COMPARISON OF TEACHER AND STANDARDIZED TEST CLASSIFICATION OF STUDENTS AS UNDER- AND OVER-ACHIEVERS

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This is to certify that the

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COMPARISON OF TEACHER AND STANDARDIZED TEST CLASSIFICATION OF STUDENTS AS UNDER- AND OVER-ACHIEVERS

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ABSTRACT

COMPARISON OF TEACHER AND STANDARDIZED TEST CLASSIFICATION OF STUDENTS AS UNDER- AND OVER-ACHIEVERS

by Ronald Andrew Esposito

This study was concerned with two problems. The first was with differences in student academic motivation, between those who were classified as under- and over-achievers by teacher ratings as opposed to achievement test scores. The secondary problem was concerned with determining differences in academic motivation of students classified as under- or over-achievers in one, and only one, of four course areas (English, social science, mathematics, and science).

For both problems the same sample of 600 tenth grade students was used. Three groups of under- and over-achievers were identified, one by GPA, one by standardized achievement tests, and one by both estimates for each of the four subject matter areas. The Farquhar-Payne Technique[1] was used for selection of the under- and over-achiever. Their technique entails the selections of subjects falling one standard error of estimate either

[1]W. W. Farquhar and D. Payne, "A Classification and Comparison of Techniques Used in Selecting Under- and Over-Achievers," Personnel and Guidance Journal, May, 1964, pp. 874-884.

side of the regression line as over-achievers (one standard error above) or under-achievers (one standard error below). Within this study DAT-VR (Differential Aptitude Test-Verbal Reasoning) was used to estimate GPA (Teacher Grades) and the ITED (Iowa Test of Educational Development) scores were used to estimate achievement from a standardized test.

The first analysis tested separately by sex and the four subject matter areas, the significance of M-Scale factor means (seven M-Scale factors plus total score) among under- and over-achievers selected by either GPA achievement test scores or both estimates. One-way analysis of variance was used to test for significance.

The results of the first analysis indicated only nine of the 128 analyses were significant at the .05 level. Four of the nine significant analyses were in the Science area, three were in Mathematics, and two in English. Any generalizations based upon the nine significant analyses must be tempered with caution because the nine may be due to change.

The second analysis in the study was concerned with tests of significance among the variables of over- and under-achievement, subject matter (four areas), and the seven M-Scale factors plus the total M-Scale score. A two-way analysis of variance with "F" test was employed for the 4 x 2 design.

No significant difference was found among the means of the seven M-Scale factors and total score across the

four subject matter areas. Significance was found, at the .05 level, between over- and under-achieving males for M-Scale factors I (Academician), II (Job Involvement), III (Agitation), V (Disinterested), VI (Succumbing to versus Defying School Norms), VII (Unique versus Common Accomplishment) and Total M-Scale scores. Significance was also found between female over- and under-achievers, at the .05 level, for M-Scale factors I (Academician), V (Educational Commitment), VII (Common versus Unique Accomplishment), and Total M-Scale scores.

No significant difference was found among the means for any interaction among the eight cells of the two-way analysis of variance design.

COMPARISON OF TEACHER AND STANDARDIZED TEST CLASSIFICATION OF STUDENTS AS UNDER- AND OVER-ACHIEVERS

By

Ronald Andrew Esposito

A THESIS

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To Andy and Laurie

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CHAPTER I

INTRODUCTION

Concern for academic achievement reaches higher levels of intensity each year. The increasing costs of education, plus the needs of an advanced technological society for highly trained and specialized personnel, place pressure on schools to identify, train, and produce educated people efficiently. Academic motivation is a pivotal factor in increased quality of academic achievement.

Need

Previous studies using general (total) scholastic achievement have focused upon identification of under-achievers. Few studies have focused upon under-achievement in various specific areas of course work. With the present emphasis upon earlier selection of vocational goals, the need to identify motivational characteristics in academic areas is important. The need exists for highly specialized knowledge about low motivation, discrepant achievement, and standardized test achievement. All may have parts in common; but empirical evidence about the interrelationships is scant. In addition, knowledge about the differences in achievement motivation among the four subject matter areas could have implications for curriculum development. If differential

motivational factors are found across subject areas individual selection and scheduling for specific high school classes could become more realistic. Instructional methods in these subjects could also be changed to be more appropriate for the motivational patterns of the selected students.

Purpose of the Study

The purpose of the study was to examine what differences existed among students who were classified as under- or over-achievers on the basis of teacher grades as opposed to standardized achievement test results. The problem was examined specifically by using grade point average and achievement scores in each of four major course areas, i.e., language arts, mathematics, social science, and science. Furthermore, relationships among motivation (as measured by the M-Scale) and the four areas of teacher and standardized achievement estimates of performance were determined.

Statement of Problem

Most studies predicting academic achievement use grade point average as an achievement criterion. Its use is defensible because it is one of the better predictors of future academic grades. However, limitations, especially due to the contamination of teacher bias, are well established. Little work has been done to evaluate the differences, specifically those of academic motivation, between teacher ratings and achievement test scores used as measures of academic achievement.

At the same time, the use of grade point average as a measure of academic achievement has typically involved the total combined grade point average of all academic courses taken by the student. Studying the academic achievement of students in specific areas, as it relates to specific motivational patterns, has not been attempted to date.

The above points are the focus of attention of this study.

Hypotheses

The rationale for the development of hypotheses is found most readily in studies of vocational choice. Roe's[1] study of scientists suggest that differential motivational patterns are associated with differential professional achievement. Motivational constructs have been extensively used by clinical and school psychologists to explain underachievement as well as differential achievement. It should follow that different motivational patterns exist among those students who are successful in certain selected academic areas.

Thus the question generated by the above assumption becomes: Is differential achievement in separate academic areas a function of differential motivational factors? Stated in broad research form: differential achievement in

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[1] A. Roe, The Psychology of Occupations, John Wiley & Sons, Inc., New York, 1956, p. 321.

separate academic areas is a function of differential motivational factors.

Organization of the Study

The general plan of the study is to present in the second chapter a review of the literature indicating relationships between selected achievement and motivation. The third chapter is an account of the sample selection, nature of the data, and the design and techniques employed to analyze the data. The results of the data are reported in the fourth chapter. The summary, conclusions and implications for further study appear in the fifth (final) chapter.

CHAPTER II

REVIEW OF THE LITERATURE

Studies relating to the areas of achievement motivation and differential achievement were reviewed. Since literature in achievement motivation was broad, only brief reviews were attempted. Little has been done in the study of differential achievement; thus the few studies were reviewed in greater depth.

Achievement Motivation

In most texts in Educational Psychology and in Learning much attention is given to the concept of motivation and its relationship to learning outcomes (Lindgren 1962[1], McDonald 1965[2], McClellan 1953[3]). Two recent texts (Cofer and Appley[4] 1967, Atkinson and Feather[5] 1967) are

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[1]H. C. Lindgren, Educational Psychology in the Classroom, John Wiley & Sons, Inc., New York, 1962.

[2]F. .J. McDonald, Educational Psychology, Wadsworth Publishing Company, Inc., Belmont, California, 1965.

[3]D. C. McClellan, J. W. Atkinson, R. A. Clark, and E. L. Lowell, The Achievement Motive, Appleton-Century-Crofts, New York, 1953.

[4]C. N. Cofer and M. H. Appley, Motivation: Theory and Research, John Wiley and Sons, Inc., New York, 1966.

[5]J. W. Atkinson, N. T. Feather, A Theory of Achievement Motivation, John Wiley & Sons, Inc., New York, 1966.

devoted completely to discussing both theory and research of motivation. Special projects that are devoted to problems of motivation include the Nebraska Symposium on Motivation[6] and Federal Grant Projects such as Farquhar's study under Grant number 846.[7]

In a review of the literature prior to 1933 Stagner (1933)[8] indicated:

1. Grades are the best measure of achievement.
2. Correlation between achievement (grades) and intelligence (IQ tests) is about .50.
3. Relationship between achievement and personality traits are inconsistent, negligible, or spuriously high.

Reviewing the literature for the 15-year period between 1933 and 1949 Donahue, Coombs, and Travers[9] in "Student Adjustment and Achievement" reported near zero correlations

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[6]Mr. Jones (Ed.), Nebraska Symposium on Motivation, Lincoln: University of Nebraska Press, 1949.

[7]W. Farquhar, "Motivational Factors Related to Academic Achievement," U.S. Office of H. E. W., Coop. Research Project #846 ER9 Office of Research & Publications, College of Education, Michigan State University, E. Lansing, Michigan, 1963.

[8]R. Stagner, "The Relation of Personality to Academic Aptitude and Achievement," J. of Educational Research, 1933, 26, 648-660.

[9]W. T. Donahue, C. H. Coombs, and R. W. Travers, The Measurement of Student Adjustment and Achievement, Ann Arbor: University of Michigan Press, 1949.

between scholarship and every conceivable variety of adjustment inventory. Ronald G. Taylor,[10] in an extensive review of the literature from 1933-1963, looked at the relationship of discrepant achievement to the following personality traits: (a) academic anxiety, (b) self values, (c) authority relations, (d) interpersonal relations, (e) independence-dependence conflict, (f) activity patterns and (g) goal orientation.

The weight of the evidence in the literature supports the following:

. . . 1. The degree to which a student is able to handle his anxiety is directly related to his level of adjustment.
2. The value the student places upon his worth affects his academic achievement.
3. The ability to conform to and/or accept authority demands will determine the amount of academic success.
4. Students who are accepted and have positive relationships with peers are better able to accept themselves. Students who do not have peer acceptance generally go outside the school environment for their satisfactions.
5. The less conflict over independence-dependence relationships a student copes with, the more effort he places on achievement.
6. Activities which are centered around academic interests are more likely to produce successful achievement.
7. The more realistic the goal the more chance there is of successful completion of that goal.[11]

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[10] R. G. Taylor, "Personality Traits and Discrepant Achievement: A Review," Journal of Counseling Psychology, Vol. XI, No. 1, 1964, pp. 76-82.

