

AN ABSTRACT OF THE THESIS OF

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The purpose of this study was to investigate the relationship between a measure of anxiety and academic achievement of freshmen women enrolled in the University of Northern Colorado (U. N. C.).

One thousand and eighty women, eighty-seven percent of the freshmen women, were included in this study. All subjects completed the American College Test (ACT) prior to their admission to U. N. C. The State-Trait-Anxiety-Inventory A-Trait (STAI) was administered to all entering freshmen.

Correlation and analysis of variance models were used to investigate the relationship of anxiety to Cumulative Grade Point Average (CGPA) for defined levels of academic ability. The subjects were grouped into three levels of anxiety designated as upper, middle and lower thirds. The four academic ability levels were based on ACT composite score distributions that were approximately proportionate to groupings common to the total range of ACT scores for women in the defined population. The four academic ability levels were designated as high ability, above average, below average, and low ability students.

The following null hypotheses were tested.

- I. There are no differences among the anxiety groups at any of the levels of tested academic ability.
- II. There are no differences in the academic achievement of high and low anxiety students who have above average academic ability.
- III. There are no differences in the academic achievement of high and low anxiety students who have below average academic ability.
- IV. There are no differences in the academic achievement of high and low anxiety students who have average academic ability.
- V. There are no differences in academic achievement between the moderate anxiety group and the combined high and low anxiety group.
- VI. There are no differences in the estimation of CGPA from ACT and anxiety scores in a second degree curvilinear equation and an estimation of CGPA from ACT and anxiety scores in a linear equation.
- VII. There are no differences in estimating CGPA from ACT measures alone and an estimate based on both ACT and anxiety scores.

Null hypothesis III was the only hypothesis rejected ($p < .05$). The level of differences found between the high and low anxiety group for this low ability category indicated that the high anxiety group obtained significantly higher CGPA. This result does not support the assumptions of drive theory. The major conclusion was that academic achievement for the 1,080 college women studied appeared to be randomly related to A-Trait anxiety measures. Further results of the study indicate that drive theory as defined in this research failed to predict or interpret the academic achievement for women students at any of the designated academic ability levels.

The Interrelationship Between Academic
Achievement of College Freshmen
Women and Measures of Anxiety and Ability

by

Douglas Lee Stutler

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THE INTERRELATIONSHIP BETWEEN ACADEMIC
ACHIEVEMENT OF COLLEGE FRESHMEN
WOMEN AND MEASURES OF
ANXIETY AND ABILITY

I. INTRODUCTION

Carter Dickson stressed the prominent role anxiety plays in the life of the human being when he stated:

In all ages, everything changes. Manners, customs, speech, views on life, even morals--all change. But fear is the same. Only fear is the same (Dickson, 1956, p. 5).

A wide gap continues to separate contemporary personality theory and the empirical foundations upon which this theory must ultimately rest. In recent years, experimental psychologists, backed with more sophisticated and powerful psychometric methods and experimental procedures, have been encouraged in their investigation of personality. The trend has been further stimulated by the appearance of limited domain theories that emphasize a particular personality construct (Spielberger, 1966).

The identification, isolation and measurement of even one theorized variable for empirical investigation has given little support to limited domain theories (Cattell and Scheier, 1958). Most anxiety research has considered the anxiety variable to be one of the constellation of variables common to characteristics of motivation. The scientific study of anxiety is usually approached by psychologists from one of two research postures. One group of psychologists believes the field of anxiety is not yet prepared to investigate anxiety as a unitary non-specific or general phenomenon. This group argues

that the scientific study of anxiety should begin with a comprehensive investigation of specific anxieties in a given situation (Levitt, 1967). Consequently, in studying anxiety these researchers limit their investigation to a study of test anxiety.

The present investigation subscribes to a second posture which defines motivation in part as a non-specific activating function of drive as proposed in the Hullian theory. While it is important for the researcher to be sensitive to the many theories that define anxiety, this study is predicated on the theory that anxiety is a non-specific activating function. The function is identified by the properties common to drive theory advanced by Spence and Spence (1966) and measured by the STAI A-Trait anxiety inventory.

Statement of the Problem

The purpose of the study was to investigate the interrelationship between academic achievement of college freshmen women and measures of anxiety and ability.

The present investigation was based on the psychological theory that supports the study of anxiety as a personality trait. Anxiety is defined in the present study as an activating force dependent on the interaction of the student's drive and the academic situation. The difficulty of the learning situation is estimated from a measure of the student's academic ability. The four academic ability levels (high, above average, below average, and low) established in this study were based on the sample distribution of American College Test (ACT) composite scores.

The investigation was conducted using two statistical designs. First, the regression of cumulative grade point average (CGPA) from the ACT and anxiety variables were computed to study the contribution of the anxiety variable to predicting CGPA. Second, the interaction of the anxiety variable with selected academic ability levels was studied. The anxiety proneness measures concerned were grouped into high, moderate and low levels of the STAI A-Trait anxiety scale. The interaction of anxiety with academic achievement was studied at four levels of academic ability as measured by ACT. The four academic ability groups were partitioned into high, above average, below average and low categories of the ACT.

Research Hypotheses

In order to facilitate the statistical treatment of the data, the following null hypotheses were selected for examination:

- I. There are no differences among the anxiety groups at any of the levels of tested academic ability.
- II. There are no differences in the academic achievement of high and low anxiety students who have above average academic ability.
- III. There are no differences in the academic achievement of high and low anxiety students who have below average academic ability.
- IV. There are no differences in the academic achievement of high and low anxiety students who have average ability.

- V. There are no differences in academic achievement between the moderate anxiety group and the combined high and low anxiety group.
- VI. There are no differences in the estimation of CGPA from ACT and anxiety scores in a second degree curvilinear equation and an estimation of CGPA from ACT and anxiety scores in a linear equation.
- VII. There are no differences in estimating CGPA from ACT measures alone and an estimate based on both ACT and anxiety scores.

Limitations of the Study

This study pertains only to freshmen women who entered the University of Northern Colorado (UNC) during the fall of 1970 and continued for three consecutive quarters. It is further limited to only those women who enrolled for at least nine quarter hours per quarter, were single, U. S. citizens, and graduated from high school in the spring of 1970. The CGPA for each student was based on those grades accumulated by the time of withdrawal or through the spring quarter of 1970.

Since the CGPA reflects all kinds of grading schemes and practices which are carried out in various departments of the university, these disparities of practice could be a source of error in this study. Furthermore, factors such as economic or health conditions of the students were not considered in this investigation.

Finally, the study was limited by the variables considered in the analyses, the nature of the instruments, and the statistical methods used to examine the null hypotheses.

Definition of Terms

A definition of terms which may be common only to this research are as follows:

1. Anxiety: Anxiety is a psychological concept of a specific emotion that is defined and measured by the A-Trait inventory.
 - 1a. High Anxiety Group: Those students from the total sample who scored in the upper 1/3 of the A-Trait anxiety inventory were placed in the high anxiety group.
 - 1b. Moderate Anxiety Group: Those students from the total sample who scored in the middle 1/3 of the A-Trait anxiety inventory were placed in the moderate anxiety group.
 - 1c. Low Anxiety Group: Those students from the total sample who scored in the lower 1/3 of the A-Trait anxiety inventory were placed in the low anxiety group.
2. Anxiety Proneness: Anxiety proneness is a pre-disposition to appraise many situations as threatening.

3. Academic Achievement: Academic achievement is the cumulative grade point average obtained by women students who have completed nine or more credit hours per term for one to three quarters. The cumulative GPA is the dependent variable in the present study.
4. American College Testing Program (ACT): The program is nationwide and is used by over 1,800 colleges and universities as admission criteria. The ACT is an achievement test which yields a composite score. In this study the composite score is used to predict academic achievement and define the four academic ability levels.
5. State-Trait Anxiety Inventory (STAI): The inventory is one that is purported to qualify both transitory emotional conditions and relatively stable individual differences in anxiety proneness (Spielberger, Gorsuch and Lushene, 1970). The STAI-A-Trait score represents the numerical value of the variable used to predict academic achievement and define the three levels of anxiety.
 - 5a. State Anxiety (A-State): State anxiety is a temporary state or condition of the student that varies in intensity and fluctuates over time.
 - 5b. Trait Anxiety (A-Trait): Trait anxiety is a relatively stable individual difference to anxiety proneness

- 5c. High Drive: High drive is a synonym for the high anxiety group.
- 5d. Moderate Drive: Moderate drive is a synonym for the moderate anxiety group.
- 5e. Low Drive: Low drive is a synonym for the low anxiety group.
6. Academic Ability: The potential college achievement of a student as measured by the ACT is academic ability.
- 6a. High Ability Group: This group consists of those students who scored in the ACT range designated by standard scores 26-36.
- 6b. Above Average Ability Group: Above average ability students are those who scored in the ACT range designated by standard scores 22-25.
- 6c. Below Average Ability Group: Below average ability students are those who scored in the ACT range designated by standard scores 18-21.
- 6d. Low Ability Group: Low ability students are those who scored in the ACT range designated by standard scores 1-17.
7. CGPA: CGPA is the cumulative grade point average based on a four point system earned on the conclusion of a student's last enrollment.

The Importance of the Study

The value of the study is important for the following reasons:

(1) The results of the study will prove useful to the administration and faculty at the University of Northern Colorado. The study will give faculty more information on the problems of students with average academic ability. (2) A greater appreciation of the influence of anxiety on the academic achievement of the average student would certainly contribute to a sounder basis for curricular and co-curricular designs aimed at meeting the needs of those students. (3) Toffler (1970) noted in his novel, Future Shock, that the search for personal identity by the masses now appears to be of paramount importance to American society today. Since over half of our society today is made up of women, and due to the fact that thousands of females in this group desire to define their identities through liberation; a study that would contribute to the understanding of these individual differences would prove beneficial to women subject to anxiety proneness.

II. REVIEW OF RELATED LITERATURE

Background to the Review

The primary purpose of the study was to investigate the relationship between the anxiety variable and the achievement for college freshmen women. To appreciate the importance of anxiety to academic achievement, a review of studies identifying the relationship of trait anxiety to intelligence and academic achievement was made. Many of the researchers indicated they found promising results, but few of the studies corroborated the findings of the others. No attempt was made to review all the studies on anxiety. Since 1950 alone, there have been over 3,500 articles or books written that relate to anxiety (Spielberger, 1966). An attempt was made to provide a selected review of the historical development of anxiety as a personality construct. A more specific review of the conception and development of anxiety as a Trait and State psychological construct is included.

The Concept of Anxiety

Sigmund Freud is generally accepted as the first psychoanalyst to conceptualize anxiety as a neurosis. He outlined this concept in his book, The Problem of Anxiety published in 1923. This position represents a drastic reorientation from his original view stated in 1894 when he believed anxiety to be a purely physiological reaction to the chronic inability to reach an orgasm in sexual relations (Levitt, 1967).

William McDougall concentrated his efforts on the primary viewpoint that was held by the purposivists of 1908. His introduction of a speculative doctrine of instinct provided the social psychologist of his time with a plausible tenant to account for the springs of human action. The purposivist psychologist studied the traditional concept that thought and action were directed toward and guided in some way by an end, or a goal. In his writing, Outline of Abnormal Psychology, McDougall (1926) defines anxiety as the name of one of the derived emotions. He saw it as one of the prospective emotions of desire that was apt to arise whenever some strong continuing desire appears likely to fail of the goal. This definition placed what was later to become known as motivation as the primary problem in the study of human behavior. The research to this point was years away from the study of motivation as a constellation of variables. Tolman and Hull's ideas (Atkinson, 1964) the refinement in the study of behavior, the postulation of intervening variables, and the concept of drive and habit constructs had not formally appeared at this point in anxiety research. Nor were the sophisticated experimental methods and psychometric techniques of today available to permit the verification of such speculative theories as William James' volition and theorized neural linkages. At this stage of development in the science of psychology, other researchers were not as willing to attribute anthropomorphic characteristics to the learning behaviors of lower animals. Edward L. Thorndike in 1897 and I. P. Pavlov in 1898 independently developed experimental studies that focused attention on associative processes. Pavlov and Thorndike were concerned with associative

processes and "intelligence", and not with motivation (Garrett, 1957). Psychologists interested in studying motivation soon adopted Pavlov's and Thorndike's techniques of isolating and objectively measuring simple behaviors common to classical conditioning studies. This emphasis on objectivity, on the need for clarity in the empirical meanings of motivational concepts, has been directed into the development of more sophisticated psychometric inventories, projective techniques and physiological tests. The empirical meanings of motivational concepts can now be measured in relation to repeated readings obtained from the administration of these instruments.

