THE RELATION BETWEEN ANXIETY AND MOTOR PERFORMANCE IN YOUNG CHILDREN

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
DUANE CONRAD MILNE
1970

This is to certify that the

thesis entitled

THE RELATION BETWEEN ANXIETY AND

MOTOR PERFORMANCE IN YOUNG CHILDREN

presented by

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has been accepted towards fulfillment
of the requirements for

Ph.D. **degree in** Physical Education

Philip L. Rarick
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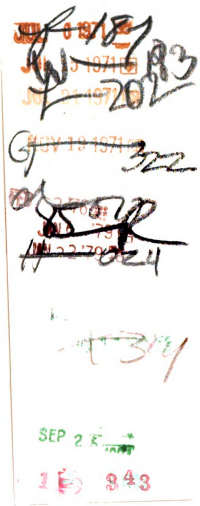
Date July 30, 1970

O-169



ABSTRACT

THE RELATION BETWEEN ANXIETY AND MOTOR PERFORMANCE IN YOUNG CHILDREN

By

Duane Conrad Milne

The purpose of this study was to determine the relationship between anxiety and motor performance of young children. These relationships were also examined for possible race and sex differences among the children.

Two hypotheses were proposed: (1) no significant relationships would exist between anxiety measures and level of motor performance; (2) no significant differences due to sex and race would be found in the relationship between the level of anxiety and level of motor performance.

The sample of 100 boys and 100 girls each from kindergarten, grade one and grade two was randomly determined by proportional stratification by school in Battle Creek, Michigan.

Each child was administered the Motor Performance Battery which included items for agility, power, flexibility, endurance and reaction time. Strength and static balance items, originally included, were excluded from the final statistical analysis due to truncation of the data.

Anxiety measurements were obtained by the Palmar Sweat Test, the General Anxiety Scale for Children, the Test Anxiety Scale for Children and the Teacher Rating Scale. Kindergarten children were not administered the Test Anxiety Scale for Children as they had not yet encountered the "testing experience."

A multiple regression analysis was employed to estimate relationships between each dependent variable and a set of independent variables. The dependent variables were the motor performance items and the independent variables included the anxiety measures, sex, and race. The same statistical technique was employed to determine the effect of race and sex upon the relationship of the motor performance items and the anxiety measures.

The results of the present study suggest that a high level of anxiety has a detrimental effect upon motor performance of young children. The analysis also indicated that race and sex are significant factors in some relationships of anxiety and motor performance, namely the Sit and Reach, the 30-yard dash and the 400-foot shuttle run.

THE RELATION BETWEEN ANXIETY AND MOTOR PERFORMANCE IN YOUNG CHILDREN

By

Duane Conrad Milne

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Health, Physical Education
and Recreation

1970

DEDICATION

To my wife and children for their unfailing support and encouragement through these stressful times

ACKNOWLEDGMENTS

The author wishes to acknowledge the invaluable assistance of Dr. Philip Reuschlein who assumed the direction of this dissertation after the death of Dr. Arthur H Steinhaus. The initial direction by Dr. Steinhaus is deeply appreciated as it was an honor and a privilege to have been associated with such an extraordinary man. In addition, the author would like to thank Dr. Vern Seefeldt and Dr. Imogene Popejoy of the Department of Health, Physical Education and Recreation, Dr. Joseph Byers and Dr. Stephen Yelon of the Department of Educational Psychology for their guidance. Particular thanks is also expressed to the members of the Battle Creek Project Team and fellow colleagues for their assistance in collection of the data. To my wife Mary, the greatest of thanks for the many hours spent in the typing of this manuscript.

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CHAPTER I

INTRODUCTION

Introduction

The study of personality of young children is becoming increasingly important in our rapidly changing society. The space age in which we live requires new ideas and concepts, not only in space vehicles and systems but also in an educational system to prepare children to meet these new demands. Research in the area of learning has indicated that children now learn greater amounts of information at a higher level of difficulty and learn it at an earlier age. Educators have responded to the changing educational demands by implementing new curriculums, devising new instructional aids, and improving teaching techniques; parents have responded by enrolling their children in pre-nursery schools in an effort to give them an initial "head-start"; and teachers have responded by assigning homework in the early grades. For the primary school child, the word "test" has now become a regular part of his vocabulary.

What effect can these above mentioned developments have upon the child? Will these stresses have any far

reaching effects upon the child's personality development? Will these stresses affect the child's learning and performance?