[11] Ibid., p. 81.

McClelland et al.[12] and Atkinson[13] both found the achievement (Ach) motives to be of negligible relationship. In addition, Atkinson indicated feelings that other motives interacted, thus contaminating the simple relationship. McKeachie[14] reported in the Nebraska Symposium on Motivation: "Individual differences in motivation are responsible for the remaining variance in college grades . . . We still have no measure of motivation which has proven useful . . " (p. 111)

Farquhar et al.,[15] in his research on Academic Motivation attempted to rectify this state of affairs by developing an objective theory based on a reliable motivational instrument. Theory was developed at two levels (focusing and predictive). Level One Theory (focusing) was used in attempting to relate personality structure to academic motivation. At Level Two Theory (predictive) McClelland's n-Ach three factors were bi-polarized and extended to predict extremes in academic motivation. The three bi-polarized factors were need for (a) long-term vs. short term involvement; (b) unique vs. common accomplishment; and (c) competing with a miximal vs a minimal standard of excellence.

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[12]McClelland, op. cit.

[13]J. W. Atkinson (Ed.), "Motives in Fantasy," Action and Society, Van Nostrand, Princeton, 1958.

[14]McKeachie, op. cit., 1961.

[15]Farquhar, op. cit., 1963.

The instrument that was developed (the M-Scales) consisted of 139 male and 136 female items. The reliability estimates ranged from .60 to .93 for the various scales. The total scale reliability estimate was .94 for males and .93 for females. The grade-point average criterion reliability estimates were .75 for males and .80 for females.

Results indicated the three factors bi-polar theory was too simple to explain academic motivation. Further study concluded with seven motivational factors for males and seven motivational factors for females. These factors and their descriptions are found in Chapter III.

Measurement Difficulties

Much of the variation between intelligence and achievement must be attributed to the measures themselves--the familiar problem of the reliability and validity of intelligence tests, grades and achievement tests.

Added to these difficulties are the low correlations found between achievement test scores and teacher ratings of achievement. Carter[16] studied this problem in six high school algebra classes (3 male and 3 female teachers). Holding I.Q. constant, he found the men teachers giving significantly lower grades than the female teachers. Female

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[16]R. S. Carter, "How Invalid are marks assigned by Teachers?" Journal of Educational Psychology, 43, 1952, pp. 218-228.

students' marks were also found to be higher than male students' marks. Female student marks and marks given by female teachers had relatively little correlation with achievement (as measured by an achievement test). Tiegs[17] has also indicated the unreliability of teacher grading.

The disagreement in the selection of under- and over-achievers also contributes to measurement difficulties. In a comparison of techniques of selection, Farquhar and Payne[18] found numerous instances of significant lack of classification agreement. One conclusion stated . . . "With the exception of the DuBois and Farquhar and Payne techniques, there appears to be little or no agreement among techniques in which an individual is designated as a discrepant achiever."[19]

Differential Achievement

Another difficulty in the prediction of overall achievement at the high school level might be the lower significance of the general achievement factor. Although

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[17] E. W. Tiegs, "Educational Diagnosis," Monterey, California: California Test Bureau, 1952, Educational Bulletin No. 18.

[18] W. W. Farquhar and D. A. Payne, "A Classification and Comparison of Techniques Used in Selecting Under- and Over-Achievers," Personnel and Guidance Journal, May 1964, pp. 874-884.

[19] Ibid., p. 883.

factor analysis research of the past thirty years has revealed a general factor (g) underlying a great deal of performance on ability tests, it has also revealed a large number of specialized abilities and skills which have relatively low correlations with each other.

The relationship between a general index of intelligence and overall performance on a battery of achievement tests approaches unity at the elementary school level[20] and drops to about .50 at the college level.[21]

The above would suggest we cannot view high school or college students, as we might elementary students, as having general transferable abilities. Guilford[22] has presented a logical analysis of mental abilities along three dimension:

1. operations (cognition, memory, divergent thinking, convergent thinking, and evaluation)
2. products (units, classes, relations, systems, transformations, and implications)
3. contents (figural, symbolic, semantic, and behavioral)

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[20]W. Coleman and E. E. Cureton, "Intelligence and Achievement, The Jangle Fallacy Again." Education Psychology Measurement, 1954, 14, pp. 347-351.

[21]A. B. Crawford and P. S. Burnham, Forecasting College Achievement, New Haven, Conn.: Yale University Press, 1946.

[22]J. P. Guilford, "Three Faces of Intellect," American Psychologists, 1959, 14, pp. 469-479.

Bloom[23] in an unpublished study speculated that "any study in which half a dozen or more specialized aptitude tests (which have low correlations with each other) are used, one-half or more of the students are likely to be in the upper tenth on one or more of the tests." It would appear that the teacher's recognition of the above diversity of each child could be important in subsequent student-teacher interactions.

Carroll[24] (1962) reviewed past studies of prediction of success in language courses and concluded ". . . facility in learning to speak and understand a foreign language is a fairly specialized talent (or a group of talents), relatively independent of those traits ordinarily included under intelligence . . ." (p. 89)

The above references point strongly enough to the presence of differences in aptitude and ability within any individual. Although many studies have focused on differences in interest patterns within individuals and groups, few studies have focused upon differential achievement and motivation, especially across subject matter areas. The following studies relate most closely with this focus.

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[23]B. S. Bloom, "Testing Cognitive Ability and Achievement," Handbook of Research on Teaching, Ed. N. L. Gage, Rand McNally & Co., Chicago, 1963, p. 384.

[24]J. B. Carroll, "The Prediction of Success in Intensive Language Training;" R. Glaser (ed.), Training Research and Education, Pittsburgh: University of Pittsburgh Press, 1962, pp. 87-136.

In a study designed to determine the nature of the relationship between interests and differential academic achievement, Johnson[25] found that differential interests correlated with differences in achievement more highly than with a general ability measure and/or past achievement. Johnson also found that correlations between interests and differential achievement were significantly greater than correlations between interests and "absolute" achievement (i.e., general achievement).

Campbell,[26] in a Ph. D. study (reported by Strong, 1943) also found evidence to suggest that achievement in one area was not related to achievement in another area. The Strong Vocational Interest Blank items, predictive of achievement in social science, were found to be insignificantly related to Strong Vocational Interest Blank items predictive of achievement in engineering.

Krathwohl,[27] (1952), in a study of undergraduates at the Illinois Institute of Technology, studied discrepant achievement in four subject matter areas. He used 308 second term sophomores who had taken aptitude tests in English, chemistry, mathematics, and physics as freshmen,

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[25]Richard W. Johnson, "The Relationship between Measured Interests and Differential Academic Achievement," Ph. D. dissertation University of Minn., 1961.

[26]Campbell, as cited in Johnson thesis.

[27]William C. Krathwohl, "Specifity of Over- and Under-Achievement in College Courses," Journal of Applied Psychology, April, 1952, pp. 103-106.

and as sophomores took achievement tests in the same four subject matter areas. Under- and over-achievers were identified by a comparison of scores (standard) on the two tests. The results indicated that the indices of achievement for English, chemistry, math, and physics were independent of each other with the exception of a slight relationship between chemistry and mathematics. The correlation ranged from .08 (English with chemistry) to .34 (math with chemistry).

Krathwohl concluded from this study that the achievement (over, under, or normal) of any individual should be considered only as achievement (under, over, or normal) in the specific subject matter area.

Haggard[28] (1957) at University of Chicago Laboratory School found differential patterns of achievement among skill areas. Students who were not high general achievers but who, nevertheless, excelled in one of the three achievement areas, were compared. Forty-five students were studied longitudinally from grades three through seven. The results clearly indicated that the specific nature of the achievement was related to particular trends in personality. Haggard's findings underscored the point that

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[28]E. A. Haggard, "Socialization, personality, and academic achievement in gifted children," The School Review, 65, Winter 1957, pp. 388-414.

achievement is not necessarily a general pattern but will often follow relatively specific directions. The three areas of achievement Haggard used were (1) Mechanics of Expression (spelling and languages), (2) Reading Speed and Comprehension and (3) Arithmetic.

Patterns of personality for each achievement area were as follows:

A. Mechanics of Expression (Achievers)
   1. Viewed parents and authority figures as more or less omnipotent, rejecting, and punitive.
   2. Were more dependent on parents and were passive and dependent in general.
   3. Sought social and parental acceptance in conformity.
   4. Were emotionally inhibited.
   5. Revealed a barren, unimaginative, fantasy life.

B. Reading Speed and Comprehension (Achiever)
   1. Mildly negative towards parents
   2. Socially withdrawn and somewhat non-conforming to correction.
   3. Had difficulty relating to others.
   4. Concentrated on maintaining inner freedom, spontaneity and independence of thought and action.

C. Arithmetic Achievers

1. Viewed their environment with curiosity and optimism.
2. Saw parents and authority with less strain.
3. Were more mature emotionally.
4. Were relatively uninhibited, expressing feelings freely without guilt anxiety.

Summary

Although research in academic motivation is plentiful and broad, at least through 1949, little correlation was found between achievement and either personality traits or adjustment inventories. The most significant correlates were between differential interest patterns and differential professional achievement.

When low correlations were found, a large number could be attributed to measurement difficulties. Problems of reliability and validity of tests and grades, sampling errors, and techniques of selection of under- (low) and over- (high) achievers all contributed to these difficulties.

Few studies in academic motivation focused upon either discrepant achievement across subject matter areas or motivational differences between teacher designated and test designated under- and over-achievement.

