	.044		.056	.030			.020
Inst. Teach	.006	.008	.022	.027		.058	.055			.051
Inst. ED 200	.013	.029	.089	.024		.059	.065			.052
N	532	148	63	85	10	52	71	14	16	55
TSS_i/TSS_T	1.000	.175	.075	.072	.013	.049	.059	.000	.012	.041
MEAN	3.270	4.074	3.698	4.353	2.900	3.846	4.225	5.000	3.813	4.345

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E9 (cont'd.)

TABLE E9 (cont'd.)

Predictor	Group Number													
	1	2	5	6	8*	9	10	11*	18*	19	32	33*	40*	41*
Sex	.001	.005	.008	.005		.001	.000	.000		.012	.005	.015		
Age	.001	.000	.001	.005		.004	.005	.015		.013	.013	.006		
Major	.023	.016	.012	.033		.042	.012	.011		.006	.104	.033		
Credits	.014	.006	.006	.006		.003	.006	.017		.018	.025	.010		
Current Load	.006	.005	.002	.001		.005	.007	.006		.007	.099	.020		
GPA	.211	.061	.049	.029		.022	.018	.050		.033	.044	.126		
CQT-V	.085	.042	.048	.052		.015	.094	.029		.132	.130	.190		
CQT-Q	.096	.043	.031	.037		.024	.157	.029		.051	.312	.072		
CQT-T	.128	.061	.058	.049		.033	.132	.041		.110	.214	.078		
Extraversion	.018	.007	.017	.025		.021	.032	.047		.070	.091	.208		
Neuroticism	.005	.015	.011	.019		.013	.092	.020		.156	.049	.099		
Eysenck Lie	.013	.026	.052	.029		.020	.038	.025		.074	.256	.016		
A-H Test Anxiety	.061	.027	.031	.034		.029	.098	.035		.078	.142	.044		
Test Anxiety-1	.000	.001	.003	.000		.000	.000	.000		.000	.000	.000		
Test Anxiety-2	.017	.014	.012	.023		.022	.087	.019		.028	.008	.089		
Test Anxiety-3	.018	.010	.004	.008		.006	.028	.029		.041	.153	.030		
Accuracy	.007	.005	.006	.014		.011	.026	.026		.027	.044	.019		
Success	.018	.013	.011	.009		.010	.013	.011		.013	.040	.014		
Learning Set	.050	.065	.071	.098	NA	.021	.051	.035	NA	.033	.044	.064	NA	NA
Reason Enrolled	.003	.002	.006	.009		.009	.023	.022		.028	.044	.040		
Pre-attitude	.003	.006	.003	.010		.016	.036	.050		.045	077	.064		
Post-attitude	.008	.021	.023	.021		.017	.016	.029		.050	.144	.024		
Discussion Attitude	.009	.007	.007	.015		.012	.007	.048		.027	.099	.064		
50-50-1 (Asp.-Exp.-1)	.072	.012	.014	.007		.005	.006	.012		.015	.044	.124		
50-50-2 (Asp.-Exp.-2)	.137	.068	.045	.016		.023	.051	.034		.124	.223	.064		
Pretest	.080	.053	.047	.030		.012	.021	.013		.013	.150	.043		
Midterm	.199	.120	.078	.013		.004	.056	.016		.018	.041	.015		
Instructor Extraversion	.006	.014	.017	.018		.016	.039	.014		.100	.256	.115		
Instructor Neuroticism	.008	.018	.025	.035		.022	.051	.005		.081	.263	.172		
Instructor Marlowe-Crowne	.004	.005	.008	.008		.003	.013	.022		.081	.140	.042		
Instructor Sanford-Gough	.012	.007	.012	.008		.003	.014	.017		.051	.130	.040		
Instructor California-F	.017	.012	.013	.013		.008	.028	.007		.100	.262	.109		
Instructor Risk	.017	.017	.014	.013		.017	.052	.013		.094	.091	.179		
Instructor Course Load	.021	.018	.018	.016		.008	.028	.009		.051	.091	.083		
Instructor Teaching Experience	.006	.014	.018	.018		.016	.039	.014		.041	.150	.051		
Instructor ED 200	.013	.015	.015	.011		.015	.057	.010		.143	.144	.189		
N	532	379	319	196	15	176	75	101	14	61	27	34	18	9
TSS_i/TSS_T	1.000	.609	.436	.251	.025	.185	.078	.100	.017	.049	.021	.022	.012	.003
MEAN	3.270	3.034	3.182	2.990	2.133	3.085	3.267	2.950	2.643	3.410	3.704	3.176	3.444	4.222

Proportion of variation explainable in each group for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E9 (cont'd.)

TABLE E9 (cont'd.)