Anxiety or stress in one form or another and in varying degrees is common to everyone--child and adult. In some cases it may act as a spur to accomplishment, and in others, it may be emotionally crippling and lead to ineffectiveness and despair. When a child experiences anxiety the compelling nature of the internal anxiety signalling stimuli renders him unable to attend to the external cues relevant to, and necessary for, successful task performance.

Psychologists have carried out numerous studies in an attempt to determine the effect of stress or anxiety upon performance and learning. Studies reporting that anxiety negatively affects academic achievement and intelligence are more abundant in the literature than those reporting a positive relationship or no relationship at all.

Research in motor learning indicates that anxiety affects complex learning tasks in a different manner than simple learning tasks. There is a tendency for the high anxious subjects to be inferior in performance to low anxious subjects as the difficulty of the task increases. The reverse is true on less difficult task components.

Low anxious subjects have been found to perform more effectively under stress in complex tasks than under normal conditions.

Need for the Study

In the early school years the young child is forced to begin evaluating himself on the basis of his own skills and attributes. The process of developing special skills is encouraged not only by the school but by the peer group. Acceptance by the peers depends primarily on what the child can offer--his talents, his assets, his skills. The child who has no skills or desirable characteristics is usually rejected quickly and pointedly. Ability in motor performance or athletic skills has usually been considered, in our society, a quick way of graining social acceptance. The awkward child may experience rejection just as quickly as the skillful child gains acceptance. Rejection by peers and the concomitant anxiety is an experience that can have a long lasting and damaging effect on the child's personality development. Therefore, there is a need to determine whether the level of motor performance is related to the level of anxiety in young children.

There have been very few studies utilizing anxiety scales involving children as young as six or seven years of age. The majority of such studies focus between the ages of 10 and 12 years or older. Of these, none attempt to determine the relationship between anxiety, as measured

either by the Palmar Sweat Test or by Sarason's tests of anxiety[1] and motor performance.

Purpose of the Study

The purpose of this study is to investigate the relationships between anxiety and motor performance of young children in kindergarten, grade one, and grade two.

Hypotheses

1. No significant relationships will exist between anxiety measures and measures of motor performance.
2. No significant differences due to sex and race will be found in the relationship between the level of anxiety and level of motor performance.

Scope of the Study

The absence of large scale studies relating anxiety to other dimensions of personality and behavior can be traced in part to the difficulty of launching and sustaining such a massive research program.

A Physical Education Curriculum Project now under way in Battle Creek, Michigan, offered an excellent opportunity for this study and the collection of data that may be unique for this age level.

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[1]Description of the anxiety scales may be found in Appendix A and of the Palmar Sweat Test on page 24 in Chapter III.

A stratified random sample proportionally allocated, was drawn from this school system. The sample consisted of 100 children of each sex, from kindergarten, grades one and two (N=600).

Definition of Terms

A. For the purpose of this study, the general term anxiety will be defined as an unpleasant conscious experience, communicable by questionnaire and having physiological concomitants. Individual anxiety constructs are as follows:

1. Physiological Arousal: the response of the sympathetic nervous system during stressful situations characterized by such physiological factors as emotional sweating, as measured by the Palmar Sweat Test.
2. General Anxiety: a conscious experience characterized by fearfulness and apprehension as measured by Sarason's General Anxiety Scale for Children (GASC) (Sarason, 1960).
3. Test Anxiety: an unpleasantness together with vague feelings of uneasiness and bodily tension in response to test-like situations measured by Sarason's Test Anxiety Scale for Children (TASC) (Sarason, 1960).
4. Teachers Rating Scale: a scaling response to a variety of questions dealing with the child's

behavior prepared by Sarason and his colleagues (Sarason, 1960).

B. Motor Performance refers to the children's level of performance compared to their peers, in tests of power, agility, flexibility, static balance, reaction time, and endurance.

C. Young Children is in reference to boys and girls in kindergarten, grade one and two who are between five and eight years of age.

Limitations of the Study

In a study of this magnitude there are certain limitations that must be noted.

1. The sample involved pupils of the elementary school system of Battle Creek, Michigan, and the generalizations may be limited by some rather specific characteristics of this community.

2. The large testing team employed would no doubt introduce some inconsistencies in the scoring for any one test even though specific instructions were provided.

3. The environmental influence may have affected the performance of some children since initial testing was done in a large crowded community college gymnasium and make-up tests were administered in the familiar confines of their school gymnasium. Even the difference between morning or afternoon testing times may have affected performance.