Those who studied discrepant achievement in subject matter found little to slight (.08 to .34) correlation between subject areas. Indications were that the specific nature of achievement was related to particular personality patterns.

The design of the present study was an attempt to identify discrepant achievement as it related to achievement motives and selection bias.

CHAPTER III

DESIGN AND METHODOLOGY

The design of the study relates to (1) Sample Selection (2) Nature of the Data (3) Analysis Procedures.

1. Sample Selection

The original sample was taken from 309 female and 281 male tenth grade students from the Aurora (East) High School. Aurora, a city of 65,000 people is divided by a river which separates the east side from the west. The east side is predominantly lower middle and upper lower class and contains much of the smaller, older industry of the city. Over the previous five years about 17% of the graduating seniors enrolled in either a college or university. These tenth grade students were administered the Michigan M-Scales during a class period in one day. The Iowa Test of Education Development (ITED) was administered over a four-hour period on two consecutive days. Approximately 280 pupils took the ITED each day. School counselors acted as proctors during the test periods. All other data on these students were taken from their cumulative records. The data were gathered in the late spring of 1965.

Under- and Over-Achievement

Reference is to students identified as under- or over-achievers (according to Farquhar-Payne technique)[1] on both standardized test scores and grade point average.

Performance of the student on standardized achievement tests and in classes (as evidenced by grades) was measured in the following areas: language, mathematics, science, and social science. Four subtests of the Iowa Tests of Educational Development were used as the standardized achievement test. Achievement in classes was measured by the grades recorded over a two-year period in the areas listed in Table 3.1.

TABLE 3.1--Classes Used to Determine Grade Point Average.

Area	Courses Used
Language	English, English Composition, English Literature
Mathematics	Business Mathematics, Algebra, Geometry, Trigonometry
Science	General Science, Biology, Chemistry
Social Science	Social Studies, History, Geography

[1]W. W. Farquhar and D. Payne, "A Classification and Comparison of Techniques Used in Selecting Under- and Over-Achievers," Personnel and Guidance Journal, May, 1964, pp. 874-884.

2. Nature of the Data

Four Types of data were gathered on each student: (1) Aptitude scores, (2) Achievement test scores, (3) Grade Point, (4) Motivational scores.

Aptitude Measures

The California Test of Mental Maturity-Language (CTMM-L) and the Differential Aptitude Test-Verbal Reasoning (DAT-VR) scores were used in obtaining a stable estimate of academic aptitude.

Grade Point Average

The grade point average was computed for each individual in each of four subject matter areas. These four areas include Language, Mathematics, Science and Social Science for both ninth and tenth grades. Only grades in courses designated as academic subjects were used, i.e., subjects requiring homework.

Achievement Test Scores

The Iowa Test of Educational Development was used as the second measure of the students' achievement. The first four subtests of the ITED (English, Social Science, Mathematics, and Natural Science) correspond with the four subject matter areas measured by grade point averages.

Motivational Score

The motivational score was obtained from the student's responses to the Michigan M-Scales. These M-Scales and the resultant motivational factors are based on the work of Farquhar, et al.[2] The scores are reported in seven categories for males and seven categories for females.

For males,[3] these factors with descriptions are as follows:

	Name	Interpretive Emphasis
I	Academician	The highly motivated male feels that his teachers will describe him with terms which have positive educational value. These terms imply a person who does well in school because he is bright, organized and dependable.
II	Job Involvement	The highly motivated male sees himself using his abilities to gain respect while the lowly motivated male wants little, if any, commitment which involves abstractions.
III	Agitation	The lowly motivated male professes problems of concentration using fantasy and distraction to avoid academic pressure.
IV	Immediate versus Long Term Gratification	The highly motivated male professes ability to wait for rewards whereas the lowly motivated male desires short term returns without exerting much effort.

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[2]W. W. Farquhar, Unpublished paper.

[3]The Kuder-Richardson Formula 20. Reliability coefficient for the present study was .977.

V	Disinterested	The lowly motivated male sees himself as one with little commitment to any task--only finishes for the sake of finishing. There is an erratic element in mood.
VI	Succumbing to versus defying school norms.	The highly motivated male internalizes the school norms, feeling that such endeavors are useful and rewarding. The lowly motivated male feels hostile towards school norms, particularly because he feels they are not worth much.
VII	Unique Versus Common Accomplishment	The highly motivated male reacts positively to doing the unusual--to continuing education and to deriving future rewards. The lowly motivated students want to do those things which the average students do, particularly in terminating formal education.

For females,[4] these factors with descriptions are as follows:

	Name	Interpretive Emphasis
I	Same as Male I	
II	Job Involvement	The lowly motivated female wants a job which has few ties--particularly in number of hours worked. The highly motivated female wants a job which permits commitment because of high standards and independence of decision making.
III	Free-Floating Anxiety	The lowly motivated female sees herself as a person of inaction who feels uneasy about not being able to focus on academic tasks.

[4]The Kuden-Richardson Formula 20 Reliability coefficient for the sample was .974.

IV	Academic Versus Social Involvement	The highly motivated female chooses the school oriented tasks in contrast to the lowly motivated female's choice of meeting affiliation needs.
V	Education Commitment	The lowly motivated female wants a job which requires no education beyond high school, the highly motivated female wants a job which requires application of self with possibility of continued learning.
VI	Fantasy	The lowly motivated female reports difficulty with focusing attention; energy is directed towards well developed day dreams. Some implication of guilt in handling repressed desires.
VII	Common Versus Unique Accomplishment	The lowly motivated female wants to do as the crowd does academically. The highly motivated female wants to do the unusual in school.

3. Analysis Procedures

Procedures for analysis of the data were as follows:

1. The DAT-Verbal Reasoning and CTMM-Language scores were used in obtaining a stable estimate of academic aptitude. This is the first step of the regression approach developed by Farquhar and Payne.[5]

2. A regression line was constructed which represented the average of X on Y, and Y on X. This line is located by determining the point of intersection of the means and

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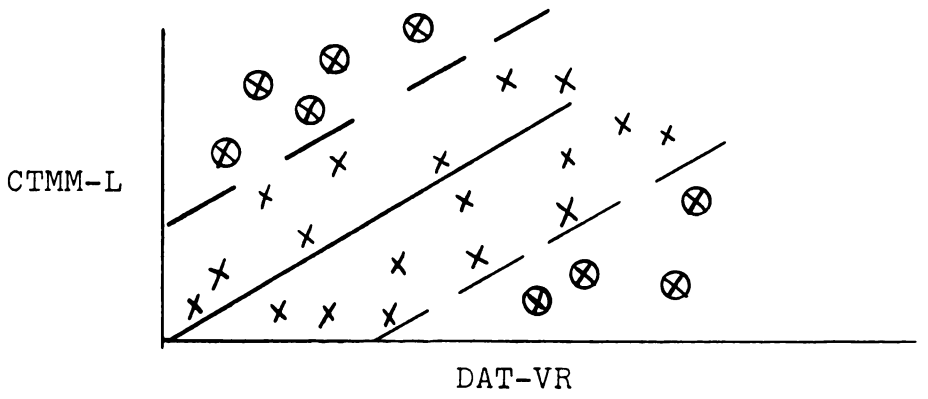
[5]Farquhar, op. cit.

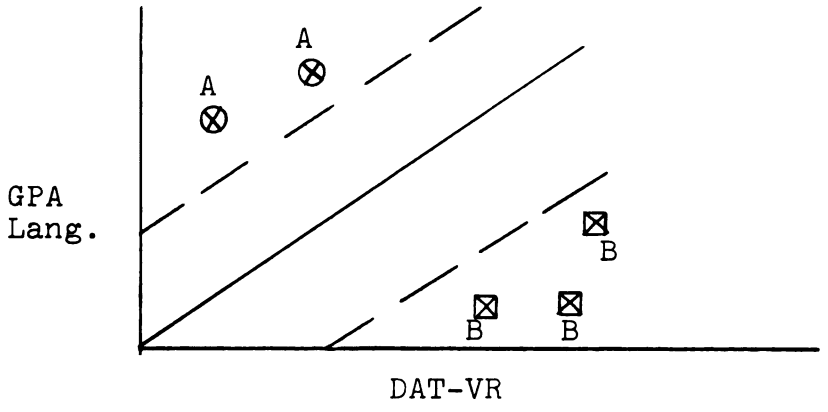
standard deviation of two aptitude predictors, and represents the regression between the two variables if the correlation were +1.00. Two lines are then drawn parallel to the regression line which are a distance away equivalent to the average of the standard error of estimate of the aptitude predictors. Only those students who fell within these limits were included in the study. Although this method runs the risk of a larger Type I error (rejected when should have been accepted), it is more important that the criteria groups be classified with little chance of making a Type II error (accepted when should have been rejected). See Figure 3.1.



⊗ = Individuals rejected from study.

Figure 3.1.--Selection of individuals with stable measured aptitude.

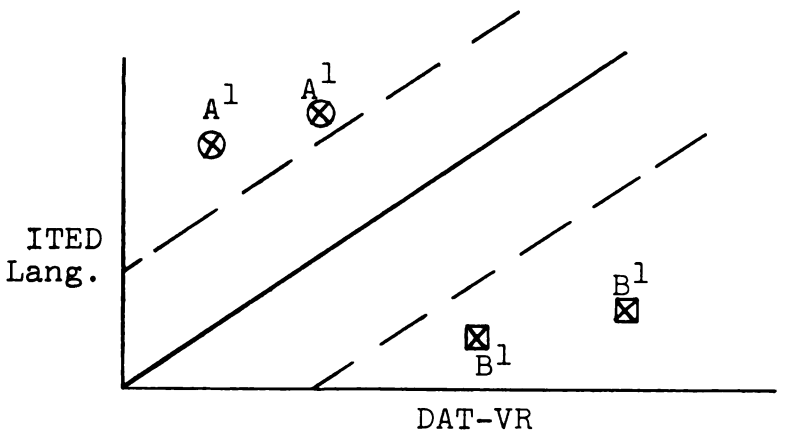
3. Regression equations predicting GPA from the DAT-VR scores were calculated for each sex in each of the four course areas. Under-achievers were defined as those individuals whose GPA fell at least one standard error of estimate below the regression line. In like manner, over-achievers were designated as falling one standard error of estimate above the regression line. See Figure 3.2.