Predictor	Group Number													
	1	2	5	7	14	15	22*	23	26*	27*	30	31*	36*	37*
Sex	.001	.005	.008	.010	.000	.094		.002		.001	.219			
Age	.001	.000	.001	.011	.022	.040		.019		.010	.135			
Major	.023	.016	.012	.016	.057	.200		.065		.081	.417			
Credits	.014	.006	.006	.005	.030	.053		.044		.045	.061			
Current Load	.006	.005	.002	.005	.001	.024		.001		.010	.061			
GPA	.211	.061	.049	.065	.104	.120		.024		.048	.101			
CQT-V	.085	.042	.048	.091	.051	.081		.119		.028	.121			
CQT-Q	.096	.043	.031	.028	.021	.167		.025		.042	.175			
CQT-T	.128	.061	.058	.113	.031	.089		.033		.058	.160			
Extraversion	.018	.007	.017	.028	.005	.112		.018		.014	.155			
Neuroticism	.005	.015	.011	.029	.034	.116		.049		.054	.127			
Eysenck Lie	.013	.026	.052	.024	.012	.123		.010		.015	.126			
A-H Test Anxiety	.061	.027	.031	.041	.037	.042		.041		.094	.034			
Test Anxiety-1	.000	.001	.003	.024	.031	.000		.045		.048	.000			
Test Anxiety-2	.017	.014	.012	.024	.031	.056		.045		.048	.057			
Test Anxiety-3	.018	.010	.004	.005	.047	.025		.045		.089	.126			
Accuracy	.007	.005	.006	.024	.042	.061		.056		.066	.232			
Success	.018	.013	.011	.027	.041	.049		.056		.066	.037			
Learning Set	.050	.065	.071	.079	.052	.123	NA	.051	NA	.115	.140	NA	NA	NA
Reason Enrolled	.003	.002	.006	.036	.044	.008		.041		.012	.043			
Pre-attitude	.003	.006	.003	.009	.051	.114		.053		.026	.212			
Post-attitude	.008	.021	.023	.016	.033	.064		.009		.056	.048			
Discussion Attitude	.009	.007	.007	.025	.031	.080		.019		.011	.137			
50-50-1 (Asp.-Exp.-1)	.072	.012	.014	.060	.017	.151		.016		.026	.179			
50-50-2 (Asp.-Exp.-2)	.137	.068	.045	.036	.041	.114		.020		.015	.209			
Pretest	.080	.053	.047	.069	.041	.201		.055		.065	.053			
Midterm	.199	.120	.078	.092	.069	.108		.059		.031	.155			
Instructor Extraversion	.006	.014	.017	.010	.036	.003		.031		.047	.033			
Instructor Neuroticism	.008	.018	.025	.013	.021	.078		.014		.037	.038			
Instructor Marlowe-Crowne	.004	.005	.008	.015	.011	.067		.020		.021	.107			
Instructor Sanford-Gough	.012	.007	.012	.022	.011	.151		.020		.016	.164			
Instructor California-F	.017	.012	.013	.020	.018	.041		.031		.032	.046			
Instructor Risk	.017	.017	.014	.018	.014	.083		.024		.036	.060			
Instructor Course Load	.021	.018	.018	.027	.033	.166		.031		.045	.177			
Instructor Teaching Experience	.006	.014	.018	.016	.028	.033		.018		.022	.009			
Instructor ED 200	.013	.015	.015	.030	.012	.058		.034		.071	.101			
N	532	379	319	123	82	41	5	77	11	66	25	16	9	16
TSS_i/TSS_T	1.000	.609	.436	.151	.075	.059	.006	.061	.009	.045	.037	.010	.007	.014
MEAN	3.270	3.034	3.182	3.488	3.293	3.878	2.400	3.351	3.909	3.258	3.560	4.375	4.333	3.125

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

→ =Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E9 (cont'd.)

Predictor	Group Number								
	1	2	4	16	17	34*	35*	38*	39*
Sex	.001	.005	.048	.052	.043				
Age	.001	.000	.104	.414	.008				
Major	.023	.016	.116	.164	.053				
Credits	.014	.006	.072	.152	.075				
Current Load	.006	.005	.096	.050	.001				
GPA	.211	.061	.027	.058	.132				
CQT-V	.085	.042	.056	.217	.075				
CQT-Q	.096	.043	.044	.150	.061				
CQT-T	.128	.061	.059	.197	.185				
Extraversion	.118	.007	.164	.246	.125				
Neuroticism	.005	.015	.020	.058	.107				
Eysenck Lie	.013	.026	.074	.037	.107				
A-H Anxiety	.061	.027	.035	.100	.231				
Test Anxiety-1	.000	.001	.000	.000	.000				
Test Anxiety-2	.017	.014	.035	.037	.107				
Test Anxiety-3	.018	.010	.033	.078	.032				
Accuracy	.007	.005	.035	.036	.032				
Success	.018	.013	.011	.134	.132				
Learning Set	.050	.065	.043	.065	.107	NA	NA	NA	NA
Reason Enrolled	.003	.002	.004	.027	.017				
Pre-attitude	.003	.006	.056	.104	.062				
Post-attitude	.008	.021	.023	.050	.153				
Discussion Attitude	.009	.007	.036	.120	.038				
50-50-1 (Asp.-Exp.)	.072	.012	.018	.064	.122				
50-50-2 (Asp.-Exp.)	.137	.068	.027	.037	.069				
Pretest	.001	.053	.131	.227	.206				
Midterm	.199	.120	.074	.071	.244				
Instructor Ext.	.006	.014	.027	.051	.149				
Instructor Neu.	.008	.018	.027	.050	.069				
Instructor M-C	.004	.005	.027	.030	.033				
Instructor S-G	.012	.007	.019	.030	.033				
Instructor Cal-F	.017	.012	.014	.011	.043				
Instructor Risk	.017	.017	.028	.022	.037				
Instructor Load	.021	.018	.025	.019	.037				
Instructor Teach.	.006	.014	.008	.052	.210				
Instructor ED 200	.013	.015	.027	.037	.033				
N	532	379	57	27	27	12	15	6	21
TSS_i/TSS_T	1.000	.609	.087	.043	.025	.004	.021	.007	.012
MEAN	3.270	3.034	2.281	1.926	2.667	1.250	2.467	2.000	2.857

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

=Split attempted but not made.

* =Final group.

NA =Split not attempted.

TABLE E10

AID III: Proportion of Variation in Instructor Grade by Group within Each Branch Explainable for Each Final-Course Variable

TABLE E10 (cont'd.)