4. The administering of the Palmar Sweat Test was accomplished with as little emotional arousal as possible. However, the arousal level measured may not be indicative of the child's base line and could only be confirmed with many trials over a period of time.

5. The validity of written test responses depends on the willingness of the respondent to admit to or ascribe to certain socially undesirable characteristics. As for example, "Do you get scared when you have to go into a dark room?" Young children, however, may be more inclined to accept questions at face value and respond honestly.

CHAPTER II

REVIEW OF THE LITERATURE

The greatest impetus to the study of anxiety and its behavioral correlates was provided by the construction of the Manifest Anxiety Scale by Taylor in 1953. Although some investigators (Faber & Spence, 1956; Cox & Sarason, 1954; Taylor, 1958), using the Taylor Manifest Anxiety Scale have presented contrary evidence, the bulk of the available findings suggest that high anxious subjects are affected more detrimentally by motivating conditions or failure reports than are subjects found lower in the anxiety score distribution. Further research by the Hullian "drive" theorists demonstrated that low anxious subjects were superior to high anxious subjects on the most complex or difficult tasks. On the least complex tasks, high anxious subjects were superior to low anxious subjects (Montague, 1953; Taylor, 1956; Sarason, 1959).

The Taylor Manifest Anxiety Scale was later modified by Castaneda and his colleagues (1956), to form the Children's Manifest Anxiety Scale (CMAS) for use in the upper elementary school grades four, five, and six. This form

consisted of 42 items plus 11 "lie scale" items designed to reveal flagrant falsification by the respondent. The following are illustrative of the anxiety items: "I worry most of the time"; "I am nervous"; "I blush easily."

Research by this group, using the CMAS indicated that anxious children performed less well than non-anxious children on relatively difficult and complex learning tasks. However, anxiety seems to facilitate certain other kinds of learning. High anxious children also tended to be less popular with their peers (Castaneda et al., 1956; Palermo et al., 1956). Specifically, the study of Palermo et al. (1956), using adult subjects, confirmed the theoretical expectation that anxious or highly motivated subjects would make significantly more errors in the learning task. The performance of the high anxious subjects when compared to low anxious subjects, was superior in simple learning situations such as classical conditioning but inferior in more complex tasks such as trial-and-error.

In comparing starting speed and movement speed of sixth grade children in a reaction time task with anxiety levels as measured by the CMAS, Palermo (1961) reported no significant difference due to the level of anxiety. Boys were found to be faster than girls in reaction time tasks. This study supports those of Kamin, 1955; Castaneda, 1956; and Faber and Spence, 1956; all of whom failed to find a significant relationship between the level of anxiety and

reaction time. Grice (1955), reported, however, that increasing the complexity of the reaction time task will impair performance of anxious subjects. The contradictions in the literature in regard to reaction time and anxiety level may in part be due to the type of anxiety scale employed as well as the age of the subjects. Some experimentors used college students while others used young children.

Reporting on fourth, fifth, and sixth grade children, Boyd et al. (1956) found that anxiety as measured by the CMAS was negatively related to school achievement (measured by the Iowa Every Pupil Test) and intelligence (measured by the Otis Quick Scoring Mental Ability Test, Form B). Higher negative correlations were found for the sixth grade children in comparison to the fourth and fifth grade children. A pattern emerged indicating that anxiety seemed to interfere more with the performance of girls than boys.

Using the CMAS, Lott and Lott (1968) failed to find a relationship between manifest anxiety and learning task performance (learning Spanish equivalents to English words). Evidence did indicate, however, that anxiety is negatively correlated with intelligence. Cowen et al. (1956), using the CMAS score as the measurement of anxiety, found that high anxiety in children relates negatively to intelligence (Otis Quick Scoring Mental Ability Test) and academic achievement (SRA).

Studying the effect of anxiety, as measured by the CMAS, on intelligence, Penny (1965) found nagative correlations between the level of anxiety and intelligence for girls in grades five and six. In a similar study, Feldhusen and Klausmeier (1962) reported negative correlations between the CMAS and the WISC IQ Test for both fifth grade boys and girls. Lunneborg (1964) reported negative correlations between the CMAS, GASC, TASC, and proficiency levels in reading and arithmetic.