A⊗ = over-achievers male
B⊠ = under-achievers male

Figure 3.2--Method of selecting under- and over-achievers by GPA.

4. Regression equations predicting ITED Scores from DAT-VR scores were calculated for each sex in each of the four corresponding subject matter areas. Under-achievers were defined as those individuals whose ITED score fell at least one standard error of estimate below the regression line. Similarly, over-achievers were designated as falling one standard error of estimate above the regression line. See Figure 3.3.



A^1 ⊗ = over-achievers male
B^1 ⊠ = under-achievers male

Figure 3.3--Method of selecting under- and over-achievers by ITED.

5. At this point the sample resulting from the above described method consisted of thirty-two (32) separate groups (16 male and 16 female) of under- and over-achievers. Within this group, however, were some subjects who were identified as under-achievers (or over-achievers) on both the grade point and the achievement test criteria. In order to make a cleaner study this group was separated and placed into a third group. The data, thereafter, consisted of 48 separate groups. See Figure 3.4 for a summary of all contrasted groups.

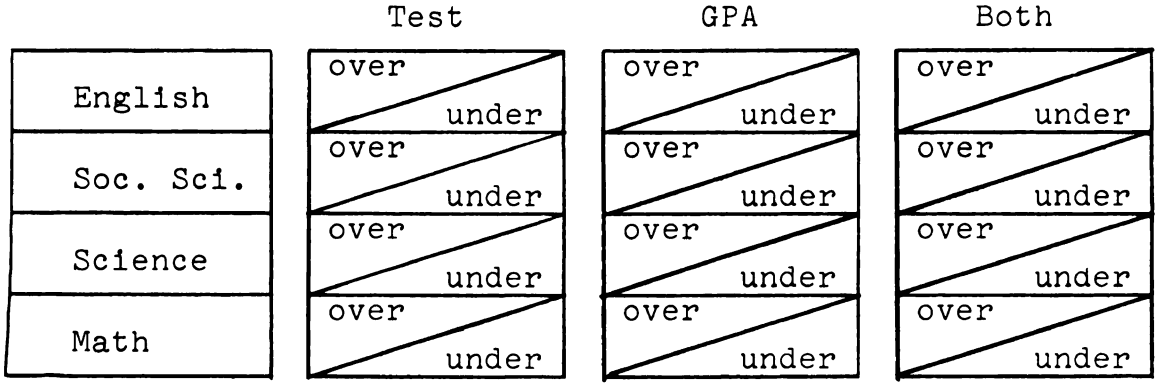


FIGURE 3.4--Schematic summary of groups tested.

6. Analysis of variance (one-way class classification) and an F test of significance was used to test differences between mean rating of the relationship of the motivational factors under different criteria measurements. To test for differences among the four subject matter areas in academic motivation, analysis of variance (two-way classification) was used. When the F test disclosed significant* differences

* The .05 level was used for all tests.

among the means, further interpretation of the data required comparisons of the different M-factors. These comparisons were made by use of the Newman-Keuls procedure.

Statistical Hypotheses

The following are restatements of the hypotheses in null form, which indicate that there is no true difference between the sample as they relate to the criterion.

Major Hypothesis

Ho_1 There are no differences on M-Scale factor means (1 - 7) for under-achievers (as designated by three criteria; GPA, test scores and both) in each of four subject matter areas.

Ho_2 There are no differences on M-Scale factor means (1 - 7) for over-achievers (as designated by three criteria; GPA, test scores and both) in each of four subject matter areas.

Ho_3 There is no difference in motivation (for seven subscales and total M-Scale factors) among individuals classified as either under- or over-achievers within one, and only one of four major subject matter areas (English, Mathematics, Social Science, and Science).

Ho_4 There is no difference in motivation (for the seven subscales and total M-Scale factors) between under- and over-achievers (classified as such by both achievement tests and GPA).

Ha_4 There is a difference with the over-achievers mean scores being higher than the under-achievers mean scores.

Ho_5 There is no interrelationship among under- and over-achievers by subject matter and motivational scores.

These hypotheses were tested for each M-Scale factor.

Summary

A sample of 690 tenth grade students was drawn from an Illinois high school. Over- and under-achievers were identified (according to the Farquhar-Payne technique) on both standardized test scores and grade point average. To study the relationship between the seven factors of the Michigan M-scale and discrepant achievement a one-way analysis of variance was used. A two-way analysis of variance was used to study the relationship of academic motivation across the four subject matter areas (English, Social Science, Mathematics, and Science).

CHAPTER IV

ANALYSIS OF THE DATA

In this chapter the analysis of the data is presented in two main sections: the first deals with tests of significance among under- and over-achievers (three different groups identified by three different criteria), subject matter (four subject areas) and the seven factors (plus total score) of the M-Scale; the second deals with tests of significance among the variables of over- and under-achievement, subject matter (four subject areas), and the 7 factors (plus total score) of the Michigan M-Scale.[1] With each analysis the M-Scale scores are the dependent variables.

Males and females are considered separately throughout the study because the M-Scales have different forms for the sexes.

In the first analysis differences among groups were tested using a one-way analysis of variance; in the second analysis a two-way analysis (4 X 2 design) was used.

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[1]Michigan M-Scale designated as M-Scale from this point on.

Analysis of Differences of Means among Under- and Over-Achievers Designated by Three Achievement Criteria

The first part of the analysis tested the significance of M-Factor means among under- and over-achievers selected by either teacher grades, achievement test scores or both grades and achievement tests, separated by sex as well as by the four subject areas. The dependent variables were the seven M-Scale factors and the total M-Scale score.

One-way analysis of variance across the classification of discrepant achievement by the three methods (teacher grades, achievement test scores and both estimates) were run for all four academic areas and for both sexes. This rather cumbersome procedure was employed because an adequate program for analysis of variance with unequal frequencies in the subcells was not available when the data were analyzed. Equalizing the cells would have overly constricted the already limited sample size.

Thus a one-way analysis of variance was conducted for each (1) sex, (2) M-Scale factor and total score, (3) subject matter area, and (4) classification of over- and under-achievement (a total of 128 analyses).

The two hypotheses tested were as follows:

Ho_1: There are no differences on M-Scale male or female means (Factors 1-7 plus total) for under-achievers (as designated by three criteria--GPA, Achievement Tests, and both) in each of four subject matter areas.

Ho_2: There are no differences on M-Scale male or female means (Factors 1-7 plus total) for over-achievers (as designated by three criteria--GPA, Achievement Tests and both) in each of four subject matter areas.

Analysis of Differences in Each of the Four Subject Matter Areas by Each M-Scale Factor and Total Score: Male Under-Achievers

The analysis of the three under-achieving groups of males for English, Social Studies, Mathematics, and Science, indicated non-significance for each of the seven M-Scale Factors and the first three M-Scale total scores. Since no difference was found Hypothesis One was not rejected for the seven M-Scale factors and the first three M-Scale total scores. The total M-Scale score for the Mathematics was significant at the .05 level and Hypothesis One was rejected for that one area (Table 4.1).

Analysis of Differences in Each of the Four Subject Matter Areas by Each M-Scale Factor and Total Score: Female Under-Achievers

The analysis of the three under-achieving groups of females for English, Social Science, Mathematics, and Science indicated significance (at the .05 level) for Factor I (Academician) and the total M-Scale score in Science. No difference was found for each of the other M-Scale Factors and the other three total M-Scale scores.

Hypothesis One was rejected for Factor I and the total score in Science and not rejected for each of the other M-Scale Factors and the other Total Scores across the four subject matter areas (Table 4.2).

TABLE 4.1--F-Ratios for Under-Achieving Males, by M-Factor, in Four Subject Matter Areas.[a]

M-Scale Factors	I	II	III	VI	V	VI	VII	TOTAL
English F-Ratio	0.19	0.32	1.55	0.40	1.62	0.20	0.67	0.12
Social Science F-Ratio	1.15	0.34	0.16	0.14	0.07	0.43	0.31	0.07
Science F-Ratio	1.00	0.007	0.22	0.05	0.60	0.21	0.86	0.15
Mathematics F-Ratio	2.72	1.05	0.36	2.31	1.81	0.41	0.25	2.76*

*Significant at the .05 level.

[a]Complete Tables can be found in Appendix A.

Analysis of Differences in Each of the Four Subject Matter Areas by Each M-Scale Factor and Total Score: Male Over-Achievers

The analysis of the three over-achieving groups of males for English, Social Science, Mathematics and Science indicated significance (at the .05 level) for Factor II (Job Involvement) in Science. No difference was found for any of the other M-Scale Factors and total score across the subject matter areas.

Hypothesis Two was rejected for Factor II in Science. The second Hypothesis was not rejected for each of the other M-Scale Factors and the total scores across the four subject matter areas (Table 4.3).

Analysis of Differences in Each of the Four Subject Matter Areas by Each M-Scale Factor and Total Score: Female Over-Achievers

The analysis of the three over-achieving groups of females for English, Social Science, Mathematics and Science indicated significance (at the .05 level) for three separate factors and two total scores. Significance was found for Factor VII (Common versus Unique Accomplishment) and the total M-Scale score in English; Factor IV (Academic versus Social Involvement) in Science; and Factor VI (Fantasy) and the total M-Scale score in Mathematics. No difference was found for any of the remaining M-Scale Factors or total scores across each of the four subject matter areas.