The emphasis on objectivity, the interest in learning patterns of dogs and other animals, and the prodding attempts to relate the scientific observations to physiological explanatory concepts was not shared by all members of the scientific community interested in man and the study of his affective behavior. Contemporary to these researchers of man were the psychoanalysts. Beginning with Freud's postulation of reality anxiety, neurotic anxiety and moral anxiety theories (Hall, 1954), subsequent psychoanalytic schools developed which explained man's affective nature solely on molar observation and introspection obtained from interviews. These theoretical speculations of man's emotional postures were categorized initially as case studies and later grouped into phylum that clinical practitioners generally agreed upon as representing similar affective characteristics. Although the development of this data was derived totally from introspection, projective tests, and observations of molar behavior, it would later become the basis for the development of more

verifiable quantitative instruments such as the Minnesota Multiphasic Personality Inventory (MMPI), the Taylor Manifest Anxiety Scale (MAS), and scores of other inventories designed to measure various personality traits.

These early twentieth-century psychoanalysts did not concur readily with a taxonomy of the possible causes of their patient's anxieties. The Neo-Freudian movement of the 1930's and 1940's is typified by Karen Horney's writings (1937). Erich Fromm, Harry S. Sullivan and others joined with Horney in redefining the orientation of psychoanalysis from a biological and instinctual premise as theorized by Freud to more of a cultural and environmental base. Thus, the beginning of personality development and subsequently anxiety patterns were seen as dependent on social patterns, customs and cultures of the individual. The claim of biological and instinctual origins of anxiety was modified to include the importance of the environment. To these theorists, anxiety could not arise before the ego had reached a minimum stage of development--that is before the organism had some awareness of its environment (Levitt, 1967). The parallel development of the study of anxiety continued its evolutionary development as simply a by-product to the study of personality by the psychoanalyst and as an uncontrollable intervening variable to the learning psychologist. Beginning from 1940 to 1950, motivational research became primary to the investigations of a few psychologists.

Development of the Trait-Anxiety Variable

Clark Hull (1943) first advanced a complete thesis on the Drive X Habit concept in his Principles of Behavior. During this time, John Dollard and Neal Miller (1950) introduced the study of anxiety as a secondary drive, one that is learned. Janet Taylor (1953) authored the first anxiety scale designed to measure a subject's predisposition to anxiety. To Taylor, anxiety was a unitary drive which affected learning. Her Manifest Anxiety Scale was developed from the MMPI but it was not intended to measure anxiety traitness as a clinical variable. It was designed to measure trait-anxiety as an experimental concept of drive. The neurotic triad scales of the MMPI aids the clinician in solving certain problems in differential diagnosis. The MAS score aids the psychological experimentalist in providing an operational index in the measurement of the anxiety trait. The inventory items of the MAS do not suggest a measure of immediate state-anxiety as most of the items ask for a self report of a general condition.

The trait-anxiety construct is very contemporary to the research field of anxiety. The first formal identification of an anxiety measure that reflected anxiety-proneness differences between individuals was made by Catell and Scheier in 1958 through 1961 from factor analytic studies (Spielberger, 1966). The trait anxiety factor was interpreted as measuring stable individual differences in a unitary and relatively permanent personality characteristic. The State-Trait Anxiety Inventory (STAI) that was used in this investigation proceeded from theories developed from Clark Hull's Drive X Habit hypotheses that

were later adjusted and clarified by Janet Taylor (1956) to accommodate the research concerned with the arousal or Drive properties of anxiety and its subsequent effects on manifest behavior. Hull's research biases defined the "striving for goals" (motivation) and the "strengthening of connections" (learning" as separate problems (Atkinson, 1964). The resulting theories of his research have provided the initial tenets on which the Taylor Manifest Anxiety Scale (MAS) and later the STAI anxiety inventory were designed. These inventories were structured to select subjects differing in emotional responsiveness so that the assumptions of Drive Theory could be tested.

J. T. Spence and Kenneth Spence describe the assumptions underlying Drive theory as follows:

The theory assumes that a learning factor (H) combines multiplicatively with a generalized drive factor (D) to determine excitatory potential (E). Thus $E = f(H \times D)$. It has further been assumed that in the conditioning situation, the level of drive (D) is a function of the magnitude of a hypothetical mechanism, i. e., a persistent emotional response aroused by aversive stimuli (1966, p. 293).

Not until the late 1950's and well into the 1960's did other researchers provide actual identification of two distinct anxiety factors. Using multivariate techniques, Cattell and Scheier (1958) were the first to identify two distinct anxiety factors. The identification afforded additional credence to Taylor's assumptions and the multitude of clinical conjectures regarding an individual's predisposition to anxiety as a variable characteristically different from the contemporaneous or state experiences of anxiety. Cattell and Scheier

(1961) in their book, The Meaning and Measurement of Neuroticism and Anxiety, define state and trait anxiety as follows:

State. A personality dimension describing change-over-time within a single individual or in groups of individuals. Essentially, a factor-dimension in intro-individual change as contrasted with a Trait which describes inter-individual differences at any one time.

Trait. A characterological or relatively permanent feature of personality (1961, p. 500).

In spite of Cattell and Scheier's demonstrable findings of two types of anxiety constructs, confusion and lack of corroboration remains evident among psychologists researching the Anxiety variable. Where Taylor, Spence, and Spielberger may view a low score on the MAS or STAI as reflective of a weak component of non-specific drive attributable to fear; Mandler and Sarason may interpret it to be a relatively weak repertory of task-irrelevant habits (Atkinson, 1964).

The Drive Theory of Anxiety

The theory adopted in this investigation was one that was originally introduced by Clark Hull (1943) and later applied to classical anxiety studies by Taylor (1956) and Spence (1956). They conceived of anxiety as an acquired drive which acted to generally energize the organism. It was understood to be a unitary, non-specific drive. It was not stimulus bound. Important differences in emotional responsiveness that contribute to drive level were assumed to exist for each individual. This theory (emotionally based drive) and its ramifications were collectively referred to in this investigation as drive theory.

Drive theory is dependent on mathematical functions that attempt to relate the observed behaviors (R) to predictions about behavior. The basic mathematical formula that describes the effects of anxiety on any one response tendency is: $R(\text{esponse}) = D(\text{rive}) \times H(\text{abit strength})$. The MAS provided earlier investigators with an operational measure of individual differences in (D). Two alternative hypotheses concerning the relationship between (D) and MAS scores have been defined by Taylor (1956). One hypothesis assumes that high anxiety students will manifest higher (D) than low anxiety students in all situations, whether stressful or not. The second hypothesis posits that high anxiety students will react with higher (D) than low anxiety students only in situations containing some degree of stress. Neither Spence nor Taylor has presented an extension of the basic Hullian formula to predict the relationship of (D) to complex learning situations which involve more than one (H). Spielberger (1966) suggested that the study of the effects of (D) could be and should be generalized to real-life learning situations if the theory were extended to embrace individual differences in intelligence. Levitt (1967) summarized Spence's theory as one where (D) is interpreted to energize or strengthen each (H) in the hierarchy of habit strengths in proportion to the initial strength of that (H). Although Spence has refrained from presenting a mathematical extension to the Hull formula to explain the multiplicative relationship of $(D \times H)$ or (R); he did attempt to define this relationship from a theoretical base common to drive theory. Spence (1956) suggested that in a simple conditioning experiment where two response tendencies may be present, one must assume that there are

two (H) present in a hierarchy proportionate to their initial strength. If the first habit (H_1) with an initial strength of three is energized by an anxiety quotient of ten (D_1), the resulting response potential will be thirty which may be represented by $H_1 \times D_1 = R_1$ or $3 \times 10 = 30$. A second habit (H_2) or response tendency with an initial strength of five may likewise be energized proportionate to the strength of the anxiety quotient of ten (D_1). The resulting response potential will be fifty which may be represented by $H_2 \times D_2 = R_2$ or $5 \times 10 = 50$. The consequence of the absolute difference between the values of H_1 and H_2 was increased from two ($H_1 = 3$ and $H_2 = 5$) to fifty ($H_1 = 30$ and $H_2 = 50$). Thus H_2 was more likely to occur than it would have been without the strengthening effect of (D) (Levitt, 1967). This phenomenon is generally subscribed to by those individuals investigating classical aversive conditioning whereby the learning situation involves the mastering of one habit. Other investigators have postulated that habit hierarchies for learning tasks of a complex nature such as college achievement may be a function of the individual's past experience (Levitt, 1967). Denny (1963) reasoned that task difficulty could be defined as a joint function of the task complexity and the student's intelligence. Child (1954) cautioned the researcher to consider the varying effects anxiety (D) may have on performance when tasks differ in complexity. He cited research which failed to find performance facilitation for high (D) students on complex tasks. He hypothesized this effect to be a function of the competing internal habits for actualization in response. He assumed the competition among these internal habits to be reinforced by (D). The result may

be heightened internal conflict and interference with manifest response. The learning of the correct (R) in a complex learning situation is impeded by the same high (D) that facilitates learning in a simple conditioning experiment. In a complex situation, Child (1954) assumed the (D) to be an energizer of the incorrect (R) along with the correct (R) which may have a lower or similar (H). Child's theory was not in disagreement with drive theory. It emphasized the importance of internal conflicting (D) initiated by anxiety where Taylor's (1956) drive theory credited the effects of complex and competitive intratasks as responsible for increased stress and poorer (R) performance for high (D) students. Wine (1971) emphasized that the highly anxious person divided his attention between self relevant and task relevant variables in contrast to the low anxious person who focused his attention more fully on the task.

In summation, Spence (1956), Taylor (1956), and Spielberger (1966) defined the drive theory as an emotionally based drive that generally energized the student. It had recognizable properties that indicated its similarity to other psychological traits which Atkinson (1964) labeled motives. Anxiety was defined by these complementary theories as an acquired drive that was unitary, non-specific and stimulus free. High (D) facilitated performance on simple tasks through its energizing effect. High (D) disrupted learning of complex tasks (R) because of competing response tendencies (H) introduced by the complex learning task. This theory maintained that anxiety prone high (D) students will experience interference in complex learning tasks (R) at first, and later realize accelerated learning

once the correct (H) moves up in the hierarchy of habit strengths as a function of practice (Taylor, 1956). Berthold (1953), in clarifying this energizing effect, described anxiety as the mother of the drive to know. Spielberger, Gorsuch and Lushene (1970) in STAI Manual for the State-Trait Anxiety Inventory define this predisposition of the drive to know as a separate construct which they titled Trait-Anxiety. They distinguished this construct as being a separate psychological concept from the more commonly understood contemporaneous emotion, state-anxiety. Their definition follows:

State-anxiety (A-State) is conceptualized as a transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity. A-State may vary in intensity and fluctuate over time.

Trait-anxiety (A-Trait) refers to relatively stable individual differences in anxiety proneness, that is, to differences between people in the tendency to respond to situations perceived as threatening with elevations in A-State intensity. As a psychological concept, trait anxiety has the characteristics of a class of constructs that Atkinson (1964) calls "motives", and which Campbell (1963) refers to as "acquired behavior dispositions" (1970, p. 3).

It is from the view of anxiety as a drive and specifically as defined by Spielberger, Gorsuch and Lushene (1970) that the relationship of manifest anxiety to academic ability and academic achievement will now be reviewed.