Predictor	Group Number 1	3	7	12	13	26*	27	32*	33	36*	37*	38*	39	48*	49*
Sex	.003	.010	.000	.009	.000		.003		.000		.001		.006	.013	
Age	.005	.003	.007	.009	.012		.018		.032		.041		.012	.032	
Major	.013	.010	.026	.044	.060		.062		.043		.034		.088	.066	
Credits	.024	.011	.017	.022	.025		.020		.044		.032		.040	.051	
Current Load	.007	.003	.002	.001	.011		.001		.004		.003		.011	.012	
GPA	.114	.129	.031	.058	.041		.029		.024		.018		.080	080	
CQT-V	.020	.021	.019	.057	.024		.073		.098		.052		.048	.038	
CQT-Q	.024	.026	.022	.095	.025		.043		.041		.058		.021	035	
CQT-T	.019	.013	.037	.027	.035		.031		.041		.034		.039	.037	
Extraversion	.009	.021	.058	.046	.109		.048		.062		.086		.091	.091	
Neuroticism	.008	.016	.029	.071	.110		.086		.041		.013		.014	.032	
Eysenck Lie	.011	.023	.027	.037	.106		.047		.033		.031		.149	.028	
A-H Test Anxiety	.013	.015	.022	.040	.035		.078		.100		.096		.110	.111	
Test Anxiety-1	.002	.001	.000	.000	.000		.001		.001		.002		.000	.001	
Test Anxiety-2	.006	.017	.008	.039	.023		.007		.016		.039		.023	.024	
Test Anxiety-3	.010	.009	.009	.013	.011		.008		.011		.014		.035	.037	
Accuracy	.003	.003	.037	.054	.023		.056		.065		.069		.041	.036	
Success	.005	.005	.004	.010	.011		.009		.021		.027		.022	.012	
Learning Set	.006	.030	.024	.075	.059		.084		.087		.076		.060	.090	
Reason Enrolled	.002	.006	.010	.016	.062	NA	.020	NA	.021	NA	.011	NA	.054	.080	NA
Pre-attitude	.005	.011	.047	.051	.086		.073		.127		.032		.094	084	
Post-attitude	.004	.013	.040	.078	.023		.054		.033		.044		.038	.023	
Discussion Attitude	.006	.009	.038	.033	.200		.031		.036		.036		.044	.077	
50-50-1 (Asp.-Exp.-1)	.052	.059	.029	.026	.104		.020		.023		.034		.133	.114	
50-50-2 (Asp.-Exp.-2)	.088	.054	.022	.013	.065		.015		.020		.045		.119	.123	
Pretest	.032	.019	.013	.023	.044		.030		.044		.067		.047	.039	
Midterm	.115	.043	.045	.054	.086		.056		.065		.069		.077	.075	
Instructor Extraversion	.015	.007	.027	.016	.010		.024		.023		.015		.033	.021	
Instructor Neuroticism	.037	.011	.011	.014	.032		.005		.011		.037		.024	009	
Instructor Marlowe-Crowne	.007	.016	.044	.014	.008		.024		.016		.037		.027	.021	
Instructor Sanford-Gough	.010	.016	.027	.023	.010		.036		.026		.032		.028	.025	
Instructor California-F	.024	.026	.063	.036	.018		.041		.066		.050		.032	.024	
Instructor Risk	.008	.021	.037	.036	.015		.041		.066		.050		.027	.021	
Instructor Load	.007	.007	.034	.077	.030		.062		.049		.075		.049	.018	
Instructor Teaching Experience	.018	.032	.106	.020	.010		.014		.015		.010		.003	.002	
Instructor Education 200	.012	.016	.026	.014	.005		.009		.015		.036		.028	.025	
N	532	243	149	86	63	4	82	7	73	2	71	3	60	59	1
TSS_i/TSS_T	1.000	.362	.186	.098	.068	.002	.086	.005	.069	.000	.060	.002	.052	.045	.000
MEAN	3.790	4.078	4.268	4.093	4.508	3.250	4.134	3.571	4.164	3.000	4.197	3.333	4.566	4.593	3.000

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E10 (cont'd.)

Predictor	Group Number														
	1	3	6	18*	19	28*	29	42	43*	44*	45	54*	55	64*	65*
Sex	.003	.010	.015		.011		.044	.044			.056		.108		.001
Age	.005	.003	.006		.020		.022	.006			.009		.046		.092
Major	.013	.010	.018		.037		.055	.088			.142		.124		.138
Credits	.024	.011	.014		.042		.058	.042			.046		.081		.120
Current Load	.007	.003	.003		.026		.022	.050			.060		.154		.193
GPA	.114	.129	.036		.058		.045	.036			.047		.107		.204
CQT-V	.020	.021	.059		.074		.055	.050			.076		.111		.132
CQT-Q	.024	.026	.057		.063		.079	.148			.113		.074		.101
CQT-T	.019	.013	.048		.046		.034	.040			.078		.129		.079
Extraversion	.009	.021	.026		.057		.045	.057			.072		.081		.120
Neuroticism	.008	.016	.084		.006		.011	.018			.046		.271		.132
Eysenck Lie	.011	.023	.053		.058		.038	.029			.033		.037		.096
A-H Test Anxiety	.013	.015	.039		.028		.051	.050			.092		.054		.031
Test Anxiety-1	.002	.001	.002		.004		.009	.013			.010		.005		.000
Test Anxiety-2	.006	.017	.064		.050		.016	.013			.023		.030		.016
Test Anxiety-3	.010	.009	.028		.054		.009	.013			.010		.020		.074
Accuracy	.003	.003	.028		.016		.013	.004			.020		.023		.016
Success	.005	.005	.043		.079		.013	.012			.030		.010		.229
Learning Set	.006	.030	.057	NA	.048	NA	.031	.041	NA	NA	.072	NA	.107	NA	.086
Reason Enrolled	.002	.006	.033		.028		.012	.002			.006		.023		.058
Pre-attitude	.005	.011	.039		.016		.031	.036			.053		.074		.041
Post-attitude	.004	.013	.031		.028		.059	.057			.076		.108		.138
Discussion Attitude	.006	.009	.026		.031		.045	.057			.045		.081		.255
50-50-1 (Asp.-Exp.-1)	.052	.059	.007		.016		.020	.093			.137		.006		.058
50-50-2 (Asp.-Exp.-2)	.088	.054	.053		.048		.095	.098			.107		.074		.041
Pretest	.032	.019	.028		.016		.040	.064			.045		.121		.079
Midterm	.115	.043	.033		.020		.008	.086			.060		.154		.193
Instructor Extraversion	.015	.007	.006		.046		.044	.064			.103		.140		.041
Instructor Neuroticism	.037	.011	.015		.015		.031	.040			.085		.123		.132
Instructor Marlowe-Crowne	.007	.016	.016		.049		.051	.050			.060		.140		.132
Instructor Sanford-Gough	.010	.016	.026		.049		.051	.050			.082		.269		.092
Instructor California-F	.024	.026	.004		.034		.080	.112			.147		.156		.092
Instructor Risk	.008	.021	.020		.030		.045	.057			.051		.074		.193
Instructor Course Load	.007	.007	.011		.028		.059	.033			.046		.111		.101
Instructor Teaching Experience	.018	.032	.002		.006		.040	.064			.078		.045		.086
Instructor ED 200	.012	.016	.018		.033		.030	.021			.051		.140		.101
N	532	243	90	13	77	16	59	55	4	11	44	15	29	7	22
TSS_i/TSS_T	1.000	.362	.127	.026	.090	.019	.064	.055	.002	.003	.044	.010	.027	.005	.016
MEAN	3.790	4.078	3.756	4.231	3.675	4.000	3.576	3.527	4.250	3.091	3.636	3.333	3.793	3.286	3.955

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E10 (cont'd.)