Hypothesis Two was rejected for Factor VII and total score in English, Factor IV in Science, and Factor VI and

TABLE 4.2--F-Ratios for Under-Achieving Females, by M-Factor, in Four Subject Matter Areas.

M-Scale Factors	I	II	III	IV	V	VI	VII	TOTAL
English F-Ratio	0.70	0.64	0.03	0.88	2.25	1.13	0.33	0.53
Social Science F-Ratio	0.02	1.51	0.53	0.68	1.21	0.90	0.43	0.61
Science F-Ratio	3.83*	2.27	1.89	1.22	1.66	1.23	3.20	3.39*
Mathematics F-Ratio	1.74	0.90	0.95	2.43	1.79	2.28	2.03	0.73

*Significant at the 0.05 level.

TABLE 4.3--F-Ratios for Over-Achieving Males, by M-Factor in Four Subject Matter Areas.

M-Scale Factors	I	II	III	VI	V	VI	VII	TOTAL
English F-Ratio	0.46	0.19	0.12	0.21	0.26	2.72	2.51	1.64
Social Science F-Ratio	0.96	3.29	0.27	1.16	1.11	1.98	2.44	2.51
Mathematics F-Ratio	0.28	0.27	0.55	0.04	0.50	0.51	0.34	0.17
Science F-Ratio	0.33	5.6*	1.43	2.02	0.45	2.36	3.05	1.61

*Significant at the .05 level.

TABLE 4.4--F-Ratios for Over-Achieving Females, by M-Factor, in Four Subject Matter Areas.

M-Scale Factors	I	II	III	IV	V	VI	VII	TOTAL
English F-Ratio	2.92	1.69	1.31	0.005	2.95	2.31	4.63*	3.81*
Social Science F-Ratio	0.47	0.34	0.71	0.050	0.48	1.90	0.47	0.33
Science F-Ratio	0.87	0.95	0.37	3.49*	0.49	0.97	1.18	0.84
Mathematics	1.13	3.46	0.91	1.890	0.57	5.48*	1.62	5.80*

*Significant at the 0.05 level.

total score in Mathematics. The Hypothesis was not rejected for each of the other M-Scale Factors and two remaining total scores across the four subject matter areas (Table 4.4).

Hypotheses

Five hypotheses were advanced to investigate relationships in the study. The three listed below were conceived to investigate the possibility that motivational differences existed across the four major subject matter areas of study.

Ho_3: There is no difference in motivation (for seven subscales and total M-Scale factors) among individuals classified as either under- or over-achievers within one, and only one of four major subject matter areas (English, Mathematics, Social Science, and Science).

Ho_4: There is no difference in motivation (for the seven subscales and total M-Scale factors) between under- and over-achievers (classified as such by both achievement tests and GPA).

Ha_4: The over-achievers mean scores are higher than the under-achievers mean scores.[1]

Ho_5: There is no interaction among classification of under- and over-achievers by subject matter for the motivation scores.

Analysis of Differences of Means: Males

Differences were found in the predicted direction at the .01 level, for M-Scales Factors I (Academician), II (Job

[1]Actually the hypothesis about over- and under-achieving differences on the M-Scales constitutes a varification of the validity of the test for the sample of this study.

Involvement), III (Agitation), V (Disinterested), VI (Succumbing to versus defying school norms), VII (Unique versus Common Accomplishment) and the total score. No difference was found for Factor IV (Immediate versus long term gratification).

No differences were found among the four subject matter areas in academic motivation scores for each of the subscores and the total M-Scale score. Furthermore, no interactions were found among discrepant achievement classifications and the four areas of academic concentration. Thus, for males the second Hypothesis (Ho_4) was rejected for M-Scale factors I, II, III, V, VI, VII, and total score, and was not rejected for M-Scale factor IV. The subject matter area and interaction (Ho_3, Ho_5) hypotheses were not rejected for each of the M-Scale factors and the total M-Scale score.

The means for each factor and the total mean score of the M-Scale for males selected as discrepant achievers in one, and only one, of four areas of academic concentration (English, social science, science, and math) are summarized in Table 4.5. The analysis of variance of motivational factors (1-7 and Total, males) for the four academic areas can be found in Appendix B.

TABLE 4.5--Summary of M-Scale Means, Males, Factors 1-7, and Total.

Factors	English	Social Science	Science	Mathematics
*Factor I (Academician)				
Over-Achiever	24.03	25.30	25.46	25.43
Under-Achiever	18.73	18.10	19.76	21.13
*Factor II (Job Involvement)				
Over-Achiever	15.00	15.16	15.03	15.10
Under-Achiever	12.16	12.63	12.80	13.50
*Factor III (Agitation)				
Over-Achiever	18.90	19.03	18.86	18.96
Under-Achiever	16.00	16.73	16.66	17.63
*Factor IV (Immediate versus Long Term Grantification)				
Over-Achiever	10.43	9.86	10.26	9.93
Under-Achiever	9.46	10.33	8.90	10.00
*Factor V (Disinterested)				
Over-Achiever	9.00	9.06	9.03	9.06
Under-Achiever	8.10	8.36	8.23	8.33
*Factor VI (Succumbing to versus Defying School Norms)				
Over-Achiever	8.40	8.56	8.50	8.53
Under-Achiever	6.86	6.93	7.53	7.33
*Factor VII (Unique versus Common Accomplishment)				
Over-Achiever	16.20	15.60	16.13	15.26
Under-Achiever	11.40	11.43	11.76	13.03
*Total Scores				
Over-Achievers	101.96	102.57	103.27	102.27
Under-Achievers	82.71	84.51	75.64	90.95

*Significant at the 0.01 level for over- and under-achiever mean scores.

Analysis of Differences of Means: Females

Differences were found at the .01 level, M-Scale factors I (Academician), V (Educational Commitment), VII (Common versus Unique Accomplishment) and total score. No differences were found for factors II (Job Involvement), III (Free Floating Anxiety), IV (Academic versus Social Involvement), and VI (Fantasy).

No differences were found among the four subject matter areas in academic motivation scores for each of the subscales and the total M-Scale. Furthermore, no interactions were found among discrepant achievement classifications and the four areas of academic concentration. Thus, for females the second Hypothesis (Ho_4) was rejected for M-Scale factors I, V, VII and total M-Scale score and not rejected for M-Scale factors II, III, IV, and VI. The subject matter and interaction Hypotheses (Ho_3 and Ho_5) were not rejected for each of the M-Scale factors and the total M-Scale score.

The means for each Factor and the total mean score of M-Scales for females selected as discrepant achievers in one, and only one, of four areas of academic concentration (English, social science, science, and math) are summarized in Table 4.6. The analysis of variance of motivational factors (1-7 and Total, females) for the four academic areas can be found in Appendix B.

TABLE 4.6--Summary of M-Scale Means, Female, Factor 1-7 (N=23).

Factors	English	Social Science	Science	Mathematics
*Factor I (Academician)				
Over-Achiever	30.34	28.82	28.26	27.73
Under-Achiever	21.30	23.30	24.47	22.95
Factor II (Job Involvement)				
Over-Achiever	20.47	20.39	20.21	20.08
Under-Achiever	19.56	19.60	21.26	19.86
Factor III (Agitation)				
Over-Achiever	8.47	7.95	8.08	8.00
Under-Achiever	8.17	8.21	8.56	8.17
Factor IV (Immediate versus Long Term Gratification)				
Over-Achiever	10.52	10.00	10.26	10.52
Under-Achiever	10.30	9.91	10.56	10.43
*Factor V (Disinterested)				
Over-Achiever	10.47	10.60	10.60	9.82
Under-Achiever	7.86	8.65	9.52	9.13
Factor VI (Succumbing to versus Defying School Norms)				
Over-Achiever	11.00	9.82	10.65	10.73
Under-Achiever	11.34	11.43	11.65	10.78
*Factor VII (Unique versus Common Accomplishment)				
Over-Achiever	9.30	9.17	8.82	8.65
Under-Achiever	7.21	7.56	7.73	8.21
**Total Score				
Over-Achiever	100.57	96.75	96.88	95.53
Under-Achievers	85.74	88.66	93.75	89.53

*Significant at the 0.01 level for over- and under-achiever mean scores.
**Significant at the 0.05 level for over- and under-achiever mean scores.

Summary

The first analysis was concerned with tests of significance of difference among the means of the seven M-Scale factors and the four total scores, for each of the four subject matter areas and the three under-achieving and three over-achieving criteria. In this section of the analysis, nine of the 128 analyses were significant at the .05 level. For under-achievers, total M-Scale score (Mathematics, males), M-Scale factor I (Science, females), and total M-Scale score (Science, female), were found to be significant at the .05 level. Thus for these three factors the first Hypothesis (Ho_1) was rejected. However, for the remaining sixty-one factors Hypothesis one was not rejected.

For over-achievers, M-Scale factor II (Science, males), M-Scale factor VII (English, females) total M-Scale score (English, females), M-Scale factor IV (Science, females), M-Scale factor VI and total score (Mathematics, females) were found to be significant at the .05 level. Thus, the second Hypothesis (Ho_2) was rejected for these six factors and was not rejected for the remaining fifty-eight. Although significance was found in nine cases the finding must be interpreted with caution because with a total of 128 analyses, the nine significant cases could easily be due to chance factors.

The second analysis was concerned with tests of significance of difference among means of the seven M-Scale factors and total scores between under- and over-achievers and among four subject matter areas. A two-way analysis of variance was used for the achievement level by subject area analysis.