Relationship of Trait Anxiety to
Academic Ability and Academic Achievement

The measurement of the theorized trait anxiety began in the early 1950's with the Taylor (1953) MAS. Contemporary to the Taylor MAS research were other investigations of the anxiety concept. Contrary to the Spence and Taylor theory, Mandler and Sarason (1952) treated anxiety as a multidimensional construct and theorized that anxiety was more stimulus bound. Anxiety was understood to be more associated with achievement situations through learning and not seen as a unitary drive. The claims of anxiety as a multidimensional construct or a unitary and relatively permanent device continues today. The theoretical basis of this research is one that holds with Spence (1956), Taylor (1956), Cattell and Scheier (1958), and Spielberger, Gorsuch and Lushene (1970). Their claim is that anxiety is identifiable in both state and trait variables. In 1958, Spielberger, working with freshmen at Duke University on psychological examinations, studied the relationship between manifest anxiety as measured by MAS and academic ability as measured by ACE. The correlation of difference reported between the MAS and the ACE for the total sample of males and females was insignificant from zero. Spielberger (1958) interpreted these results to indicate anxiety as being uncorrelated with a measure of academic ability. In describing further trends which appeared from his intensive analysis of the distributions, Spielberger found the magnitudes of obtained correlations between the MAS and ACE were related to the mean ACE scores of the males in the six sub samples. As the mean ACE increased, the extent of the

negative correlation between the ACE and MAS decreased. The rank difference correlation for this relationship was .94. Discounting this difference, Spielberger noted that the negative correlation decreased and approached zero as the mean ACE increased. He attributed this phenomenon to the presence of students scoring in the lower ranges of the ACE distribution. Two of the six Pearson product-moment correlations for the females were significant. Further analysis of these distributions did not suggest any systematic interpretations; therefore, the females were dropped from the research for further study. Spielberger concluded this research offered no explanation for a relationship between the MAS and ACE. He did suggest that experimenters using the MAS should control for academic ability, especially so when studying heterogeneous populations with low mean academic ability. (Spielberger, 1958). In 1970, Spielberger, Gorsuch, and Lushene (1970) attempted to determine how emotional responses, as measured by the State Trait Anxiety Inventory (STAI), related to academic performance for students of comparable ability. They postulated that a reliable index would be essentially unrelated to academic ability. The theory was tested on a sample of 1200 entering freshmen at Florida State University. The resulting correlations were based on high school class rank, and scores on the Florida state test given to all seniors. Also, CEEB scores were used for 15% of the students. All correlations were zero. In allowing for the results of Spielberger's earlier research, reported in 1958 that reported slight negative correlations for some sub samples of a more heterogeneous sample, the

authors concluded that it appeared that STAI A-Trait scores were unrelated to academic ability indexes. Allen (1970) studied the use of the STAI A-Trait and A-State in predicting academic achievement of college students. He theorized that high test anxiety (TA) students would emit more task-irrelevant responses than low TA students in situations perceived as threatening; however, no differences perceived as non-threatening. The STAI was one of four instruments used in this experiment. Allen found the Trait scales tended to be quite robust. Furthermore, he found them to have more reliability across different conditions of administration than did the State scales. Allen further suggested that the STAI may be a useful predictor of academic success. Spielberger (Allen, 1970) provides some agreement in the use of the STAI A-Trait as an instrument for predicting academic achievement. Spielberger found anxiety and academic performance to be related negatively for students in the middle ranges of academic ability; however, this relationship was not significant. Cattell, Barton and Dielman (1972) studied the prediction of academic achievement for sixth and seventh grade pupils from motivation, personality, and ability measures. All three measured were found to contribute to the variance found in achievement scores. Levitt (1967) encourages further research of the anxiety variable through physiological and inventory means. He specifically recommends the STAI as a promising development in inventory measures of anxiety to warrant extensive use in future research on anxiety.

Warburton (1962) reviewed 30 investigations of anxiety which studies the relationship between anxiety and school achievement in the

United States. His results are as follows:

Significant negative correlations.....	13
Non-significant negative correlations.....	15
Zero correlations.....	1
Significant positive correlations.....	1

(1962, p. 199)

Although additional investigation of the distributions would be necessary for specific comments, it is reasonable to interpret Warburton's summary of studies as indicating a negative relationship being present between anxiety and academic achievement for 96% of the investigations. In two separate reports, Spielberger and Katzenmeyer (1959) and Spielberger (1962), the results of research on Duke University students for three years, from 1954 through 1957, indicate that the grades of low aptitude students tend to be uniformly low and irrespective of anxiety level. In the middle academic ability range, high anxiety students obtained poorer grades than did the low anxiety students. Spielberger's description of this relationship is based on observed heterogeneous interaction of anxiety and average ability. He indicates the analysis of the Variance test for this interaction as being insignificant. For superior students, Spielberger found grades to be high and apparently independent of anxiety level. In the final analysis, according to Spielberger and Katzenmeyer (1959), anxiety has no systematic effect on high or low academic ability students.

Nelson (1971) researched the use of the STAI inventory in predicting the first term grades of 465 students who were sampled at random. Nelson's results supported Allen's (1970) and Spielberger, Gorsuch and Lushene (1970) theories of the STAI A-Trait inventory as being useful as a predictor of academic achievement. Nelson

(1971) further found no significant correlations between trait anxiety and American College Test (ACT) scores. His findings indicated that A-Trait and ACT scores were independently related to prediction of academic achievement. Hountras, Grady and Vraa (1970) studied the prediction of academic achievement from ACT and A-Trait scores for 62 college students; although, no significant relationships were found. Boor (1972) suggested that future investigations determine the extent to which anxiety measures are related to academic performance only when the effects of academic ability are taken into account.

The above review of literature indicates both contradictory and inconsistent findings regarding the relationship of anxiety and academic ability measures to academic achievement. Recent research with the STAI is more conclusive in indicating a more stable and consistent independence between anxiety and academic ability measures Allen (1970), Spielberger, Gorsuch and Lushene (1970), and Nelson (1971). Spielberger (1962) suggests as plausible the predictability of college grade point averages from the STAI A-Trait scores for average academic ability students.

The Effects of Moderate Anxiety Scores on Learning

The possible effects of various anxiety levels measured by the MAS is reported by Taylor (1956). The relationship of anxiety level to six independent classical eyelid conditioning endeavors was measured in these studies. The data available for subjects in the moderate range of anxiety indicated a monotonic relationship between

conditioning and MAS scores. On the relationship of anxiety to learning, subsequent reports of experiments by Allen (1970), Spielberger (1962) and others have elected to omit use of the moderate anxiety level student.

Effects of Sex Differences on Academic Achievement

A review of the literature indicates that many studies failed to control the effects of sex differences on the criterion variable. Those who attempted to report found differences that were inconsistent both to the data under investigation and to the results of other studies. Spielberger, Gorsuch and Lushene (1970) reported that females tend to be more emotionally labile than males or more willing to report their feelings. Hodges and Feeling (1970) however, found that females tended to differ in A-State anxiety level to men when exposed to physical danger and pain, but not on other stressful situations frequently found in college life. Earlier, in Spielberger's formative research to build the STAI, he inferred that male college students may not have the same intellectual correlates as females when compared on the MAS for anxiety (Spielberger and Weitz, 1964).

The Weitz and Clover (1959) studies suggest that females relate to different nonintellective factors than do males. These separate investigations all suggest the importance of controlling for the effects sex differences may have to perceiving anxiety.

Summary

The review of literature provided a selected historical account of the development of anxiety as a psychological construct from its initial introduction by Freund in 1894. No attempt was made to review all of the 3,500 plus articles and books published on anxiety since 1950. The development of the anxiety construct was reviewed from its early beginnings as a hypothesized clinical variable, a by-product to the experimental studies of learning, and finally as a descriptive concept of both unstable contemporaneous and stable personality traits common to principles long identified with anxiety. The development of the Taylor (1956) MAS and the Cattell and Scheier (1961) factor analytical studies offered further evidence to the emergence to two separate and identifiable concepts of anxiety. Although this emergence of a State and a Trait concept of anxiety was theorized and studied, other psychological researchers (Mandler and Sarason, 1952) continued to suggest that anxiety was more stimulus bound. They suggested more experimental gains could be made if the concept were studied from this reference, even though they acknowledged anxiety had properties common to other personality traits and motives.

The Spence and Spence (1966) Drive Theory has sought tests of its predictability from classical conditioning experiments. Spielberger (1958) has extended the Drive Theory to study more complex and intra-task competitive learning situations found in real life. He suggested controlling for sex and academic ability differences when studying the properties of Drive Theory in predicting college academic achievement. The research cited indicated that grades of low ability

students tended to be uniformly low irrespective of their anxiety level. These studied works pertained to the relationship of anxiety to academic achievement in complex situations. Superior students obtained a high level of achievement and appeared to be independent of anxiety level as well. The average academic ability student appeared to have a negative relationship between anxiety and academic achievement. This apparent independence of anxiety to low and high academic ability students varied depending on the complexity of the tasks involved.

This review of literature discussed the development of anxiety as a psychological construct, the emergence of anxiety as a trait, and the relationship of anxiety to academic achievement when academic ability and sex differences were taken into account. These relationships were included because the literature indicated (1) a variety of theories concerning anxiety, (2) the importance of understanding the differences between a trait and state conception of anxiety, and (3) the indication that academic ability should be controlled in studying the relationship of anxiety to academic achievement.

III. METHODOLOGY AND PROCEDURE

This chapter describes the research objectives, the sources of data, the sampling technique, and the experimental design.

Research Objectives

The objective of this research was to isolate, identify and measure the relationship of one theoretical variable to academic achievement. The theoretical variable was A-Trait anxiety. The subjects were all of the undergraduate women who entered UNC fall term 1970 and were single, between the ages of 16 and 20, high school graduates in the spring of 1970, and citizens of the United States. The sample was designed to represent the "typical" freshman college woman.

The theoretical basis of this investigation was derived from the properties of scientific theory as outlined by Levitt (1967). They are:

1. The phenomenon (trait anxiety) being explained must be capable of being measured objectively.
2. The theoretical statement (a study of the relationship of anxiety proneness to cumulative grade point average variances among student sub groups) must be based on some already known facts in a logical manner.
3. The theory (a significant relationship is suggested between individual anxiety proneness and levels of academic achievement for college women students) must permit the deduction of new hypotheses which can be tested experimentally (Levitt, 1967, p. 17).

The trait anxiety variable was a resultant construct of eighty years of anxiety research as discussed and defined in Chapter II. For purposes of this study, the theorized definition of trait anxiety as

offered by Spielberger, Corsuch and Lushene (1970) will further be limited. Trait anxiety to this investigation was understood to be the resulting mathematical quotient of the STAI. The A-Trait anxiety score provides an objective measure of the concept, drive theory.

The State-Trait Anxiety Inventory

An examination of the STAI manual provided the following discussion of the reliability and validity tests of the STAI inventory.

The STAI inventory is comprised of two separate self-report scales for measuring state anxiety (A-State) and trait anxiety (A-Trait). Each separate scale consists of 20 statements. The scales are printed on opposite sides of a single test form. The inventory has no time limits and college students usually complete either the A-State or A-Trait scale in six to eight minutes. The range of possible scores for form X-2 (A-Trait) vary from a minimum score of 20 to a maximum score of 80. Subjects respond to each inventory item by rating themselves on a four point scale. The following is a sample inventory item:

21. I feel pleasant
1. Almost never
 2. Sometimes
 3. Often
 4. Almost always

The test construction of the STAI was begun in 1964 at Vanderbilt University and later continued at Florida State University. The items were originally built from a pool of items used by the IPAT anxiety scale, Taylor MAS, and Welsh anxiety scales. The retained items were repeatedly tested on Vanderbilt students. The latest research information reviewing the reliability and validity of the STAI

was largely provided by Spielberger since the instrument did not become available through Consulting Psychologists Press, Inc. until 1971. Allen (1970) of the University of Illinois provided some additional review which will be discussed later.