TABLE E10 (cont'd.)

TABLE E10 (cont'd.)

Predictor	Group Number													
	1	2	5	9	20*	21	24	25*	30	31*	46*	47	52*	53*
Sex	.003	.001	.000	.000		.015	.010		.000			.002	.038	
Age	.005	.014	.019	.013		.009	.008		.033			.051	.058	
Major	.013	.020	.032	.038		.040	.050		.055			.055	.012	
Credits	.024	.016	.024	.001		.013	.012		.038			.055	.050	
Current Load	.007	.008	.009	.021		.030	.036		.001			.002	.001	
GPA	.114	.052	.013	.033		.029	.022		.062			.125	.175	
CQT-V	.020	.003	.010	.105		.030	.036		.046			.048	.082	
CQT-Q	.024	.012	.012	.034		.040	.092		.093			.055	.118	
CQT-T	.019	.006	.013	.032		.034	.036		.062			.055	.106	
Extraversion	.009	.030	.035	.032		.040	.050		.074			.118	.093	
Neuroticism	.008	.011	.013	.054		.067	.046		.017			.038	.043	
Eysenck Lie	.011	.007	.013	.027		.039	.055		.080			.168	.062	
A-H Test Anxiety	.013	.011	.015	.105		.123	.072		.046			.052	.043	
Test Anxiety-1	.002	.002	.004	.000		.000	.000		.000			.000	.000	
Test Anxiety-2	.006	.001	.002	.002		.005	.008		.033			.054	.038	
Test Anxiety-3	.010	.004	.016	.019		.048	.050		.151			.050	.092	
Accuracy	.003	.010	.018	.026		.040	.050		.055			.055	.036	
Success	.005	.009	.014	.004		.009	.012		.008			.010	.004	
Learning Set	.006	.017	.021	.035	NA	.031	.031	NA	.043	NA	NA	.038	.014	NA
Reason Enrolled	.002	.004	.005	.024		.016	.009		.009			.021	.006	
Pre-attitude	.005	.013	.017	.032		.048	.035		.046			.058	.082	
Post-attitude	.004	.007	.013	.032		.034	.040		.043			.081	.082	
Discussion Attitude	.006	.018	.040	.067		.054	.118		.048			.055	.064	
50-50-1 (Asp.-Exp.-1)	.052	.015	.026	.009		.008	.020		.023			.015	.024	
50-50-2 (Asp.-Exp.-2)	.088	.018	.029	.045		.034	.036		.046			.048	.081	
Pretest	.032	.013	.016	.030		.040	.050		.055			.058	.166	
Midterm	.115	.037	.055	.015		.007	.002		.003			.019	.018	
Instructor Extraversion	.015	.039	.033	.085		.060	.031		.036			.033	.032	
Instructor Neuroticism	.037	.038	.036	.013		.039	.022		.020			.013	.018	
Instructor Marlowe-Crowne	.007	.021	.022	.040		.011	.002		.010			.024	.047	
Instructor Sanford-Gough	.010	.012	.004	.027		.019	.033		.033			.027	.040	
Instructor California-F	.024	.027	.023	.114		.059	.036		.023			.015	.024	
Instructor Risk	.008	.005	.004	.113		.008	.014		.023			.041	.056	
Instructor Course Load	.007	.005	.027	.111		.017	.012		.014			.021	.018	
Instructor Teaching Experience	.018	.040	.037	.013		.023	.031		.036			.033	.020	
Instructor ED 200	.012	.011	.041	.053		.048	.050		.046			.030	.038	
N	532	285	193	70	5	65	64	1	50	14	2	48	41	7
TSS_i/TSS_T	1.000	.515	.334	.120	.006	.100	.088	.000	.054	.002	.000	.046	.034	.004
MEAN	3.790	3.551	3.668	3.900	3.000	3.969	4.000	2.000	3.880	4.429	5.000	3.833	3.927	3.286

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E10 (cont'd.)

TABLE E10 (cont'd.)

Predictor	Group Number																
	1	2	5	8	11	16	17	22	23	50	51*	56*	57*	68*	69*	70*	71*
Sex	.003	.001	.000	.000	.011	.014	.027	.010	.000	.010							
Age	.005	.014	.019	.031	.029	.014	.115	.051	.023	.051							
Major	.013	.020	.032	.034	.023	.034	.186	.051	.050	.321							
Credits	.024	.016	.024	.084	.012	.028	.274	.071	.028	.130							
Current Load	.007	.008	.009	.014	.020	.041	.000	.025	.064	.035							
GPA	.114	.052	.013	.034	.027	.059	.081	.050	.071	.089							
CQT-V	.020	.003	.010	.021	.030	.067	.077	.077	.077	.289							
CQT-Q	.024	.024	.012	.024	.056	.085	.077	.107	.070	.089							
CQT-T	.019	.006	.013	.027	.090	.090	.077	.051	.132	.211							
Extraversion	.009	.030	.035	.082	.077	.067	.117	.171	.064	.114							
Neuroticism	.008	.011	.013	.015	.052	.090	.240	.167	.100	.109							
Eysenck Lie	.011	.007	.013	.005	.016	.020	.072	.105	.083	.288							
A-H Test Anxiety	.013	.011	.015	.059	.067	.101	.088	.292	.050	.186							
Test Anxiety-1	.002	.002	.004	.005	.000	.000	.000	.000	.000	.000							
Test Anxiety-2	.006	.001	.002	.009	.013	.005	.091	.071	.030	.036							
Test Anxiety-3	.010	.004	.016	.022	.017	.034	.127	.051	.028	.187							
Accuracy	.003	.010	.018	.011	.019	.013	.186	.169	.033	.089							
Success	.005	.009	.014	.035	.041	.045	.057	.165	.009	.255							
Learning Set	.006	.017	.021	.040	.087	.093	.077	.091	.132	.183	NA	NA	NA	NA	NA	NA	NA
Reason Enrolled	.002	.004	.005	.028	.036	.012	.061	.037	.091	.067							
Pre-attitude	.005	.013	.017	.048	.040	.026	.061	.195	.058	.043							
Post-attitude	.004	.007	.013	.038	.027	.037	.108	.049	.070	.267							
Discussion Attitude	.006	.018	.040	.038	.059	.044	.077	.088	.040	.293							
50-50-1 (Asp.-Exp.-1)	.052	.015	.026	.038	.041	.060	.026	.113	.091	.035							
50-50-2 (Asp.-Exp.-2)	.088	.018	.029	.014	.011	.006	.077	.092	.040	.044							
Pretest	.032	.013	.016	.035	.063	.045	.240	.057	.064	.156							
Midterm	.115	.037	.055	.055	.064	.087	.242	.107	.070	.088							
Instructor Extraversion	.015	.039	.033	.044	.050	.010	.027	.077	.132	.035							
Instructor Neuroticism	.037	.038	.036	.076	.112	.032	.013	.077	.132	.187							
Instructor Marlowe-Crowne	.007	.021	.022	.043	.055	.027	.027	.041	.037	.106							
Instructor Sanford-Gough	.010	.012	.004	.024	.014	.053	.027	.028	.213	.358							
Instructor California-F	.024	.027	.023	.039	.030	.019	.027	.077	.214	.151							
Instructor Risk	.008	.005	.004	.025	.033	.033	.013	.077	.259	.071							
Instructor Course Load	.007	.005	.027	.050	.025	.048	.053	.051	.069	.255							
Instructor Teaching Experience	.018	.040	.037	.067	.063	.011	.013	.049	.034	.077							
Instructor ED 200	.012	.011	.041	.039	.033	.026	.007	.015	.172	.106							
N	532	285	193	123	91	66	25	29	37	23	14	14	15	17	8	10	13
TSS_i/TSS_T	1.000	.515	.334	.196	.139	.102	.022	.041	.050	.020	.017	.022	.008	.013	.003	.003	.010
MEAN	3.790	3.551	3.668	3.537	3.660	3.803	3.280	3.552	4.000	3.739	4.429	3.929	3.200	3.471	2.875	4.100	3.462