No statistically significant difference was found among the means of the seven M-Scale factors and total score across the four subject matter areas. Thus the third Hypothesis (Ho_3) was not rejected.

Significance was found, at the .05 level, between over- and under-achieving males for M-Scale factors I (Academician), II (Job Involvement), III (Agitation), V (Disinterested), VI (Succumbing to versus Defying School Norms), VII (Unique versus Common Accomplishment), and total score. Significance was also found at the .05 level, between over- and under-achieving females for M-Scale factors I (Academician), V (Educational Commitment), VII (Common versus Unique Accomplishment) and total score.

No significant difference was found among the means on any interaction among the eight cells of the two-way analysis of variance design. The fifth Hypothesis (Ho_5) was then not rejected.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Two problems were investigated in this study. The primary problem concerned differences in student academic motivation, between those who were classified as under- and over-achievers by teacher ratings as opposed to achievement test scores. The secondary problem was concerned with determining differences in academic motivation of students classified as under- or over-achievers in one, and only one, of four course areas (English, social science, mathematics, and science).

For both problems the same sample of 600 tenth grade students was used. Three groups of under- and over-achievers were identified, one by GPA, one by standardized achievement tests, and one by both estimates for each of the four subject matter areas. The Farquhar-Payne Technique[1] was used for selection of the under- and over-achiever. Their technique entails the selection of subjects falling one standard error of estimate either side of the regression line as over-achievers (one standard error above) or under-achievers (one standard error below). Within this study DAT-VR (Differential Aptitude Test-Verbal Reasoning)

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[1]Farquhar and Payne, op. cit.

was used to estimate GPA (Teacher grades) and the ITED (Iowa Test of Educational Development) scores were used to estimate achievement from a standardized test.

The first analysis tested separately by sex and the four subject matter areas, the significance of M-Scale factor means (seven M-Scale factors plus total score) among under- and over-achievers selected by either GPA. achievement test scores or both estimates. One-way analysis of variance was used to test for significance.

The results of the first analysis indicated only nine of the 128 analyses were significant at the .05 level. Four of the nine significant analyses were in the Science area, three were in Mathematics, and two in English. Any generalizations based upon the nine significant analyses must be tempered with caution because the nine may be due to chance.

The second analysis in the study was concerned with tests of significance among the variables of over- and under-achievement, subject matter (four areas), and the seven M-Scale factors plus the total M-Scale score. A two-way analysis of variance with "F" test was employed for the 4 x 2 design.

No significant difference was found among the means of the seven M-Scale factors and total score across the four subject matter areas. Significance was found, at the .05 level, between over- and under-achieving males for

M-Scale factors I (Academician), II (Job Involvement), III (Agitation), V (Disinterested), VI (Succumbing to versus defying school norms), VII (Unique versus Common Accomplishment) and Total M-Scale scores. Significance was also found between female over- and under-achievers, at the .05 level, for M-Scale factors I (Academician, V (Educational Commitment), VII (Common versus Unique Accomplishment), and Total M-Scale scores.

No significant difference was found among the means for any interaction among the eight cells of the two-way analysis of variance design.

Conclusions and Findings

The failure to reject all but one of the null hypotheses of the study was interpreted as an indication that, within the limitations imposed, little difference can be found in motivational patterns of students who are classified according to three categories of under- and over-achievement or who do exceptionally well or poorly in four subject matter areas.

1. For the three designated groups of under-achievers in each of the four subject matter areas only three factors in two areas (M-Scale factor I and Total in Science, and M-Scale factor Total in Mathematics) were found significant. Thus little difference appeared to exist in academic motivation among the three classifications of under-achievement.

2. For the over-achieving group, significance was found for only six of the factors thus indicating that little difference in academic motivation can be found among the three classifications of over-achievement.

3. For this population there were no differences in academic motivation among students who were classified as under- and over-achievers in one, and only one area of achievement: English, social studies, mathematics, and science.

4. There were significant differences between under- and over-achievers on all but one M-Scale factor for males and for three of the seven M-Scale factors for females. Significant differences between under- and over-achievers on the total M-Scale score were found for both males and females.

5. When academic motivation is the dependent variable, no significant interaction appeared among the four subject matter areas and under- and over- achievement.

6. When identified by teacher grade point averages or standardized test scores the results indicate that, for this sample, under-achievers as a group or over-achievers as a group are not different in academic motivation. If the finding is consistent from future cross-validation, the researcher will be free to use the less expensive estimate of achievement, whatever it is.

7. The Science area indicated signs of being more sensitive to the M-Scale factor differences than the other three areas. The Science data indicated higher but not significant F-ratio scores than in the areas of English, mathematics, and social science. It is possible that over- and under-achievers in science might have a more differential pattern of academic motivation than over- and under-achievers in the other subject matter areas.

Discussion

The findings of few, other than chance, differences between three classifications of under- and over-achievers and the non-significance of differential achievement motivation across subject matter areas is somewhat of an enigma. It was also surprising that no differences were found between discrepant achievers identified as such by either teacher grades or achievement test scores. The related literature indicated large discrepancies between teacher perception of achievement and test measures of achievement. The policy of the school from which the sample of this study was drawn encouraged relying heavily upon standardized and departmental testing to award grades may have nullified some of the expected differences between GPA and achievement tests. The lack of differences across subject matter areas would indicate little uniqueness of these areas, leading to the conclusion that special techniques to aid learning in specific subject areas was not employed.

The possibility that the M-Scales might not be as sensitive to differences between specific subject matter areas since they were validated using combined GPS should not be overlooked. Perhaps the differences which might have existed were obscured by the loss of items in the original Farquhar study.

The studies by Krathwohl,[1] Haggard[2] and Johnson,[3] all of which resulted in significant differences among subject matter areas, did not relate as closely as assumed to this study. One reason for the difference among the studies can be found in the criterion for identification of under- and over-achievement used. Each study used different criteria for identification than the present study and none of the former studeis met the criteria of selection and identification established by Farquhar and Payne.[4]

Thus, the possible reasons for negative findings include:

1. An error in the basic assumptions, i.e., perhaps no differences do exist in motivation across subject matter areas or between estimates of achievement.
2. Sample fluke, i.e., a possibility that the population was atypical or not large enough.

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[1]Krathwohl, op. cit. [2]Haggard, op. cit.

[3]Johnson, op. cit. [4]Farquhar and Payne, op. cit.

3. Measurement limitations, as previously discussed.

The negative findings have not proved equality but also have failed to prove inequality. Although little can be said concerning curricular implications in this study speculation of the importance of similar studies for curriculum development should generate continued research.

Implications for Further Research

The need for further research has been testified to in the review of the literature which indicates that little has been done on the subject of differential academic achievement. The assumption that individuals selected within under- and over-achiever groups came from different statistical populations and thus may be discrepant achievers for different reasons remains reasonable. More work nees to be done in defining the discrepant achiever population. Other recommendations are as follows:

1. Replicate the study using a larger, more heterogeneous sample than the one employed for this study.
2. Refine the sample population to include high schools using well-defined track systems for more adequate differentiation of ability and subject matter levels, holding intelligence constant.
3. An intensified study of discrepant achievement using just the science area since it appeared to

be more sensitive to differences. Selected in-depth interviews could be used in addition to the original M-Scale items to increase understanding of responses of under- and over-achievers.

4. Inclusion of M-Scales as a variable in future studies of the learning process in single subject matter areas. If there are different learning processes for specific subject matter areas, differential motivational patterns might also be found.
5. The development of a new motivation scale or the refinement of the present M-Scale validated separately for each subject matter area has promise if initial analysis as detailed above discovers any differences.

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APPENDICES

APPENDIX A

ANALYSIS OF VARIANCE OF UNDER- AND OVER-ACHIEVERS (MALE, FEMALE) IN FOUR SUBJECT MATTER AREAS BY THE THREE ACHIEVEMENT CRITERIA ON THE M-SCALE FACTORS

TABLE A.1--Analysis of Variance (One-Way) of Male Under-Achievers in English by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	48.14	2	24.07	0.19
Within	4101.75	32	128.18	
Total	4149.89	34		
Factor II				
Among	10.95	2	5.48	0.33
Within	536.93	32	16.78	
Total	547.89	34		
Factor III				
Among	106.55	2	53.27	1.55
Within	1097.85	32	34.30	
Total	1204.39	34		
Factor IV				
Among	8.99	2	4.49	0.40
Within	357.58	32	11.17	
Total	366.57	34		
Factor V				
Among	6.82	2	3.41	1.62
Within	67.35	32	2.10	
Total	74.17	34		
Factor VI				
Among	2.40	2	1.20	0.20
Within	185.60	32	5.80	
Total	188.00	34		
Factor VII				
Among	26.69	2	13.35	0.67
Within	635.87	32	19.87	
Total	662.57	34		
Total Score				
Among	110.75	2	55.38	0.12
Within	12279.94	32	454.81	
Total	12390.69	34		

TABLE A.2--Analysis of Variance (One-Way) of Male Under-Achievers in Social Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	272.06	2	136.02	1.15
Within	3407.81	29	117.51	
Total	3679.87	31		
Factor II				
Among	8.61	2	4.30	0.33
Within	369.10	29	12.72	
Total	377.71	31		
Factor III				
Among	6.05	2	3.02	0.16
Within	525.16	29	18.10	
Total	531.21	31		
Factor IV				
Among	2.43	2	1.21	0.14
Within	251.07	29	8.65	
Total	253.50	31		
Factor V				
Among	0.21	2	0.10	0.06
Within	48.25	29	1.66	
Total	48.46	31		
Factor VI				
Among	4.26	2	2.13	0.43
Within	142.70	29	4.92	
Total	146.96	31		
Factor VII				
Among	9.90	2	4.95	0.31
Within	458.56	29	15.81	
Total	468.46	31		
Total Score				
Among	65.71	2	32.85	0.07
Within	11421.00	32	456.84	
Total	11486.71	34		