Test-retest correlations, alpha coefficient measures of internal consistency, and item-remainder correlations were the analyses selected by the inventory authors to test the stability and internal consistency of the STAI. The test-retest correlations of $r = .73$ to $r = .86$ were interpreted by the test authors to be reasonably high. The alpha coefficients of $r = .86$ and $r = .89$ were found for male and female undergraduates. The authors state that the STAI scales indicate a high degree of internal consistency and reliability as evidenced by the above three tests.

The STAI manual was carefully reviewed with regard to the criteria of excellence established by the American Psychological Association (APA) (1954). The APA publication was structured to inventory a new psychological test against APA standards of excellence for sound psychometric instrument construction. Spielberger, Gorsuch and Lushene (1970) present a very objective and open attempt to note the validity, reliability and norm group limitations of the STAI. Since the STAI is not a nationally known test similar to the ACT, the norm groups are adequate, though small. The norm groups were established from over 3,000 high school and college students. However, there are some inferences and omissions made by the STAI authors that need to be challenged. Although the test-retest reliability coefficient for 231 women yields a fairly respectable correlation

coefficient of $r = .77$, it is calculated and reported on a relatively short time period of 104 days, the equivalent of one collegiate quarter. The sample was not collected randomly but represented only those women who enrolled in an introductory psychology course for one quarter. The assumption of a moderately high reliability coefficient should be held tenuously, at best, with the above factors in mind.

The STAI concurrent validity correlation coefficient also needs further clarification. The assumption of a moderately high validity with a report on the concurrent coefficient of validity was based on well accepted and researched anxiety inventories presently in the field. They are: the Taylor Manifest Anxiety Scale (MAS), the Institute for Personality and Ability Testing (IPAT Anxiety Scale), and the Zuckerman Affect Adjective Check List (AACL). These concurrent validity correlations are presented in Table I.

TABLE I. Correlations Between the STAI A-Trait Scale and Other Measures of Trait Anxiety

Anxiety Scale	College Females N = 126		College Males N = 80			NP Patients N = 66		
	STAI	IPAT	TMAS	STAI	IPAT	TMAS	STAI	IPAT
IPAT	.75			.76			.77*	
TMAS	.80	.83		.79	.73		.83	.84
AACL	.52	.57	.53	.58	.51	.41		

*N = 112 for the correlation of STAI to IPAT

In Table I, the test authors noted the moderately high correlation coefficients of concurrent validity between the STAI and the IPAT or TMAS. They suggested that these three inventories could be assumed

to be alternate measures of A-Trait, but that the AACL was only moderately correlated. The present study suggests that the correlations noted by Spielberger, Gorsuch and Lushene (1970) may suggest inflated relationships. This would seem to be a natural result since the STAI was constructed from a pooling and evaluation of test items taken from the TMAS, IPAT and Welsh Anxiety Scale (Spielberger, Gorsuch and Lushene, 1970). A logical conclusion would seem to indicate that the STAI was tested for concurrent validity by using parent tests that helped conceive the STAI.

The most serious omission of validation committed by the test authors is one which necessitates the need for studying the relationship of A-Trait anxiety levels to academic achievement. The authors attempted to determine this relationship and proceeded to verify it by administering the STAI A-State and A-Trait inventories to 1,200 entering college freshmen at Florida State University. The criterion of aptitude and achievement are determined from a variety of academic data which happened to be available prior to the students enrollment at Florida State University. The criteria were as follows:

1. High school grade point averages
2. High school class rank
3. The Florida High School 12th grade test
4. CEEB scores

The resulting correlations were essentially zero for the STAI scores and each of the above criteria. From this analysis, the authors concluded that the STAI scores seemed unrelated to achievement or aptitude as defined by the above criteria. This conclusion was not borne out by Allen (1970) who studied the predictability of academic achievement from anxiety inventories. Allen also

investigated the effects of these different conditions of administration on state and trait anxiety measures. The findings were as follows:

Of the 198 correlations, 28 were significant at the .05 level or better. The STAI-T accounted for 6 and the STAI-S for 13. The STAI-S, administered under regular conditions, significantly correlated with 10 of the 11 academic variables (ranging from -.37 to -.63 with a mean correlation of -.51). These data suggest the STAI may be a useful predictor of academic success, although a replication of these findings would considerably strengthen this hypothesis (Allen, 1970, p. 357).

Although the inferences and omissions introduced above were considered serious, they were not considered to be flagrant and did not constitute willful disregard for honesty and precision in test construction. On the contrary, they were suggestive of additional research to verify the speculative usefulness of the STAI A-Trait inventory in academic settings.

The American College Test

The purpose of the ACT, as stated in the Technical Report (1965), was to transmit timely information that was especially relevant to the student, his high school, and his college during the transition from secondary to higher education. The test uses the four subtests of English, mathematics, social studies, and natural science to measure academic potential and educational development. A raw score is obtained for each of the four subtest. Each subtest score is converted to a standard score. A fifth score, the composite score, is derived by computing the mean from the sum of the four standard scores of the test battery. The composite score for each student can then be compared to several different norm groups that have been

defined and compiled by the ACT program. Institutional norm groups are also provided for colleges who participate with ACT research services.

A selection of self reported high school grades and a student information blank complete the total test. The test takes approximately three and one half hours and testing centers are now located throughout the world. The present data bank of ACT contains information concerning over two million students per year who have written the ACT since its inception in 1959. Because of the general acceptance of the information regarding ACT, it was not considered necessary to present a review of the numerous reliability and validity studies that are available in the literature.

The ACT composite scores used in this study were drawn from computerized records and student permanent records of the University of Northern Colorado during the summer term of 1972.

The Experimental Design

The two independent variables in the study were: (1) A-Trait anxiety scores; and (2) ACT composite scores. The A-Trait anxiety scores were obtained from unit record files maintained by the University Counseling Center. The ACT composite scores were on file in the Registrar's Office of the University.

The CGPA was the dependent variable and represented the mean grade point average of each of the freshmen women in the sample. The sample and the ACT scores were obtained from the permanent records. The CGPA was available from computer center records.

The nature of the relationship of anxiety to academic achievement is not clearly defined by other studies. The literature suggests that the anxiety and academic achievement appears to vary with the learning situation and the subject's academic ability. The relationship of anxiety to academic achievement for average ability students represents the focal problem of the present study. The literature was consistent in indicating independence of the anxiety variable to the typical collegiate CGPA measures of academic ability. Nelson (1971), Spielberger, Gorsuch and Lushene (1970) along with other investigators provided agreement in their findings of no significant correlations between trait anxiety and ACT scores. To determine if these non-significant correlations may indicate a curvilinear relationship for building a curvilinear regression equation, a graphical, two dimensional plot of a random sample of 100 A-Trait to ACT scores was drawn and inspected for possible curvilinear trends which would not be indicated by a simple correlation coefficient. Inspection of the scatter diagram did not yield any elliptical fields that would be suggestive of either a linear or curvilinear trends between the two variables. This evidence was accepted as sufficient indication of the independence of the anxiety measures to the ACT scores. A copy of the scattergram is found in Appendix A.

Continued inspection of the raw data was made to determine if an analysis of variance as outlined by Lindquist (1956) and a linear or curvilinear regression analysis as described by Croxton and Cowden (1955) would be appropriate. An investigation of the data by an analysis of variance design for treatment by levels requires that the

criteria meet certain assumptions in order to yield an unbiased F ratio. The assumptions basic to the ratio of the mean square for treatment by levels to that for within-cells distributed as F are listed as follows:

1. Each treatment subgroup has been randomly selected from the corresponding subpopulation in the present population.
2. The distribution of criterion measures for each of these subpopulations is normal.
3. All of these distributions have the same variance (σ^2) (Linquist, 1956, p. 138).

To aid in the verification of a statistical design that would lend itself to the data and not violate the assumptions requisite of the statistical test, the 1,080 CGPA's linearly transformed to Z scores. It is particularly important to note that the form of the Z distribution is invariant from the original form common to the original CGPA score distribution (Blomiers and Lindquist, 1960). A frequency polygon was then sketched from points selected every .5 σ distance beginning with the extreme plus and minus Z scores represented. An approximate normal curve was then plotted from the normalized Z scores to provide a graphical comparison to the Z scores distribution derived from CGPA marks. The mathematical function used to determine the transformed normal Z scores from the original Z scores is described by Croxton and Cowden (1955). The graph is found in Appendix B. Inspection of the graph indicated that the distribution of CGPA scores conformed very well to the superimposed approximate normal curve with only a slight score restriction at the extreme upper end of the scale.

The analysis of variance with a treatment by levels designed required a three by four array to meet the specifications defined in this study. The criterion scores were the scores common to the rows and columns which were compared for variance. The three levels of anxiety which would represent the three columns of the array were determined on an arbitrary basis of upper-third, middle-third, and lower-third of all the anxiety scores for women. The four levels or rows represented the high, above average, below average, and low academic ability levels of the students. These four levels were based on classifications that were approximately proportionate to groupings common to the total range of ACT scores for women in the defined population. The groupings have been adjusted to provide for balance. The groupings presented in Table II were based on the ACT composite scores that range from a low of one to a high of thirty-six.

TABLE II. Act Score Distribution for Women and the Number of Scores in Each of the Four Tested Levels.

Academic Ability Level	ACT Score	Number of Women	Percent of Scores
High Ability	26-36	156	14%
Above Average	22-25	353	33%
Below Average	18-21	367	34%
Low Ability	1-17	204	19%

The scatter of scores or variance of the population was assumed to be similar to the variance of each of the subpopulation distributions since the total defined population was used in establishing twelve subpopulations in the three by four array. To give further credence to this assumption, graphical plots of random samples of one hundred scores each were made from all four of the levels of defined academic

ability based on grouping from the ACT. Inspection of the graphs indicated no marked heterogeneity of variance patterns from one ability level to another. A graphical inspection of the score scatter at the various treatment levels was considered sufficient to support the assumption of homogeneity of variance among the treatment populations congruent with the normal distribution of the parent population of criteria scores. Additional support for accepting this assumption was provided by the Norton study of the effects of non-normality and heterogeneity of variance (Lindquist, 1956). Norton investigated both the joint effects of lack of symmetry in criteria scores and heterogeneous variances; and the separate effects of heterogeneity of variance and non-normality upon the F distribution. In general, Norton found that unless the heterogeneity of either form or variance was so extreme as to be readily apparent upon inspection of the data, the effect upon the F distribution was probably negligible. Graphical plots of these distributions are found in Appendix C.

The analysis of variance in treatment by levels as described by Lindquist (1956) was selected as one of the statistical test designs for the following reasons:

1. An inspection of the scatter diagram of the relationship of anxiety to ACT scores indicated an independent and random relationship.
2. A plot of the criteria scores against a hypothetical normal curve indicated that the population of criteria scores could be defined as meeting the assumption of normality.
3. An inspection of the possible heterogeneity of criteria score variances at the various treatment levels yielded similar patterns of score scatter with no marked extreme bi-modal score clusters. And finally --

4. The Norton study indicated that only extreme heterogeneity of variance combined with skewed score distributions would bias the F ratio (Lindquist, 1956). Neither the form nor the variance appeared markedly skewed from the normal or heterogeneous in variance from row to row and column to column.

In an attempt to further define the possible relationship anxiety may have with academic achievement, a second degree polynomial was developed to predict CGPA from ACT and anxiety scores. The equation was developed with ACT weighted in a linear relationship to CGPA. This relationship is well established by the American College Testing Program (1971). The relationship of the second independent variable, anxiety, was based on a linear and a quadratic relationship that was computed after an inspection of the graphs and a review of the literature. A copy of these graphs are in Appendix C. The curvilinear predictive equation was obtained after repeated computer runs to determine the best curvilinear predictive equation. A linear or first degree polynomial was also developed which placed both the ACT and anxiety variables in a linear relationship to CGPA scores. This first degree curve was then compared with the second degree curve to determine if the non-linear coefficient of determination was significantly larger. It was also a part of this study to test the increase in the explained variation of the computed values of CGPA that resulted from the introduction of anxiety as the second independent variable to the variation that had not been explained before the introduction of the anxiety variable.