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E10 (cont'd.)

Predictor	Group Number						
	1	2	5	8	10	58*	59*
Sex	.003	.001	.000	.000	.029		
Age	.005	.014	.019	.031	.016		
Major	.013	.020	.032	.034	.078		
Credits	.024	.016	.024	.084	.070		
Current Load	.007	.008	.009	.014	.009		
GPA	.114	.052	.013	.034	.113		
CQT-V	.020	.003	.010	.021	.032		
CQT-Q	.024	.012	.012	.024	.112		
CQT-T	.019	.006	.013	.027	.053		
Extraversion	.009	.030	.035	.082	.077		
Neuroticism	.008	.011	.013	.015	.242		
Eysenck Lie	.011	.007	.013	.005	.035		
A-H Test Anxiety	.013	.011	.015	.059	.112		
Test Anxiety-1	.002	.002	.004	.005	.002		
Test Anxiety-2	.006	.001	.002	.009	.122		
Test Anxiety-3	.010	.004	.016	.022	.078		
Accuracy	.003	.010	.018	.011	.067		
Success	.005	.009	.014	.035	.114		
Learning Set	.006	.017	.021	.040	.101	NA	NA
Reason Enrolled	.002	.004	.005	.028	.036		
Pre-attitude	.005	.013	.017	.048	.108		
Post-attitude	.004	.007	.013	.038	.099		
Discussion Attitude	.006	.018	.040	.038	.190		
50-50-1 (Asp.-Exp.-1)	.052	.015	.026	.038	.008		
50-50-2 (Asp.-Exp.-2)	.088	.018	.029	.014	.017		
Pretest	.032	.013	.016	.035	.078		
Midterm	.115	.037	.055	.055	.068		
Instructor Extraversion	.015	.039	.033	.044	.060		
Instructor Neuroticism	.037	.038	.036	.076	.066		
Instructor Marlowe-Crowne	.007	.021	.022	.043	.131		
Instructor Sanford-Gough	.010	.012	.004	.024	.146		
Instructor California-F	.024	.027	.023	.039	.109		
Instructor Risk	.008	.005	.004	.025	.132		
Instructor Load	.007	.005	.027	.050	.234		
Instructor Teaching Exp.	.018	.040	.037	.067	.243		
Instructor ED 200	.012	.011	.041	.039	.187		
N	532	285	193	123	32	16	16
TSS_i/TSS_T	1.000	.515	.334	.626	.040	.018	.013
MEAN	3.790	3.551	3.668	3.537	3.188	2.875	3.500

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E10 (cont'd.)

TABLE E10 (cont'd.)