TABLE A.3--Analysis of Variance (One-Way) of Male Under-Achievers in Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	237.55	2	118.77	1.00
Within	4010.77	34	117.96	
Total	4248.32	36		
Factor II				
Among	0.22	2	0.11	0.00
Within	522.75	34	15.37	
Total	522.97	36		
Factor III				
Among	15.32	2	7.65	0.21
Within	1194.68	34	35.13	
Total	1210.00	36		
Factor IV				
Among	1.38	2	0.69	0.05
Within	461.53	34	13.57	
Total	462.91	36		
Factor V				
Among	2.28	2	1.13	0.60
Within	63.82	34	1.87	
Total	66.10	36		
Factor VI				
Among	2.02	2	1.00	0.21
Within	161.22	34	4.74	
Total	163.24	36		
Factor VII				
Among	36.73	2	18.35	0.86
Within	724.94	34	21.32	
Total	761.67	36		
Total Score				
Among	1777.69	2	888.84	1.159
Within	26071.12	34	766.79	
Total	27848.81	36		

TABLE A.4--Analysis of Variance (One-Way) of Male Under-Achievers in Mathematics by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	538.83	2	269.41	2.73
Within	2668.63	27	98.83	
Total	3207.46	29		
Factor II				
Among	27.71	2	13.85	1.05
Within	355.79	27	13.17	
Total	383.50	29		
Factor III				
Among	18.44	2	9.22	0.35
Within	698.52	27	25.87	
Total	716.96	29		
Factor IV				
Among	34.21	2	17.10	2.31
Within	199.79	27	7.39	
Total	234.00	29		
Factor V				
Among	9.53	2	4.76	1.80
Within	71.13	27	2.63	
Total	80.66	29		
Factor VI				
Among	4.71	2	2.35	0.41
Within	153.96	27	5.70	
Total	158.67	29		
Factor VII				
Among	10.20	2	5.10	0.25
Within	530.76	27	19.65	
Total	540.96	29		
Total Score				
Among	2506.82	2	1253.40	2.76*
Within	12255.05	27	453.89	
Total	14761.87	29		

*Significant at the .05 level.

TABLE A.5--Analysis of Variance (One-Way) of Female Under-Achievers in English by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	170.54	2	85.26	0.70
Within	2674.90	22	121.58	
Total	2845.44	24		
Factor II				
Among	36.96	2	18.48	0.64
Within	633.04	22	28.77	
Total	670.00	24		
Factor III				
Among	0.06	2	0.03	0.02
Within	23.94	22	1.08	
Total	24.00	24		
Factor IV				
Among	13.44	2	6.72	0.87
Within	168.80	22	7.67	
Total	182.24	24		
Factor V				
Among	43.22	2	21.60	2.25
Within	210.78	22	9.58	
Total	254.00	24		
Factor VI				
Among	15.43	2	7.71	1.125
Within	150.81	22	6.85	
Total	166.24	24		
Factor VII				
Among	3.07	2	1.53	0.32
Within	102.93	22	4.67	
Total	106.00	24		
Total Score				
Among	557.56	2	278.78	0.535
Within	9908.30	22	521.49	
Total	10565.86	24		

TABLE A.6--Analysis of Variance (One-Way) of Female Under-Achievers in Social Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	5.50	2	2.75	0.02
Within	3262.66	27	120.83	
Total	3268.16	29		
Factor II				
Among	86.92	2	43.46	1.51
Within	776.44	27	28.75	
Total	863.36	29		
Factor III				
Among	1.48	2	0.73	0.52
Within	37.88	27	1.40	
Total	39.36	29		
Factor IV				
Among	8.14	2	4.07	0.68
Within	161.22	27	5.97	
Total	169.36	29		
Factor V				
Among	29.39	2	14.69	1.21
Within	327.81	27	12.14	
Total	357.20	29		
Factor VI				
Among	12.86	2	6.43	0.90
Within	191.80	27	7.10	
Total	204.66	29		
Factor VII				
Among	4.57	2	2.28	0.43
Within	140.88	27	5.21	
Total	145.46	29		
Total Score				
Among	590.49	2	295.28	0.609
Within	13085.81	27	484.66	
Total	13676.30	29		

TABLE A.7--Analysis of Variance (One-Way) of Female Under-Achievers in Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	815.38	2	407.69	3.83*
Within	2871.98	27	106.36	
Total	3687.36	29		
Factor II				
Among	104.02	2	52.01	2.27
Within	617.84	27	22.88	
Total	721.86	29		
Factor III				
Among	4.51	2	2.25	1.89
Within	32.15	27	1.19	
Total	36.66	29		
Factor IV				
Among	20.65	2	10.32	1.22
Within	227.51	27	8.42	
Total	248.16	29		
Factor V				
Among	32.78	2	16.39	1.66
Within	265.38	27	9.82	
Total	298.16	29		
Factor VI				
Among	17.71	2	8.85	1.23
Within	194.15	27	7.19	
Total	211.86	29		
Factor VII				
Among	24.73	2	12.36	3.20
Within	104.23	27	3.86	
Total	128.96	29		
Total Score				
Among	2460.86	2	1230.43	3.399*
Within	10496.10	27	361.93	
Total	12956.96	29		

*Significant at the .05 level.

TABLE A.8--Analysis of Variance (One-Way) of Female Under-Achievers in Mathematics by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	449.76	2	224.88	1.74
Within	3730.45	29	128.63	
Total	4180.21	31		
Factor II				
Among	58.80	2	29.40	0.90
Within	943.20	29	32.52	
Total	1002.00	31		
Factor III				
Among	2.50	2	1.25	0.95
Within	37.96	29	1.30	
Total	40.46	31		
Factor IV				
Among	34.47	2	17.23	2.43
Within	205.40	29	7.08	
Total	239.87	31		
Factor V				
Among	45.05	2	22.52	1.79
Within	363.81	29	12.54	
Total	408.87	31		
Factor VI				
Among	27.60	2	13.80	2.28
Within	175.36	29	6.04	
Total	202.96	31		
Factor VII				
Among	20.83	2	10.41	2.03
Within	148.67	29	5.12	
Total	169.50	31		
Total Score				
Among	862.05	2	431.03	0.73
Within	14103.36	29	587.64	
Total	14965.41	31		

TABLE A.9--Analysis of Variance (One-Way) of Male Over-Achievers in English by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	162.91	2	81.45	0.78
Within	3118.72	30	103.95	
Total	3281.63	32		
Factor II				
Among	33.56	2	16.78	1.76
Within	285.40	30	9.51	
Total	318.96	32		
Factor III				
Among	1.81	2	0.90	0.11
Within	235.70	30	7.85	
Total	237.51	32		
Factor IV				
Among	5.36	2	2.68	0.20
Within	390.15	30	13.00	
Total	395.51	32		
Factor V				
Among	0.57	2	0.28	0.25
Within	33.43	30	1.11	
Total	34.00	32		
Factor VI				
Among	10.43	2	5.21	2.72
Within	57.44	30	1.91	
Total	67.87	32		
Factor VII				
Among	77.53	2	38.76	2.51
Within	463.19	30	15.43	
Total	540.72	32		
Total Score				
Among	1050.49	2	525.25	1.65
Within	9553.02	30	318.42	
Total	10603.51	32		

TABLE A.10--Analysis of Variance (One-Way) of Male Over-Achievers in Social Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	158.66	2	79.33	0.96
Within	2223.64	27	82.35	
Total	2382.30	29		
Factor II				
Among	45.57	2	22.78	3.29
Within	186.59	27	6.91	
Total	232.16	29		
Factor III				
Among	4.73	2	2.36	0.27
Within	234.23	27	8.67	
Total	238.96	29		
Factor IV				
Among	27.65	2	13.82	1.16
Within	319.81	27	11.84	
Total	347.46	29		
Factor V				
Among	1.82	2	0.91	1.11
Within	22.04	27	0.81	
Total	23.86	29		
Factor VI				
Among	6.85	2	3.42	1.98
Within	46.51	27	1.72	
Total	53.36	29		
Factor VII				
Among	55.68	2	27.84	2.44
Within	307.51	27	11.38	
Total	363.19	29		
Total Score				
Among	1320.08	2	660.04	2.52
Within	7077.78	27	262.14	
Total	8397.86	29		

TABLE A.11--Analysis of Variance (One-Way) of Male Over-Achievers in Science by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	58.73	2	29.36	0.33
Within	2604.90	30	86.83	
Total	2663.63	32		
Factor II				
Among	64.60	2	32.30	5.62*
Within	172.30	30	5.74	
Total	236.90	32		
Factor III				
Among	21.04	2	10.52	1.42
Within	220.83	30	7.36	
Total	241.87	32		
Factor IV				
Among	34.60	2	17.30	2.02
Within	256.30	30	8.54	
Total	920.90	32		
Factor V				
Among	0.80	2	0.40	0.45
Within	26.71	30	0.89	
Total	27.51	32		
Factor VI				
Among	5.70	2	2.85	2.36
Within	36.17	30	1.20	
Total	41.87	32		
Factor VII				
Among	97.55	2	48.77	3.05
Within	478.51	30	15.95	
Total	576.06	32		
Total Score				
Among	893.64	2	446.82	1.608
Within	8335.33	30	277.84	
Total	9228.97	32		

*Significant at the .05 level.