The .05 level was selected as the minimum acceptable level for all tests of significance.

Summary

Information was presented on the definition and selection of the total population studied in this investigation. A review of the reliability and validity of the STAI A-Trait and ACT instruments used in this study was presented.

The total number of students studied and the percent of the population divided into four ability groups and three anxiety groups were given.

A preliminary analysis of the properties of the criterion variable CGPA as to normality, variance and linear relationship to the two independent variables was revised. A graphical comparison to inspect the relationship of ACT to anxiety was also present.

Finally, the selection of the analysis of variance and multiple linear and curvilinear regression equations as the statistical functions used to test the hypotheses were discussed.

IV. ANALYSIS OF THE DATA

There were 1,228 freshmen women who entered the University of Northern Colorado the fall quarter of 1970. A total of 1,080 women, eighty-seven percent, met the population parameters defined in this investigation and were included in the study.

An analysis of variance model was used to analyze the data for null hypotheses I through V.

The tests of significance for hypotheses VI and VII were based upon the t-test for coefficients of correlation as defined by Croxton and Cowden (1955).

The three levels of anxiety were determined on an arbitrary basis by dividing the total sample of A-Trait scores into thirds defined as upper-third, middle-third, and lower-third anxiety groups. The four levels of academic ability were based on the distribution of ACT composite scores for students in this sample. The four groupings of high, above average, below average, and low levels of academic ability were approximately proportionate to ACT composite score distribution of the sample.

The ($p < .05$) was selected prior to this investigation as the minimum level of significance accepted for all seven null hypotheses.

Null hypothesis I stated that there are no differences among the three anxiety groups at any of the levels of tested academic ability. The common F test for analysis of variance in a treatment by levels design was employed to make the comparison (Lindquist, 1956). The F test was used to determine the presence of CGPA differences among the three anxiety groups. Academic ability differences were not

considered for this analysis. The results of the analysis were not significant and null hypothesis I was retained. The analysis of mean CGPA variance by anxiety groups in a treatment by levels design is shown in Table III.

TABLE III. Analysis of CGPA Variance for High, Moderate and Low Anxiety Groups

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Between Groups	2	0.656	0.328	0.98
Within Groups	1077	361.273	0.335	
Total	1079	361.930		
Low Anxiety:	N = 355	$\bar{X} = 2.78$	s = 0.589	
Moderate Anxiety:	N = 346	$\bar{X} = 2.80$	s = 0.571	
High Anxiety:	N = 379	$\bar{X} = 2.74$	s = 0.578	

F at .05 = 2.99

N number of subjects in the group
 \bar{X} mean
s standard deviation

Null hypothesis II stated that there are no differences in the academic achievement of high and low anxiety students who have above average academic ability. Drive theory assumes that high anxiety students of above average academic ability should earn higher CGPA marks than students of similar academic ability but lower anxiety drive. The CGPA variance for high and low anxiety students of equal academic ability did not differ significantly. Therefore, null hypothesis II was retained. The analysis of CGPA variance for high or low anxiety prone students with above average ACT scores is presented in Table IV.

TABLE IV. Analysis of CGPA Variance for High and Low Anxiety Students with Above Average Academic Ability

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Between Groups	1	0.003	0.003	0.01
Within Groups	245	71.770	0.293	
Total	246	71.773		
Low Anxiety:	N = 131	$\bar{X} = 2.89$	s = 0.545	
High Anxiety:	N = 116	$\bar{X} = 2.88$	s = 0.537	

F at .05 = 2.88

N number of subjects in the group
 \bar{X} mean
s standard deviation

Null hypothesis III stated that there are no differences in the academic achievement of high and low anxiety students who have below average academic ability. Drive theory assumes that high drive students who have below average academic ability should experience lower CGPA achievement than low drive students with the same academic ability. The results of the F test indicated a significant difference existed between the two anxiety groups. Investigation of the mean CGPA difference between the groups indicated higher achievement for the high anxiety group. These findings did not support the drive theory tenets defined in this investigation. As a result of the significant differences found, null hypothesis III was rejected. The F test of CGPA variance for students of below average ability and either high or low anxiety proneness is presented in Table V.

TABLE V. Analysis of CGPA Variance for High and Low Anxiety Students with Below Average Academic Ability.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Between Groups	1	1.165	1.165	4.86*
Within Groups	249	59.686	0.240	
Total	250	60.850		
Low Anxiety	N = 112	$\bar{X} = 2.55$	s = 0.503	
High Anxiety	N = 139	$\bar{X} = 2.68$	s = 0.478	
F at .05 = 3.88				
*p < .05				
N number of subjects in the group				
\bar{X} mean				
s standard deviation				

Null hypothesis IV stated that there are no differences in the academic achievement of high and low anxiety students who have average academic ability. For this test, the below average and above average academic ability groups were combined to form a general category defined as average. The results of the F test indicated no significant difference between students who have average academic ability and are members of either the high or low anxiety groups. Therefore, null hypothesis IV was retained. The F test of the CGPA variance for these students is presented in Table VI.

TABLE VI. Analysis of CGPA Variance for the Combined Groups of Above and Below Average Academic Ability who Differed in Respect to High or Low Anxiety Measures

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Between Groups	1	0.228	0.228	0.80
Within Groups	496	140.936	0.284	
Total	497	141.164		
Low Anxiety:	N = 243	$\bar{X} = 2.73$	s = 0.552	
High Anxiety:	N = 255	$\bar{X} = 2.77$	s = 0.514	
F at .05 = 3.85				
N number of subjects in the group \bar{X} mean s standard deviation				

Null hypothesis V stated that there are no differences in academic achievement between moderate anxiety students and the combined groups of high and low anxiety students. Prediction consistent with drive theory assumes that students with moderate anxiety should not realize significantly different grade point averages than do their counterparts with comparable academic ability and higher or lower anxiety proneness. No differences were found between the moderate anxiety group and the combined high and low anxiety group. The combined group of high and low anxiety students did not differ in CGPA achievement from the moderate anxiety group. Since no differences were found, null hypothesis V was retained. The F test of the CGPA variance for the moderate anxiety group combined to the high and low anxiety group is presented in Table VII.

TABLE VII. Analysis of CGPA Variance for the Combined High and Low Anxiety Groups Compared to the Moderate Anxiety Group

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Sum of Squares	F
Between Groups		0.434	0.434	1.29
Within Groups	1078	361.139	0.355	
Total	1079	361.563		
Low-High Anxiety:	N = 734	\bar{X} = 2.76	s = 0.583	
Moderate Anxiety:	N = 346	\bar{X} = 2.80	s = 0.571	
F at .05 = 3.85				
N number of subjects in the group				
\bar{X} mean				
s standard deviation				

Null hypothesis VI stated that there are no differences in the estimation of CGPA from ACT and anxiety scores in a second curvilinear equation and an estimation of CGPA from ACT and anxiety

scores in a linear equation. Drive theory suggests that the anxiety variable would have a curvilinear relationship to CGPA for the average ranges of academic ability. Therefore, a linear relationship of A-Trait anxiety to CGPA for all levels of academic ability would not be consistent with the tenets of drive theory. The statistical results suggest that the curvilinear equation is not significantly different from the linear equation in prediction efficiency ($t = .3822$, $p > .05$). The formula used in computing the correlation and in completing this statistical test is included in Appendix D. The results of the t-test indicated no significant difference between the linear coefficient of correlation and the coefficient of correlation based on the curve. Null hypothesis VI was retained.

Null hypothesis VII stated that there are no differences in estimating CGPA from ACT measures alone and an estimate based on both ACT and A-Trait anxiety scores. Visual inspection of computer runs with samples of the studied population indicated that the anxiety to CGPA relationship was not a linear one. The resulting prediction equation of CGPA was formulated with ACT in a linear and anxiety in a quadratic relationship to CGPA. The results of the t-test indicated no significant difference could be attributable to predicted CGPA based on ACT scores alone and CGPA based on ACT and the additional A-Trait anxiety scores ($t = 1.6685$, $p > .05$). Since no differences were found, null hypothesis VII was retained. The formula for the t-test is found in Appendix D.

Summary

The results of the analysis of data was incongruent with the tenets of drive theory presented in this study. The tests of significance found for the second and third null hypotheses were of particular interest. It was assumed from drive theory that students of above average academic ability and high anxiety would achieve a higher mean CGPA than students of the same academic ability and low anxiety. It was speculated that academic achievement would not be too difficult for this group. Therefore, the high anxiety group would benefit from strong drives associated with high anxiety. They would realize better CGPA achievement as a result. A test of the significance of CGPA differences for these two groups was defined by hypothesis II. The F test indicates no significant difference at the $\bar{\alpha}$.05 level.

The same drive theory suggests that below average academic ability students would find the task of academic achievement difficult. The high anxiety group would realize lower CGPA achievement than the low anxiety group in the below average ability level because the high anxiety group would realize more confusion and stress in attempting to cope with their excessive drive in a complex learning situation. Therefore, the low anxiety group of the same academic ability level would realize better academic achievement. Hypothesis III, the test of significant CGPA differences for high and low anxiety students of below average academic ability, did not support the differences implied by drive theory. The F test of hypothesis III was found to be significant. Hypothesis III was rejected. Inspection of the CGPA means for

the two groups indicated that the high drive students obtained a superior CGPA mean. Drive theory expectations would have predicted a superior mean CGPA for the low drive students. The significant CGPA difference found for low and high anxiety groups of below average academic ability did not complement the relationship anticipated by drive theory. A significant difference did exist for this below average ability group but it was not one consistent with drive theory.

No differences were apparent from a test of variance among anxiety groups for all the academic ability levels combined. Neither was a significant difference found in a comparison of high and low anxiety groups to the moderate anxiety group of students. Specific examination of the consistency of drive theory expectations was directed toward the two levels of average academic ability. It was in the average academic ability levels that differences in academic achievement consistent with drive theory expectations received additional investigation. None of the tests of differences in academic achievement between the high and low anxiety students of average academic ability supported drive theory expectations.

The investigation of the data tends to negate the expectations of academic achievement anticipated from drive theory for the 1,080 freshmen women comprising this study.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was concerned with determining the relationship of anxiety to CGPA marks for selected levels of academic ability. The anxiety variable in this study was defined as representative of either high, moderate or low drive traits. The groups were selected from a division of the STAI A-Trait anxiety inventory scores for the sample studied. The divisions represented equal thirds. The CGPA marks represented the cumulative grade point average for all freshmen women who completed at least nine hours per quarter for three consecutive terms at the University of Northern Colorado. All women in the study matriculated fall 1970. The subjects were all single, between the ages of 16 and 20, citizens of the United States, and high school graduates in the Spring term of 1970. Four levels of academic ability were selected from an approximate normal distribution of ACT scores obtained for the sample studied. Those students scoring beyond plus or minus one standard deviation were assigned to high and low levels of academic ability. Those scoring within plus or minus one standard deviation of the mean were classified respectively to above and below average ability levels. The distribution percentages were slightly adjusted at the extremes to provide for better balance.

The data were analyzed by the use of two automatic data processing programs written for this purpose. Analysis of variance tests of CGPA differences for selected anxiety and academic ability groups were made. Regression equations were computed, by a method of

least squares, and resulting numerical values of correlation coefficients were determined for these simple, multiple linear and multiple quadratic equations.

First, F ratios for the first five null hypotheses were computed. Next, three regression equations were developed for predicting CGPA from the independent variables, anxiety and ACT, to determine the unique contribution of each variable.

An overall F test of variance was made of CGPA differences for all of these three anxiety groups. The high and low anxiety groups were then tested for variances in academic achievement for the following three academic ability levels: above average, below average, and above and below levels combined. The last F ratio tested the variance in academic achievement for students of moderate anxiety compared to students classified in the high or low anxiety groups.

Three regression equations were developed for predicting CGPA achievement for the total population.