Predictor	Group Number														
	1	2	4	14	15	34	35	40*	41	60*	61*	62*	63*	66*	67*
Sex	.003	.001	.022	.010	.035	.016	.009		.051	.001					.003
Age	.005	.014	.007	.033	.045	.145	.028		.073	.008					.193
Major	.013	.020	.073	.089	.209	.189	.208		.281	.224					.255
Credits	.024	.016	.019	.019	.088	.096	.076		.273	.122					.041
Current Load	.007	.008	.010	.033	.003	.033	.037		.175	.059					.101
GPA	.114	.052	.009	.061	.105	.161	.119		.223	.191					.138
CQT-V	.020	.003	.020	.051	.092	.044	.064		.272	.059					.073
CQT-Q	.024	.012	.046	.043	.102	.067	.066		.206	.059					086
CQT-T	.019	.006	.022	.039	.185	.073	.123		.146	.119					.227
Extraversion	.009	.030	.073	.148	.092	.068	.069		.280	.149					.120
Neuroticism	.008	.011	.035	.062	.104	.231	.062		.273	.078					.231
Eysenck Lie	.011	.007	.009	.027	.109	.161	.080		.164	.084					.138
A-H Test Anxiety	.013	.011	.059	.022	.274	.064	.044		.576	.043					.088
Test Anxiety-1	.002	.002	.000	.000	.000	.000	.000		.000	.000					.000
Test Anxiety-2	.006	.001	.026	.036	.041	.146	.153		.023	.180					.192
Test Anxiety-3	.010	.004	.028	.027	.030	.145	.157		.031	.178					.193
Accuracy	.003	.010	.098	.040	.300	.077	.182		.044	.223					.107
Success	.005	.009	.011	.033	.060	.073	.045		.054	.059					.120
Learning Set	.006	.017	.054	.089	.220	.122	.251	NA	.273	.059	NA	NA	NA	NA	.083
Reason Enrolled	.002	.004	.019	.010	.032	.020	.048		.036	.037					.003
Pre-attitude	.005	.013	.013	.038	.052	.035	.119		.097	.191					.092
Post-attitude	.004	.007	.032	.065	.032	.090	.061		.051	.112					.193
Discussion Attitude	.006	.018	.029	.033	.022	.043	.037		.109	.059					.084
50-50-1 (Asp.-Exp.-1)	.052	.015	.026	.030	.085	.084	.066		.073	.053					.101
50-50-2 (Asp.-Exp.-2)	.088	.018	.022	.036	.035	.122	.037		.011	.059					.132
Pretest	.032	.013	.068	.057	.092	.096	.156		.273	.178					.239
Midterm	.115	.037	.027	.074	.077	.199	.068		.282	.040					.231
Instructor Extraversion	.015	.039	.052	.018	.032	.112	.009		.003	.018					.075
Instructor Neuroticism	.037	.038	.081	.103	.032	.137	.029		.127	.059					.088
Instructor Marlowe-Crowne	.007	.021	.104	.033	.032	.162	.001		.127	.016					.088
Instructor Sanford-Gough	.010	.012	.089	.094	.032	.233	.048		.164	.037					.138
Instructor California-F	.024	.027	.046	.032	.076	.200	.011		.103	.040					.079
Instructor Risk	.008	.005	.023	.013	.038	.103	.005		.073	.025					.079
Instructor Course Load	.007	.005	.021	.024	.032	.079	.036		.164	.040					.088
Instructor Teaching Experience	.018	.040	.046	.035	.048	.079	.004		.273	.076					.088
Instructor ED 200	.012	.011	.005	.102	.048	.166	.029		.273	.027					.138
N	532	285	91	61	30	29	29	9	21	28	1	19	2	7	22
TSS_i/TSS_T	1.000	.515	.153	.072	.066	.028	.034	.013	.033	.025	.000	.014	.000	.005	.016
MEAN	3.790	3.511	3.297	3.131	3.633	2.897	3.379	4.333	3.333	3.321	5.000	3.158	5.000	2.429	3.045

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E11

AID III: Proportion of Variation in Final Course Grade by Group within Branch Explainable for Each Final-Course Variable

TABLE E11 (cont'd.)

Predictor	Group Number												
	1	3	7	10	11	24*	25	26	27*	30*	31*	38*	39*
Sex	.004	.000	.021	.026	.027	.002	.052	.001	.010		.098		
Age	.002	.015	.017	.013	.025	.118	.055	.452	.018		.009		
Major	.040	.042	.030	.075	.074	.102	.203	.347	.036		.303		
Credits	.036	.027	.011	.006	.025	.042	.013	.364	.021		.295		
Current Load	.007	.003	.011	.024	.016	.127	.030	.094	.014		.024		
GPA	.258	.229	.101	.172	.043	.015	.162	.085	.014		.295		
CQT-V	.088	.081	.069	.075	.074	.035	.125	.136	.027		.159		
CQT-Q	.073	.067	.061	.072	.048	.102	.055	.139	.023		.063		
CQT-T	.103	.082	.088	.088	.063	.135	.085	.179	.053		.074		
Extraversion	.025	.013	.038	.049	.142	.070	.055	.276	.071		.213		
Neuroticism	.003	.013	.014	.021	.022	.132	.066	.136	.042		.089		
Eysenck Lie	.012	.007	.010	.028	.021	.085	.024	.085	.052		.170		
A-H Test Anxiety	.052	.045	.035	.004	.043	.095	.098	.169	.083		.357		
Test Anxiety-1	.001	.006	.010	.036	.008	.195	.013	.000	.007		.004		
Test Anxiety-2	.019	.030	.015	.120	.045	.196	.030	.029	.029		.141		
Test Anxiety-3	.023	.019	.010	.022	.019	.028	.042	.085	.072		.170		
Accuracy	.009	.004	.013	.076	.034	.050	.098	.273	.007		.141		
Success	.021	.006	.017	.031	.091	.060	.060	.237	.007		.191		
Learning Set	.041	.040	.038	.061	.045	.176	.093	.179	.042	NA	.194	NA	NA
Reason Enrolled	.004	.013	.017	.049	.002	.058	.068	.061	.021		.174		
Pre-attitude	.005	.014	.021	.013	.046	.048	.217	.063	.138		.187		
Post-attitude	.010	.023	.021	.048	.095	.058	.128	.085	.091		.165		
Discussion Attitude	.009	.012	.008	.048	.025	.023	.030	.085	.048		.051		
50-50-1 (Asp.-Exp.-1)	.085	.116	.095	.098	.185	.023	.045	.276	.020		.356		
50-50-2 (Asp.-Exp.-2)	.192	.130	.140	.078	.157	.116	.096	.217	.089		.014		
Pretest	.082	.062	.055	.010	.171	.042	.089	.284	.072		.171		
Midterm	.335	.223	.144	.033	.018	.010	.040	.029	.056		.089		
Instructor Extraversion	.011	.004	.019	.001	.027	.045	.006	.085	.028		.063		
Instructor Neuroticism	.020	.004	.029	.012	.131	.049	.041	.226	.141		.029		
Instructor Marlowe-Crowne	.007	.007	.029	.012	.133	.035	.019	.109	.111		.035		
Instructor Sanford-Gough	.097	.010	.006	.010	.014	.015	.019	.103	.014		.063		
Instructor California-F	.219	.040	.035	.020	.088	.095	.104	.307	.071		.129		
Instructor Risk	.219	.040	.026	.017	.048	.162	.059	.226	.071		.042		
Instructor Course Load	.239	.040	.017	.013	.044	.052	.028	.237	.071		.042		
Instructor Teaching Experience	.109	.005	.018	.025	.085	.058	.058	.139	.063		.028		
Instructor Education 200	.186	.006	.032	.012	.116	.075	.056	.168	.090		.014		
N	532	242	149	81	68	38	43	21	47	19	22	10	11
TSS_i/TSS_T	1.000	.282	.127	.058	.051	.014	.034	.018	.024	.012	.013	.003	.007
MEAN	3.633	4.149	4.389	4.198	4.618	3.976	4.395	4.286	4.766	4.632	4.136	3.900	4.636

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E11 (cont'd.)