TABLE A.12--Analysis of Variance (One-Way) of Male Over-Achievers in Mathematics by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	51.13	2	25.56	0.28
Within	3187.08	35	91.05	
Total	3238.21	37		
Factor II				
Among	4.26	2	2.13	0.27
Within	271.63	35	7.76	
Total	275.89	37		
Factor III				
Among	13.55	2	6.77	0.55
Within	426.66	35	12.19	
Total	440.21	37		
Factor IV				
Among	0.65	2	0.32	0.03
Within	316.32	35	9.03	
Total	316.97	37		
Factor V				
Among	1.29	2	0.64	0.50
Within	45.05	35	1.28	
Total	46.34	37		
Factor VI				
Among	1.51	2	0.75	0.51
Within	51.33	35	1.46	
Total	52.84	37		
Factor VII				
Among	12.35	2	6.17	0.34
Within	630.41	35	18.01	
Total	642.76	37		
Total Score				
Among	103.90	2	51.95	0.173
Within	10207.18	35	300.21	
Total	10311.08	37		

TABLE A.13--Analysis of Variance (One-Way) of Female Over-Achievers in English by the Three Achievement Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	578.97	2	289.48	2.92
Within	2872.53	29	99.05	
Total	3451.50	31		
Factor II				
Among	38.56	2	19.27	1.69
Within	329.90	29	11.37	
Total	368.46	31		
Factor III				
Among	3.74	2	1.87	1.31
Within	41.13	29	1.41	
Total	44.87	31		
Factor IV				
Among	0.00	2	0.00	0.00
Within	179.21	29	6.17	
Total	179.21	31		
Factor V				
Among	39.23	2	19.61	2.95
Within	192.73	29	6.64	
Total	231.96	31		
Factor VI				
Among	32.34	2	16.17	2.31
Within	202.53	29	6.98	
Total	234.87	31		
Factor VII				
Among	37.29	2	18.64	4.23*
Within	116.71	29	4.02	
Total	154.00	31		
Total Score				
Among	2066.94	2	1033.47	3.816*
Within	7852.77	29	270.78	
Total	9919.71	31		

*Significant at the .05 level.

TABLE A.14--Analysis of Variance (One-Way) of Female Over-Achievers in Social Science by the Three Achievement on Criteria on the M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	81.62	2	40.81	0.47
Within	2319.34	27	85.90	
Total	2400.96	29		
Factor II				
Among	7.78	2	3.89	0.34
Within	301.42	27	11.16	
Total	309.20	29		
Factor III				
Among	2.40	2	1.20	0.71
Within	45.46	27	1.68	
Total	47.86	29		
Factor IV				
Among	0.77	2	0.38	0.05
Within	207.09	27	7.67	
Total	207.86	29		
Factor V				
Among	5.41	2	2.70	0.48
Within	149.38	27	5.53	
Total	154.79	29		
Factor VI				
Among	30.62	2	15.30	1.93
Within	213.38	27	7.90	
Total	244.00	29		
Factor VII				
Among	4.61	2	2.30	0.47
Within	130.35	27	4.82	
Total	134.96	29		
Total Score				
Among	235.85	2	117.92	0.333
Within	8486.14	27	353.59	
Total	8721.99	29		

TABLE A.15--Analysis of Variance (One-Way) of Female Over-Achievers in Science by the Three Achievement Criteria on M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	156.95	2	78.47	0.87
Within	2252.47	25	90.09	
Total	2409.42	27		
Factor II				
Among	46.04	2	23.02	1.95
Within	294.06	25	11.76	
Total	340.10	27		
Factor III				
Among	1.36	2	0.68	0.37
Within	45.31	25	1.81	
Total	46.67	27		
Factor IV				
Among	30.83	2	15.41	3.49*
Within	110.13	25	4.40	
Total	140.96	27		
Factor V				
Among	8.77	2	4.38	0.49
Within	222.08	25	8.88	
Total	230.85	27		
Factor VI				
Among	18.22	2	9.11	0.97
Within	232.63	25	9.30	
Total	250.85	27		
Factor VII				
Among	13.20	2	6.60	1.18
Within	138.80	25	5.55	
Total	152.00	27		
Total Score				
Among	582.12	2	291.06	0.845
Within	8609.98	25	344.39	
Total	9192.10	27		

*Significant at the .05 level.

TABLE A.16--Analysis of Variance (One-Way) of Female Over-Achievers in Mathematics by the Three Achievement Criteria on M-Scale, Factors 1 thru 7, Plus Total.

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Among	195.67	2	97.83	1.13
Within	1722.75	20	86.13	
Total	1918.43	22		
Factor II				
Among	91.07	2	45.53	3.46
Within	262.75	20	13.13	
Total	353.82	22		
Factor III				
Among	3.02	2	1.51	1.91
Within	32.98	20	1.64	
Total	36.00	22		
Factor IV				
Among	32.09	2	16.04	1.89
Within	169.64	20	8.48	
Total	201.73	22		
Factor V				
Among	10.55	2	5.27	0.57
Within	182.75	20	9.13	
Total	193.30	22		
Factor VI				
Among	63.19	2	31.59	5.48*
Within	115.24	20	5.76	
Total	178.43	22		
Factor VII				
Among	14.99	2	7.49	1.62
Within	92.22	20	4.61	
Total	107.21	22		
Total Score				
Among	2708.49	2	1354.24	5.805*
Within	4665.42	20	233.27	
Total	7373.91	22		

*Significant at the .05 level.

APPENDIX B

ANALYSIS OF VARIANCE OF MOTIVATIONAL SCORES FOR UNDER- AND OVER-ACHIEVERS FROM FOUR ACADEMIC AREAS (MALE, FEMALE)

TABLE B.1--Analysis of Variance of Motivational Scores (Factor 1 thru 7, Plus Total Males) for Under- and Over-Achievers from Four Academic Areas.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Subject matter	135.34	3	45.11	0.429
Over- vs under-achievers	1898.43	1	1898.43	18.091*
Interaction	65.21	3	21.73	0.207
Remaining error	24345.50	232	104.93	
Total	26444.49	239		
Factor II				
Subject matter	15.48	3	5.16	0.453
Over- vs under-achievers	317.40	1	317.40	27.900*
Interaction	12.50	3	4.16	0.366
Remaining error	2639.26	232	11.37	
Total	2984.64	239		
Factor III				
Subject matter	22.23	3	7.41	0.399
Over- vs under-achievers	286.01	1	286.01	15.425*
Interaction	18.75	3	6.25	0.337
Remaining error	4301.59	232	18.54	
Total	4628.59	239		

Factor IV				
Subject matter	8.83	3	2.94	0.297
Over- vs under-achievers	12.15	1	12.15	1.228
Interaction	33.21	3	11.07	1.119
Remaining error	2295.40	232	9.89	
Total	2349.60	239		
Factor V				
Subject matter	1.03	3	0.34	0.212
Over- vs under-achievers	36.81	1	36.81	22.692*
Interaction	0.35	3	0.11	0.071
Remaining error	376.40	232	1.62	
Total	414.60	239		
Factor VI				
Subject matter	5.64	3	1.88	0.552
Over- vs under-achievers	108.00	1	108.00	31.681*
Interaction	4.11	3	1.37	0.402
Remaining error	790.89	232	3.40	
Total	908.66	239		
Factor VII				
Subject matter	12.81	3	4.27	0.243
Over- vs under-achievers	908.70	1	908.70	51.719*
Interaction	58.14	3	19.38	1.103
Remaining error	4076.23	232	17.56	
Total	5055.89	239		
Total Score				
Subject matter	717.05	3	239.02	0.588
Over- vs under-achievers	2219.13	1	2219.13	5.462*
Interaction	503.27	3	167.76	0.413
Remaining error	71494.52	176	406.21	
Total	74933.99	183		

*Significant at the .05 level.

TABLE B.2--Analysis of Variance of Motivational Scores (Factor 1 thru 7, Plus Total Females) for Under- and Over-Achievers from Four Academic Areas.

Source of Variance	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic
Factor I				
Subject matter	25.43	3	8.47	0.079
Over- vs under-achievers	1526.63	1	1526.63	14.258*
Interaction	174.10	3	58.03	0.542
Remaining error	18844.43	176	107.07	
Total	20570.60	183		
Factor II				
Subject matter	18.89	3	6.29	0.339
Over- vs under-achievers	2.17	1	2.17	0.117
Interaction	27.52	3	9.17	0.494
Remaining error	3267.13	176	18.56	
Total	3315.71	183		
Factor III				
Subject matter	2.63	3	0.87	0.620
Over- vs under-achievers	1.06	1	1.06	0.753
Interaction	3.76	3	1.25	0.887
Remaining error	248.69	176	1.41	
Total	256.15	183		

Factor IV				
Subject matter	8.02	3	2.67	0.360
Over- vs under-achievers	0.02	1	0.02	0.002
Interaction	1.76	3	0.58	0.079
Remaining error	1303.91	176	7.40	
Total	1313.71	183		
Factor V				
Subject matter	19.00	3	6.33	0.701
Over- vs under-achievers	115.84	1	115.84	12.838*
Interaction	25.58	3	8.52	0.945
Remaining error	1588.17	176	9.02	
Total	1748.60	183		
Factor VI				
Subject matter	10.45	3	3.48	0.443
Over- vs under-achievers	25.87	1	25.87	3.297
Interaction	16.79	3	5.59	0.713
Remaining error	1380.95	176	7.84	
Total	1434.08	183		
Factor VII				
Subject matter	0.89	3	0.29	0.062
Over- vs under-achievers	78.26	1	78.26	16.385*
Interaction	17.34	3	5.78	1.210
Remaining error	840.60	176	4.77	
Total	937.10	183		
Total Score				
Subject matter	1214.88	3	404.96	1.078
Over- vs under-achievers	15248.20	1	15248.20	40.608*
Interaction	843.65	3	281.21	0.748
Remaining error	87114.76	232	375.49	
Total	104421.49	239		

*Significant at the .05 level.