The first equation predicted CGPA as a linear function of ACT only. The second equation predicted CGPA as a linear function of ACT and A-Trait anxiety measures. The third equation predicted CGPA as a linear function of ACT and a quadratic function of A-Trait anxiety measures. The two null hypotheses that were formulated to study the varying relationship of ACT and A-Trait anxiety in predicting CGPA were both retained. Correlation coefficients were computed and t-tests were developed to compare the differences among the equations in predicting academic achievement for the total population.

The independent variables, A-Trait anxiety and ACT, were examined to determine if they would aid in explaining the variation of the criterion, CGPA. Analyses were made for the total population and for selected groups of the population.

Null hypothesis I was retained. It was considered the main hypothesis in the analysis of variance model. It stated that there are no differences among the anxiety groups as any of the levels of tested academic ability. Hypothesis III was the only null hypothesis rejected. It was written to study the differences in academic achievement for high and low anxiety student groups that were below average in academic ability. An inspection of the CGPA means for the two groups indicated that the high anxiety group earned higher CGPA marks.

The major finding was the drive theory as defined in this research failed to predict or interpret the academic achievement among average academic ability students. The high anxiety group of low ability students achieved significantly higher CGPA marks than the low anxiety group of low ability students. Drive theory as defined in this study allowed the hypothesis that the low anxiety students would receive higher marks. Academic achievement was assumed to be difficult for this low academic ability level. Therefore, a high drive predisposition would tend to interfere with learning the appropriate adaptive response necessary for achieving higher CGPA marks. Thus, drive theory would predict that the low drive students would realize significantly better academic achievement. The level of differences found between the high and low anxiety group of low ability indicates that the high anxiety group obtained significantly higher CGPA marks.

This result does not support the assumptions of drive theory. The retention of the other six null hypotheses of no difference for the total population and other selected levels suggests that the relationship of A-Trait anxiety to CGPA is a random one. The insignificant differences found for the other null hypotheses and the lack of support for drive theory assumptions indicates by the statistically significant differences found for null Hypothesis III suggests that caution should be used in interpreting the implied difference. The significant difference in CGPA variance between the high and low anxiety groups of low academic ability compared to the lack of difference found for the other six null Hypotheses also suggests the operation of extrinsic error factors. The validity of the STAI A-Trait inventory in measuring the concept anxiety as conceptualized by the tenants of drive theory is also open to question. Equally plausible is the consideration of the criteria variable, CGPA, as an inappropriate criterion.

Conclusions

The major conclusion of this study was that academic achievement for the 1,080 college women studied appeared to be randomly related to A-Trait anxiety scores. This randomness was expected for the extremes of academic ability. Students of average academic ability were expected to demonstrate a predictable relationship to CGPA achievement that could be implied from their A-Trait anxiety score and the assumptions of drive theory presented in Chapter II. Null Hypothesis III was rejected. The implication of this null hypothesis is that a difference exists in academic achievement for the

high and low anxiety groups common to below average academic ability. Inspection of the mean for each group indicates that the high anxiety group attained better academic achievement than the low anxiety group. The statistical analysis of the apparent difference associated with anxiety group membership is not supported by the statistical tests of the other levels of average academic ability. Neither is this difference predicted from the tenants of drive theory. Drive theory assumptions suggest higher achievement for the women with low anxiety means and below average academic ability. Although the A-Trait anxiety membership and CGPA achievement may be a significant one statistically for this ability level, a knowledge of drive theory introduced by Spence (1956), Taylor (1956), and Spielberger (1966) would suggest that the differences may be more due to extrinsic or random factors than to a relationship with A-Trait anxiety measures. The extrinsic factors may have been introduced by the experimental design selected for this investigation. There are other logical appeals to explaining the statistical significance found for one level of the population and not supported by similar findings at other critical levels. This realization suggests caution to interpreting the significance of this difference as attributable to a variance in CGPA associated with group membership determined by anxiety scores.

The study of CGPA prediction from the ACT variable alone and prediction based on the addition of the anxiety variable in both a linear and quadratic relationship implies that anxiety is not a significant contributor to predicting academic achievement. Results of the study

indicate a correlation of (.5056) exists between ACT and CGPA. Further data analysis of the inclusion of A-Trait anxiety as a linear and later as a quadratic predictor of CGPA with the ACT predictor only increases the correlation ratios to (.5074 and 0.5075) respectively. This improved correlation coefficient was tested to be non-significant. These findings corroborate the implications suggested from the analyses of variance model discussed above. The results tested by both statistical models indicate that knowledge of a subject's A-Trait anxiety score affords little predictive value of her academic achievement.

Recommendations

Based upon the data, the findings, and conclusions of this study the writer recommends the following:

1. The STAI A-Trait inventory should be given to all incoming students who scored in the 18-25 range of the ACT. Various patterns of CGPA achievement could then be investigated to determine if other factors could be identified which could be added to improve the prediction of academic achievement for college freshmen women.
2. A follow-up study should be made of those women in the sample who had high or low A-Trait anxiety scores and scored in the below average academic ability range on the ACT.

Task complexity should include other factors such as, number of quarter hours carried and department major. The inclusion of these factors with a student's academic ability (ACT) would afford a more precise definition of task difficulty.

3. Present procedure should be tried with other populations to determine if the present results generalize to other groups.
4. A follow-up study should be made for all University of Northern Colorado men who met the population specifications defined in this study for women. A study of the men would present additional information concerning the difference between men and women in their non-intellective characteristics to one variable, A-Trait anxiety.
5. A longitudinal study of trait anxiety encompassing college persistence through graduation would be of value.

In summary, the STAI A-Trait inventory did not appear to make a significant contribution to predicting or explaining the variance in academic achievement for a sample of the University of Northern Colorado women. The significant difference in academic achievement found for the low and high anxiety groups of below average academic ability should be considered with caution. The drive theory subscribed to for interpreting the data did not explain this significance nor did

additional statistical tests for other selected partitions of the sample collaborate the findings suggested for the below average level of academic ability. Further research of the STAI A-Trait anxiety inventory is needed to test the usefulness of this instrument in understanding the variance in academic achievement among college women.

BIBLIOGRAPHY

- Allen, G. J. 1970. Effect of three conditions of administration on trait and state measures of anxiety. *Journal of Consulting and Clinical Psychology* 34:355-359.
- American Psychological Association. 1954. Technical recommendations for psychological tests and diagnostic techniques. *Psychological Bulletin* 51:13-28.
- American College Testing Program. 1965. Technical Report. Iowa City. 40 p.
- American College Testing Program. 1971. Your college freshmen. Iowa City. 252 p.
- Atkinson, John W. 1964. An introduction to motivation. Princeton, D. Van Nostrand. 335 p.
- Berger, I. L. and A. R. Butker. 1965. The relationship of emotional adjustment and intellectual capacity to the academic achievement of college students. *Mental Hygiene* 40:65-77. January.
- Berthold, Fred. 1963. Anxious longing. In: *Constructive aspects of anxiety*, ed. by Seward Hiltner and Karl Menninger, New York, Abingdon Press. 173 p.
- Boor, Myron. 1972. Relationship of test anxiety and academic performance when controlled for intelligence. *Journal of Clinical Psychology* 28:171-173.
- Blommers, Paul and E. F. Lindquist. 1960. *Elementary statistical methods in psychology and education*. Cambridge, Houghton Mifflin. 538 p.
- Cattell, R. B. and I. H. Scheier. 1958. The nature of anxiety: a review of thirteen multivariate analyses comprising 814 variables. *Psychological Reports* 4:351-388.
- Cattell, R. B. and I. H. Scheier. 1961. *The meaning and measurement of neuroticism and anxiety*. New York, The Ronald Press. 535 p.
- Cattell, R. B. and T. E. Dielman. 1972. Prediction of school achievement from motivation, personality and ability measures. *Psychological Reports* 30:35-43.
- Child, I. L. 1954. Personality. *Annual Review of Psychology* 5:149-170.

- Coleman, James C. 1960. Personality dynamics and effective behavior. Chicago, Scott Foresman. 566 p.
- Croxton, Frederick E., and Dudley J. Crowden. 1955. Applied General Statistics. 2nd ed. Englewood Cliffs, Prentice-Hall. 843 p.
- Denny, J. P. 1963. The effects of anxiety and intelligence on concept formation. Doctoral dissertation, Duke University. (Abstracted in Dissertation Abstracts 24:2132-2133. 1963).
- Dickson, Carter. 1956. Fear is the same. New York, William Marrow. (Cited in: Levitt, Eugene. 1967. The Psychology of Anxiety. Indianapolis, Bobbs-Merrill. 223 p.
- Dollard, J. and Neal E. Miller. 1950. Personality and Psychotherapy. New York, McGraw-Hill.
- Draper, N. and H. Smith. 1966. Applied regression analysis. New York, Wiley. 407 p.
- Edwards, Allen L., et al. 1970. Anxiety, structure, or social desirability. Journal of Consulting and Clinical Psychology 34:236.
- Ebel, Robert L. 1961. Must all tests be valid. American Psychologist 10: 640-647.
- Farber, I. E. 1954. Anxiety as a drive state. Nebraska Symposium on motivation. Nebraska University Press.
- Ferguson, George A. 1966. Statistical analysis in psychology and education. New York, McGraw-Hill. 446 p.
- Garrett, Henry E. 1957. Great experiments in psychology. New York, Appleton-Century-Crafts. 358 p.
- Hall, Calvin S. 1954. A primer of freudian psychology. New York, New American Library of World Literature. 122 p.
- Harris, D. 1940. Factors affecting college grades: a review of the literature, 1930-1937. Psychological Bulletin 37:125-166.
- Hodges, William F. and James P. Felling. 1970. Types of stressful situations and their relation to trait anxiety and sex. Journal of Consulting and Clinical Psychology 34:333-337.
- Horney, Karen. 1937. The neurotic personality of our time. New York, W. W. Norton. 250 p.