Predictor	Group Number				
	1	3	6	18*	19*
Sex	.004	.000	.033	.090	.001
Age	.002	.015	.042	.012	.036
Major	.040	.042	.029	.089	.076
Credits	.036	.027	.058	.059	.097
Current Load	.007	.003	.002	.001	.063
GPA	.258	.229	.080	.070	.184
CQT-V	.088	.081	.019	.055	.143
CQT-Q	.073	.067	.024	.039	.184
CQT-T	.103	.082	.035	.038	.143
Extraversion	.025	.013	.053	.045	.143
Neuroticism	.003	.013	.019	.029	.076
Eysenck Lie	.012	.007	.040	.039	.412
A-H Test Anxiety	.052	.045	.013	.018	.076
Test Anxiety-1	.001	.006	.019	.019	.000
Test Anxiety-2	.019	.030	.035	.049	.123
Test Anxiety-3	.023	.019	.071	.010	.409
Accuracy	.009	.004	.036	.038	.048
Success	.021	.006	.023	.029	.241
Learning Set	.041	.040	.048	.038	.259
Reason Enrolled	.004	.013	.044	.020	.075
Pre-attitude	.005	.014	.018	.028	.189
Post-attitude	.010	.023	.008	.038	.107
Discussion Attitude	.009	.012	.039	.085	.076
50-50-1 (Asp.-Exp.-1)	.085	.016	.019	.019	.023
50-50-2 (Asp.-Exp.-2)	.192	.130	.075	.035	.076
Pretest	.082	.062	.047	.053	.184
Midterm	.335	.223	.253	.004	.143
Instructor Extraversion	.011	.004	.010	.028	.286
Instructor Neuroticism	.020	.004	.011	.031	.176
Instructor Marlowe-Crowne	.007	.007	.026	.018	.184
Instructor Sanford-Gough	.097	.010	.022	.011	.143
Instructor California-F	.219	.040	.037	.045	.139
Instructor Risk	.219	.040	.037	.059	.259
Instructor Course Load	.239	.040	.037	.024	.418
Instructor Teaching Experience	.109	.005	.010	.036	.021
Instructor ED 200	.186	.006	.018	.012	.076
N	532	242	89	69	20
TSS_i/TSS_T	1.000	.282	.086	.052	.012
MEAN	3.633	4.149	3.753	3.594	4.300

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

=Split attempted but not made.

* =Final group.

TABLE E11 (cont'd.)

TABLE E11 (cont'd.)

Predictor	Group Number											
	1	2	5	9	14	15*	20	21	28*	29*	34*	35*
Sex	.004	.004	.007	.012	.007	.012	.196	.006			.003	
Age	.002	.005	.008	.010	.032	.012	.228	.016			.004	
Major	.040	.032	.056	.140	.021	.053	.052	.172			.179	
Credits	.036	.013	.021	.005	.017	.038	.027	.009			.045	
Current Load	.007	.008	.008	.008	.014	.004	.027	.060			.004	
GPA	.258	.072	.059	.122	.110	.403	.069	.073			.049	
CQT-V	.088	.046	.051	.072	.055	.290	.096	.060			.202	
CQT-Q	.073	.041	.041	.056	.064	.073	.096	.096			.070	
CQT-T	.103	.051	.049	.056	.083	.290	.096	.093			.061	
Extraversion	.025	.020	.023	.070	.058	.172	.057	.072			.061	
Neuroticism	.003	.009	.022	.003	.081	.078	.064	.262			.219	
Eysenck Lie	.012	.031	.023	.049	.025	.359	.067	.036			.058	
A-H Test Anxiety	.052	.039	.045	.046	.081	.093	.122	.136			.196	
Test Anxiety-1	.001	.000	.001	.000	.000	.000	.000	.000			.000	
Test Anxiety-2	.019	.025	.015	.019	.023	.031	.112	.020			.003	
Test Anxiety-3	.023	.028	.007	.004	.040	.172	.016	.142			.202	
Accuracy	.009	.004	.033	.004	.013	.012	.009	.060			.148	
Success	.021	.015	.064	.008	.008	.007	.041	.010			.011	
Learning Set	.041	.030	.017	.025	.018	.290	.139	.050	NA	NA	.061	NA
Reason Enrolled	.004	.002	.017	.013	.012	.073	.096	.093			.135	
Pre-attitude	.005	.014	.013	.053	.046	.172	.205	.036			.047	
Post-attitude	.010	.011	.012	.016	.027	.241	.069	.067			.061	
Discussion Attitude	.009	.015	.015	.019	.028	.143	.067	.033			.172	
50-50-1 (Asp.-Exp.-1)	.085	.036	.003	.013	.005	.065	.079	.012			.061	
50-50-2 (Asp.-Exp.-2)	.192	.086	.013	.020	.014	.189	.020	.093			.028	
Pretest	.082	.043	.039	.048	.050	.215	.037	.061			.196	
Midterm	.335	.172	.089	.003	.009	.001	.052	.004			.009	
Instructor Extraversion	.011	.010	.006	.026	.054	.031	.138	.122			.091	
Instructor Neuroticism	.020	.012	.005	.018	.075	.172	.138	.068			.135	
Instructor Marlowe-Crowne	.007	.008	.010	.042	.044	.065	.083	.072			.055	
Instructor Sanford-Gough	.097	.006	.004	.043	.038	.143	.083	.024			.061	
Instructor California-F	.219	.006	.011	.021	.046	.055	.175	.042			.095	
Instructor Risk	.219	.021	.011	.021	.014	.030	.143	.039			.137	
Instructor Load	.239	.017	.012	.028	.031	.132	.143	.039			.216	
Instructor Teaching Experience	.109	.018	.006	.007	.046	.172	.027	.061			.061	
Instructor Education 200	.186	.008	.008	.011	.044	.151	.269	.072			.055	
N	532	286	226	102	79	23	29	50	17	12	36	14
TSS_i/TSS_T	1.000	.378	.244	.104	.077	.013	.036	.032	.015	.011	.014	.010
MEAN	3.633	3.200	3.345	3.459	3.671	3.130	3.414	3.820	3.706	3.000	3.972	3.429

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

↷ =Split made on this variable.