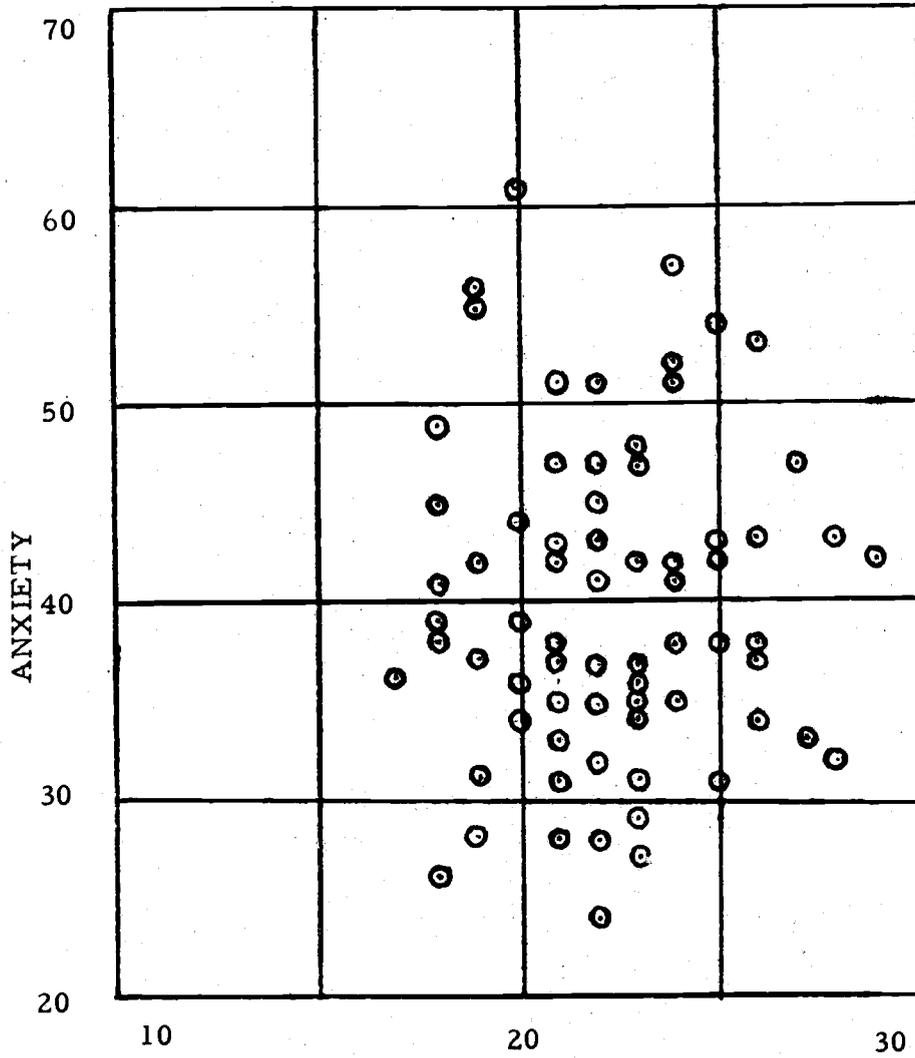
- Houtras, P. T., W. E. Grady and C. W. Vraa. 1970. Manifest anxiety and academic achievement of American and Canadian college freshmen. *The Journal of Psychology* 76:3-8.
- Hull, Clark. 1943. *Principles of behavior*. New York, Appleton Century. 422 p.
- Kahn, S. B. 1970. Dimensions of manifest anxiety and their relationship to college achievement. *Journal of Consulting and Clinical Psychology* 35:223-228.
- Kestenbaum, Joel M. and Bernard Weiner. 1970. Achievement performance related to achievement motivation and test anxiety. *Journal of Consulting and Clinical Psychology* 34:343-344.
- Kirk, B. A. 1966. The challenges ahead in counseling and testing. *College Student Personnel Work in the Years Ahead*. Washington, D. C., The American College Personnel Association 22-29.
- Klugh, H. E. and A. W. Bendig. 1955. The manifest anxiety and ACE scales and college achievement. *Journal of Consulting and Clinical Psychology* 19:487.
- Levitt, Eugene. 1967. *The psychology of anxiety*. Indianapolis, Bobbs-Merrill. 223 p.
- Lindquist, E. F. 1956. *Design and analysis of experiments in psychology and education*. Boston, Houghton Mifflin, 393 p.
- Mandler, G. and S. B. Sarason. 1952. A study of anxiety and learning. *Journal of Abnormal and Social Psychology* 47:166-173.
- McDougall, William. 1926. *Outline of Abnormal Psychology*. New York, Charles Scribner's Sons. 572 p.
- Menninger, Kark A. 1946. *The human mind*. New York, Alfred A. Knopf. 517 p.
- Nelson, David. 1971. Trait anxiety as an individual factor in prediction and as it correlates with other variables in predicting academic achievement. Doctoral dissertation. Greeley, University of Northern Colorado. 81 numbered leaves.
- Prince, Marton. 1929. *Clinical and experimental studies in personality*. Cambridge, Sci-Art. 559 p.
- Sarason, S. B., K. Hill, and P. A. Zimbardo. 1964. A longitudinal study of the relation of test anxiety to performance on intelligence and achievement tests. *Monographs of the Society for Research in Child Development* 29:7-98.

- Sax, Gilbert. 1968. Empirical foundations of educational research. Englewood Cliffs, Prentice-Hall. 443 p.
- Sharma, Sager. 1970. Manifest anxiety and school achievement of adolescents. *Journal of Consulting and Clinical Psychology* 34:403-407.
- Shulz, R. E. and A. D. Calvin. 1955. A failure to replicate the findings of a negative correlation between manifest anxiety and ACE scores. *Journal of Consulting and Clinical Psychology* 19:223-224.
- Spence, K. W. 1956. Behavior theory and conditioning. New Haven, Yale University Press. 262 p.
- Spence, J. T. and Kenneth W. Spence. 1966. The motivational components of manifest anxiety: drive and drive stimuli. In: *Anxiety and behavior*, ed. by Charles D. Spielberger, New York Academic Press. 291-326.
- Spielberger, C. D. 1958. On the relationship between manifest anxiety and intelligence. *Journal of Consulting and Clinical Psychology* 22:220-224.
- Spielberger, C. D. (ed.). 1966. *Anxiety and behavior*. New York, Academic Press. 414 p.
- Spielberger, C. D. (ed.). 1972. *Anxiety: current trends in theory and research*. Vol. 1. New York, Academic Press. 237 p.
- Spielberger, C. D., R. L. Gorsuch and R. E. Lushene. 1970. *STAI manual for the state-trait anxiety inventory*. Palo Alto, Consulting Psychologist Press. 24 p.
- Spielberger, C. D. and W. G. Katzenmeyer. 1959. Manifest anxiety, intelligence and college grades. *Journal of Consulting and Clinical Psychology* 13:278-281.
- Spielberger, Charles D. and Henry Weitz. 1964. Improving the academic performance of anxious college freshmen: a group-counseling approach to the prevention of underachievement. *Psychological monographs: General and applied* 590:1-20.
- Spielberger, C. D., Henry Weitz and J. Peter Denny. 1962. Group counseling and the academic performance of anxious college freshmen. *Journal of Counseling and Clinical Psychology* 9:195-204.
- Szulc, Stefan. 1965. *Statistical methods*. Oxford, Pergamon Press. 666 p.

- Taylor, Janet A. 1953. A personality scale of manifest anxiety. *Journal of Abnormal and Social Psychology* 48:285-290. April.
- Teevan, Richard C. and Robert C. Birney. 1964. *Theories of motivation in learning*. New Jersey, D. Van Nostrand 215 p.
- Toffler, Alvin. 1970. *Future Shock*. New York, Random House. 561 p.
- Tollefson, A. 1956. A study of a three-variable coding system as a method for predicting academic achievement. Doctoral dissertation. Minneapolis, University of Minnesota. 104 numbered leaves.
- Warburton, F. W. 1962. The measurement of personality-III. *Educational Research* 4:193-206.
- Weitz, H. and R. M. Colver. 1959. The relationship between the educational goals and the academic performance of women, a confirmation. *Educational Psychological Measurement* 19: 373-380.
- Wine, Jeri. 1971. Test anxiety and direction of attention. *Psychological Bulletin* 76:92-105.

APPENDIX A

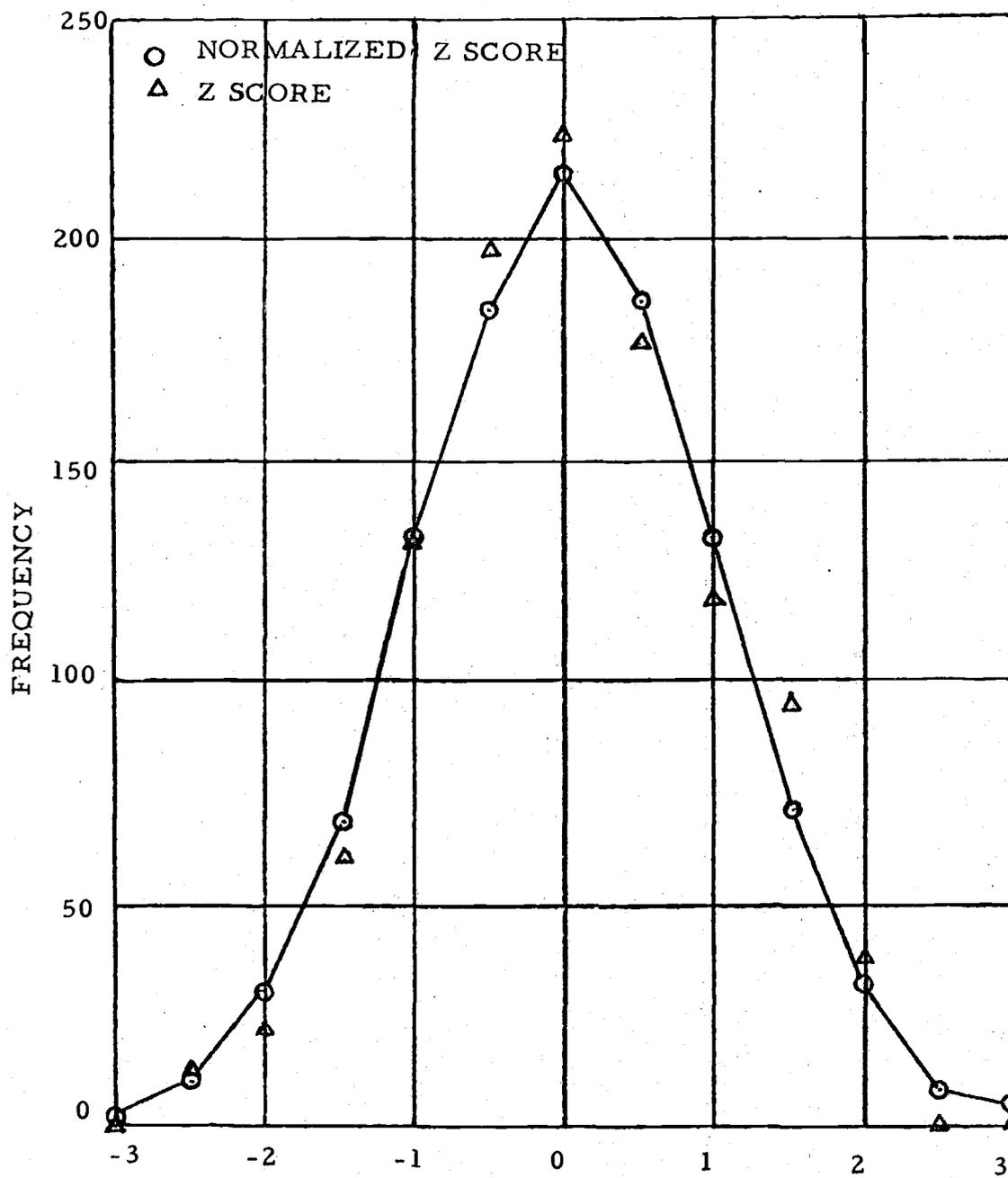
SCATTERGRAM OF STAI A-TRAIT ANXIETY AND
ACT SCORES FOR A RANDOM SAMPLE OF 100 WOMEN