(.xxx) =Next best BSS/TSS.

* =Final group.

↓ =Split attempted but not made.

NA =Split not attempted.

TABLE E11 (cont'd.)

Predictor	Group Number									
	1	2	5	8	12	13*	16	17*	36*	37*
Sex	.004	.004	.007	.003	.005		.039	.012	.024	
Age	.002	.005	.008	.002	.006		.093	.019	.107	
Major	.040	.032	.056	.019	.037		.116	.048	.099	
Credits	.036	.013	.021	.086	.083		.001	.012	.004	
Curr. Ld.	.007	.008	.008	.037	.062		.111	.039	.069	
GPA	.258	.072	.059	.055	.070		.123	.053	.131	
CQT-V	.088	.046	.051	.063	.052		.035	.030	.024	
CQT-Q	.073	.041	.041	.060	.057		.093	.046	.113	
CQT-T	.103	.051	.049	.050	.050		.037	.035	.081	
Extraversion	.025	.020	.023	.020	.022		.020	.037	.034	
Neuroticism	.003	.009	.022	.017	.020		.129	.025	.091	
Eys. Lie	.012	.031	.023	.024	.034		.090	.040	.087	
A-H Anxiety	.052	.039	.045	.051	.056		.239	.038	.004	
Anxiety-1	.001	.000	.001	.001	.001		.001	.000	.070	
Anxiety-2	.019	.025	.015	.008	.009		.066	.013	.088	
Anxiety-3	.023	.028	.007	.030	.017		.010	.050	.063	
Accuracy	.009	.004	.033	.001	.006		.055	.003	.023	
Success	.021	.015	.064	.019	.023		.139	.026	.171	
Learning Set	.041	.030	.017	.012	.016	NA	.133	.037	.184	NA
Reason Enrol	.004	.002	.017	.017	.040		.117	.031	.115	
Pre-attitude	.005	.014	.013	.018	.020		.046	.023	.094	
Post-attitude	.010	.011	.012	.028	.011		.129	.026	.070	
Disc. Att.	.009	.015	.015	.018	.020		.085	.021	.002	
50-50-1	.085	.036	.003	.115	.018		.066	.030	.008	
50-50-2	.192	.086	.013	.038	.026		.093	.021	.107	
Pretest	.082	.043	.039	.021	.014		.093	.045	.107	
Midterm	.335	.172	.089	.027	.027		.034	.023	.023	
Inst. Ext.	.011	.010	.006	.029	.030		.105	.025	.107	
Inst. Neu.	.020	.012	.005	.004	.010		.094	.018	.107	
Inst. M-C	.007	.008	.010	.002	.008		.170	.006	.215	
Inst. S-G	.097	.006	.004	.009	.018		.172	.013	.225	
Inst. Cal-F	.219	.006	.011	.007	.017		.063	.084	.036	
Inst. Risk	.219	.021	.011	.014	.012		.095	.021	.121	
Inst. Load	.239	.017	.012	.014	.016		.039	.052	.113	
Inst. Teach.	.109	.018	.006	.027	.030		.035	.025	.030	
Inst. ED 200	.186	.008	.008	.006	.006		.042	.012	.041	
N	532	286	226	124	122	1	36	86	34	2
TSS_i/TSS_T	1.000	.378	.244	.118	.103	.000	.028	.066	.021	.000
MEAN	3.633	3.200	3.345	3.177	3.189	1.000	2.944	3.291	2.882	4.000

Proportion of variation in that group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

* =Final group.

=Split attempted but not made.

NA =Split not attempted.

TABLE E11 (cont'd.)

Predictor	Group Number						
	1	2	4	22	23*	32*	33*
Sex	.004	.004	.031	.038			.009
Age	.002	.005	.151	.141			.112
Major	.040	.032	.073	.187			.280
Credits	.036	.014	.014	.118			.026
Current Load	.007	.008	.028	.001			.013
GPA	.258	.072	.129	.274			.126
CQT-V	.088	.046	.046	.153			.112
CQT-Q	.073	.041	.042	.160			.074
CQT-T	.103	.051	.064	.245			.089
Extraversion	.025	.020	.218	.420			.170
Neuroticism	.003	.009	.002	.169			.245
Eysenck Lie	.012	.031	.064	.089			.045
A-H Test Anxiety	.052	.039	.040	.102			.093
Test Anxiety-1	.001	.000	.000	.000			.000
Test Anxiety-2	.019	.025	.027	.087			.042
Test Anxiety-3	.023	.028	.035	.077			.073
Accuracy	.009	.004	.021	.047			.032
Success	.021	.015	.090	.014			.023
Learning Set	.041	.030	.031	.046	NA	NA	.074
Reason Enrolled	.004	.002	.012	.066			.013
Pre-attitude	.005	.014	.082	.182			.126
Post-attitude	.010	.011	.082	.113			.181
Discussion Attitude	.009	.015	.041	.039			.071
50-50-1 (Asp.-Exp.)	.085	.036	.044	.047			.044
50-50-2 (Asp.-Exp.)	.192	.087	.079	.169			.244
Pretest	.082	.043	.115	.143			.172
Midterm	.335	.172	.158	.143			.173
Instructor Extraversion	.011	.010	.080	.045			.071
Instructor Neuroticism	.020	.012	.065	.033			.038
Instructor Marlowe-Crowne	.007	.008	.045	.028			.064
Instructor Sanford-Gough	.097	.006	.045	.047			.116
Instructor California-F	.219	.006	.043	.057			.116
Instructor Risk	.219	.021	.045	.089			.217
Instructor Course Load	.239	.017	.031	.049			.026
Instructor Teaching Exp.	.109	.018	.123	.045			.071
Instructor ED 200	.186	.008	.036	.038			.044
N	532	286	60	33	24	7	26
TSS_i/TSS_T	1.000	.378	.066	.033	.017	.002	.017
MEAN	3.633	3.200	2.644	2.394	3.000	3.143	2.192

Proportion of variation in each group explainable for each predictor $(BSS/TSS)_i$

=Split made on this variable.

.xxx =Next best BSS/TSS.

=Split attempted but not made.

* =Final group.

NA =Split not attempted.