A. C. T. COMPOSITE SCORE

APPENDIX B

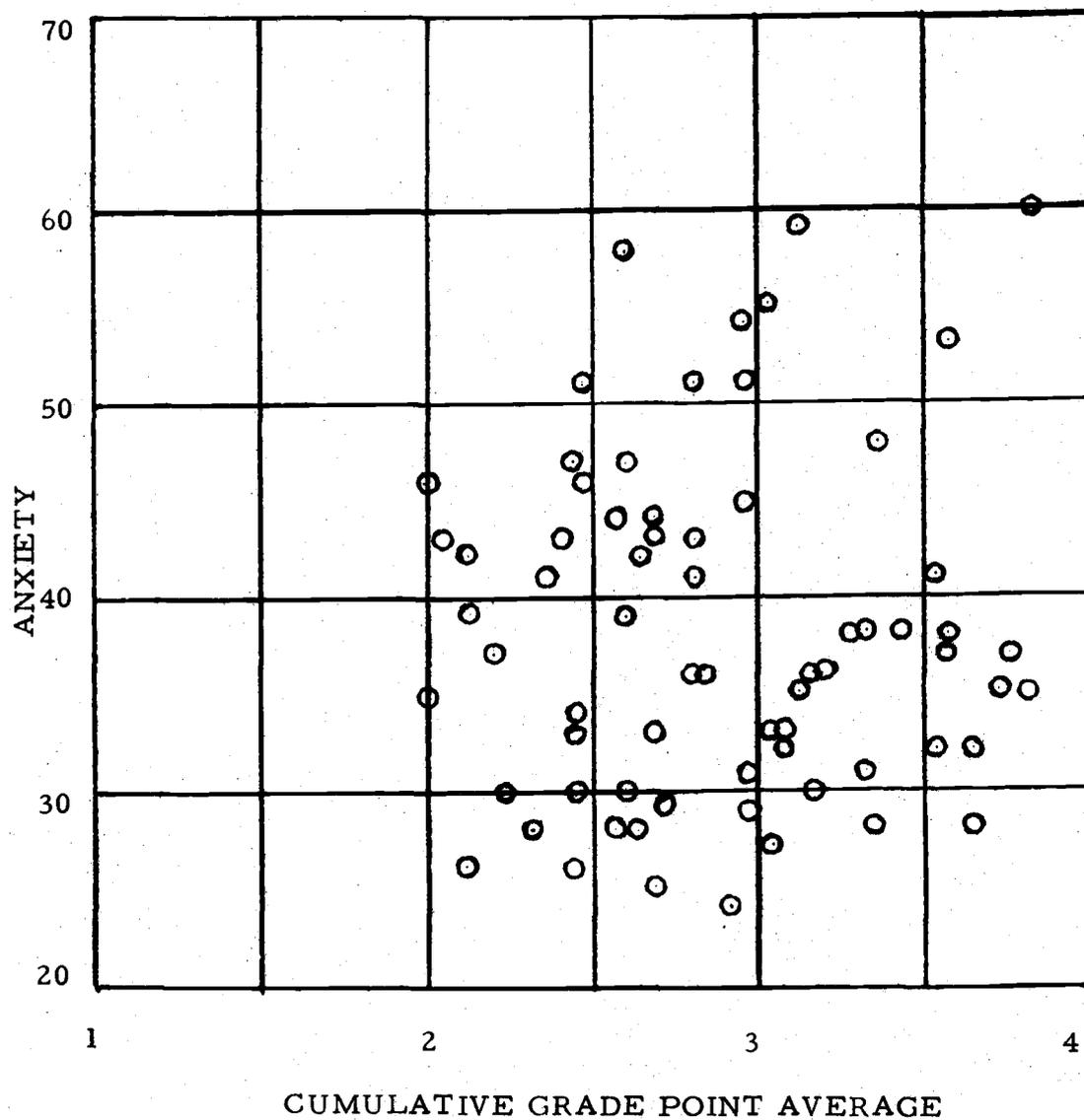
**A COMPARATIVE FREQUENCY DISTRIBUTION OF CGPA MARKS
FOR 1080 WOMEN THAT ARE TRANSFORMED TO Z-SCORE
INTERVALS AND PLOTTED AGAINST A NORMALIZED
DISTRIBUTION OF GROUPED Z-SCORES**



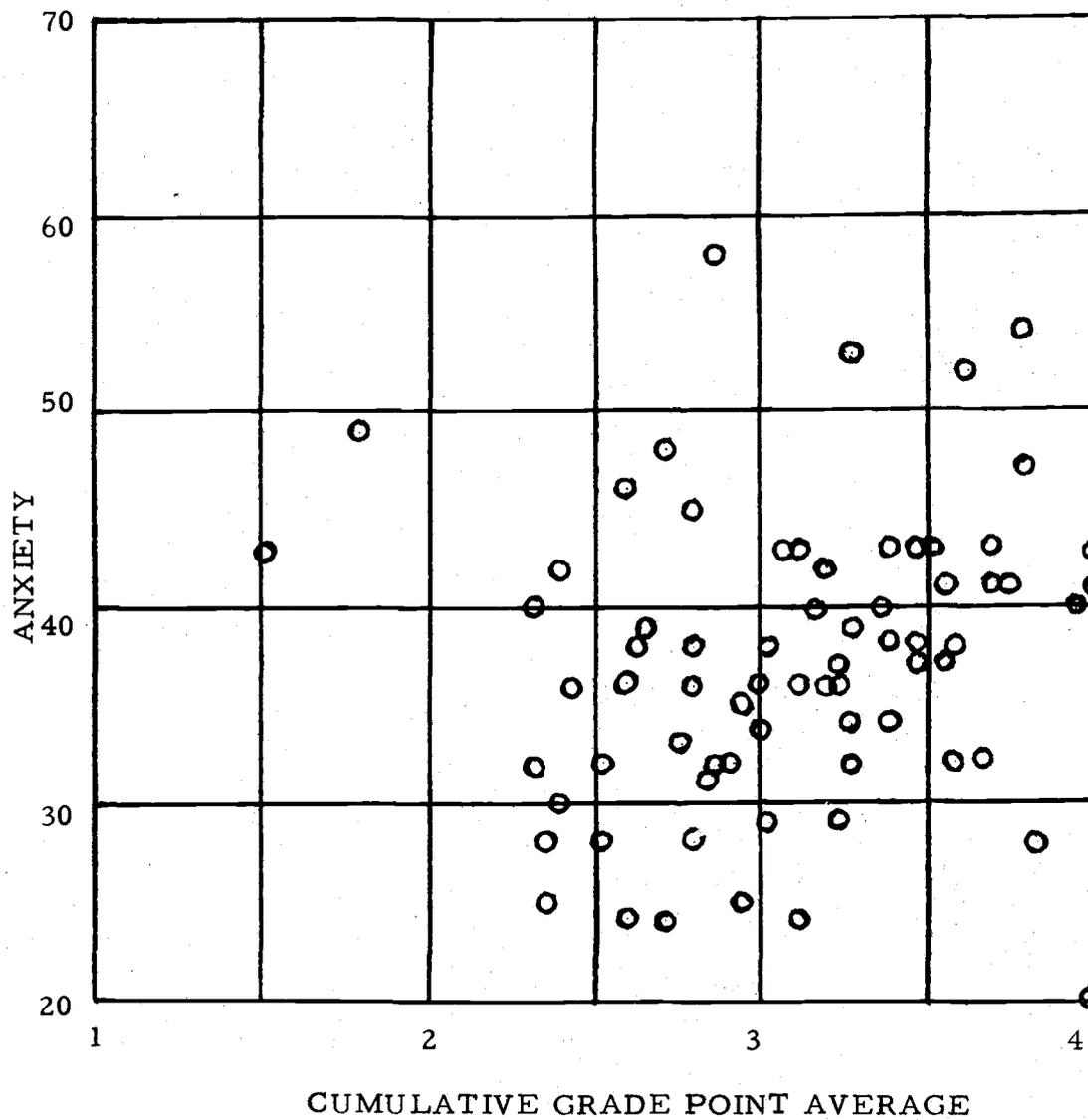
CUMULATIVE GRADE POINT AVERAGE (Z-SCORE)

APPENDIX C

FOUR SCATTERGRAMS OF CGPA MARKS AND ANXIETY
SCORE DISTRIBUTIONS FROM A RANDOM SAMPLE OF
100 WOMEN WHOSE ACT SCORES ARE COMMON TO A
GIVEN ACADEMIC ABILITY LEVEL



Scattergram of STAI A-Trait anxiety scores and CGPA marks for a sample of 100 women with above average academic ability.



Scattergram of STAI A-Trait anxiety scores and CGPA marks for a sample of 100 women with high academic ability

APPENDIX D

COMPUTED REGRESSION EQUATIONS AND
FORMULAS FOR CORRELATION COEFFICIENTS
AND SUBSEQUENT t-TESTS

COMPUTED REGRESSION EQUATIONS AND
FORMULAS FOR CORRELATION COEFFICIENTS
AND SUBSEQUENT t-TESTS

The notation used herein is given at the end of this appendix.

The population data were used in an automatic data processing program to compute, by a method of least squares, regression equations of three types. The same program gave numerical values of the applicable correlation coefficients are noted below.

For CGPA as a linear function of ACT only:

$$Y = 1.26 + 0.0718 X_1$$

$$r_{YX_1} = 0.5056$$

For CGPA as a linear function of ACT and
Anxiety A-Trait measures:

$$Y = 1.13 + 0.0726 X_1 + 0.00290 X_2$$

$$r_{Y.X_1X_2} = 0.5074$$

For CGPA as a linear function of ACT and a quadratic
function of Anxiety A-Trait measures:

$$Y = 1.638 + 0.0501 X_1 + 0.0215 X_2$$

$$+ 0.00107 X_1 X_2^2 + 0.000279 X_2^2$$

$$+ 0.0000123 X_1 X_2^2.$$

$$r_{Y.X_1X_2X_2^2} = 0.5075$$

The formulas used to compute coefficients of correlation and determination, and for the subsequent t-tests ratios are presented below. All are adapted from similar relations given in Croxton and

Cowden (1955).

Coefficients of correlation of CGPA with ACT:

$$r_{YX_1} = \sqrt{\frac{\sum(Y_{X_1} - \bar{Y})^2}{\sum(Y - \bar{Y})^2}}$$

Coefficient of multiple correlation of CGPA with ACT and

Anxiety:

$$r_{Y.X_1X_2} = \sqrt{\frac{\sum(Y_{X_1X_2} - \bar{Y})^2}{\sum(Y - \bar{Y})^2}}$$

Coefficient of multiple correlation of CGPA with ACT a linear variable and Anxiety a quadratic variable:

$$r_{Y.X_1X_2X_2^2} = \sqrt{\frac{\sum(Y_{X_1X_2X_2^2} - \bar{Y})^2}{\sum(Y - \bar{Y})^2}}$$

Coefficient of partial determination giving the proportion that the added variation explained by the use of X_2 constitutes, of the variation unexplained by X_1 alone:

$$r^2_{YX_2.X_1} = \sqrt{\frac{\sum r^2_{Y.X_1X_2X_2^2} - r^2_{YX_1}}{\sum 1 - r^2_{YX_1}}}$$

Numerically:

$$r^2_{YX_2.X_1} = \sqrt{\frac{\sum(0.5075)^2 - (0.5056)^2}{\sum 1 - (0.5056)^2}}$$

$$= 0.002586 .$$

Coefficient of partial determination giving the proportion that the added variation explained by the inclusion of X^2 as a quadratic variable constitutes, of the variation unexplained with X_1 and X_2 as

linear variables:

$$r^2_{YX_2^2 \cdot X_1 X_2} = \frac{r^2_{Y \cdot X_1 X_2 X_2^2} - r^2_{Y \cdot X_1 X_2}}{1 - r^2_{Y \cdot X_1 X_2}}$$

Again numerically:

$$\begin{aligned} r^2_{YX_2^2 \cdot X_1 X_2} &= \frac{(0.5075)^2 - (0.5074)^2}{1 - (0.5074)^2} \\ &= 0.000136 \end{aligned}$$

The significance of the additional variation explained using X_2 over the variation explained by X_1 alone was tested by a t-test where

$$t = \sqrt{\frac{r^2_{YX_2 \cdot X_1} (N - n)}{1 - r^2_{YX_2 \cdot X_1}}}$$

Numerically:

$$\begin{aligned} t &= \sqrt{\frac{(0.00258) (1080 - 3)}{0.99742}} \\ &= 1.67 \end{aligned}$$

Similarly the additional variation explained using X_2 as a quadratic variable over that using X_2 linearly was tested by computing t from:

$$t = \sqrt{\frac{r^2_{YX_2^2 \cdot X_1 X_2} (N - n)}{1 - r^2_{YX_2^2 \cdot X_1 X_2}}}$$

And numerically:

$$t = \sqrt{\frac{0.000136 (1080 - 6)}{0.999864}}$$

$$t = 0.382$$

Y	cumulative grade point average.
X ₁	ACT Composite Score.
X ₂	anxiety STAI A-Trait measure.
r _{YX₁}	coefficient of correlation of Y and X ₁ .
r _{Y.X₁X₂}	coefficient of multiple correlation of Y with X ₁ and X ₂ ; X ₁ and X ₂ as linear variables.
r _{Y.X₁X₂X₂²}	coefficient of multiple correlation for Y with X ₁ and X ₂ ; X ₁ as a linear variable, X ₂ a quadratic variable.
r ² _{YX₂.X₁}	coefficient of partial determination giving the added variation explained by using X ₂ , expressed as a proportion of the variation unexplained by X ₁ .
r ² _{YX₂².X₁X₂}	coefficient of partial determination giving the added variation explained by using X ₂ as a quadratic variable, expressed as a proportion of the variation unexplained when using X ₁ and X ₂ linearly.
t	statistic used for testing significance of difference between two coefficients of correlation.

N number of items in the sample.

n number of degrees of freedom attributable to the applicable regression equation.