The most thorough research inquiry concerning the development of anxiety and its correlates among elementary school children has been conducted by S. B. Sarason and his colleagues at Yale. They have developed the General Anxiety Scale for Children (GASC), the Test Anxiety Scale for Children (TASC) and the Teachers Rating Scale (TRS) (1960). Research using these measuring devices has supported the findings of Castaneda et al. Children who admit to fear and anxiety over school tests obtain slightly lower intelligence scores than children who report low anxiety. Children with high GASC scores also obtain low intelligence scores. A positive relationship (.55) between admitting to anxiety over tests and general anxiety has also been found. Boys are found to score lower on anxiety tests than girls, with high anxious boys performing less well in school and in tests of problem solving than low anxious boys. However, no difference was found between the problem solving ability of low and high anxious girls. Anxious boys

apparently become more flustered in problem solving situations and their performance is therefore negatively affected. Sarason explains the sex difference as either due to the greater social acceptability of expressions of worry and concern from girls than from boys, or a function of the inappropriateness of the measures used for girls.

Reporting on learning and problem solving tasks with fourth and sixth grade children, Stevenson and Odom (1965) found a negative correlation between T.A.S.C. and intelligence. The results for the achievement tests indicate a rather consistent tendency for children with high levels of anxiety to perform more poorly than children with lower levels of anxiety. Girls indicated slightly higher scores on the TASC than boys. I. G. Sarason (1957) employing S. B. Sarason's Test Anxiety Scale and the General Anxiety Scale with college students reported a significant correlation between the TAS and academic achievement. High test anxious subjects performed at a significant lower level than did low test anxious subjects. The GAS did not correlate significantly with college entrance scores but tended to correlate positively with their grade point average.

Matching children in grades two to five on such factors as grade, intelligence, age, and sex, Waite (1958) concluded that whatever it is that anxiety scales measure, it is highly related to the differences in performance level demonstrated in a card sorting task. His results indicated that low anxious children performed better than

high anxious children and that girls generally perform better than boys in a card sorting task. Sarnoff (1959) found that test anxiety correlates negatively with measured IQ and school achievement as well as with performance in experimental situations requiring new learning.

When comparing performance and anxiety, similar results are found whether the Taylor Manifest Anxiety Scale is used for adults or the CMAS, GASC, or the TASC is employed for children. The performance of low anxious subjects is superior to the performance of high anxious subjects in complex tasks. The performance of high anxious subjects is superior to the performance of low anxious subjects in simple tasks. The correlations of anxiety with intelligence and academic achievement are found to be negative, indicating the detrimental effect of anxiety.

In studying the effect of stress upon motor learning and performance, Carron (1968) reported that stress (electrical shock) introduced early in learning had a greater effect upon the performance of high anxious subjects than on low anxious subjects. When the stress was introduced late in performance, both high and low anxious groups suffered detrimental effects upon performance. In a motor learning task employing a stabilometer, Ryan (1962) found that as learning progressed, the group that indicated a sharp rise in arousal level, as measured by GSR conductance, also indicated a higher performance level than the group showing no arousal increase. Matarozzo and

Matarozzo (1956), using a pursuitmeter in a complex coordination task, indicated that subjects whose scores fell within the middle ranges of the Taylor Manifest Anxiety Scale (re. Taylor, 1956), performed better than those subjects at either end of the scale. High anxious subjects tended to perform at a lower level than did the low anxious subjects.

Using mirror drawing tasks with normal and emotionally aroused patients, Wechsler and Hartogs (1945) found that fine motor coordination tasks were adversely affected by anxiety.

Several studies have attempted to determine relationships between personality traits as measured by an all-encompassing personality test such as the California Psychological Inventory, and motor ability or physical fitness levels. Merriman (1960), using the California Psychological Inventory with high school boys, found that those boys who scored high on the motor ability test also scored high on such personality traits as dominance, poise, self-assurance, capacity for status, tolerance, sociability, and sense of well-being. He also concluded that motor ability rather than participation in athletics per se is a potent factor in the development of personality traits. Rarick (1949) found that the more proficient performers in motor skills showed a greater frequency of positive traits such as popularity, calmness, resourcefulness, attentiveness, and satisfactory scholastic adjustment when

compared to the inferior group of performers. The inferior group of performers showed a higher frequency of negative traits and were more often indicated as being shy, retiring, and tense. Lamb (1966) reported that junior high school girls who scored the highest on the motor educability test consistently scored the highest on the various tests of the California Psychological Inventory.

The "well adjusted" nursery school child as rated by observers has been reported by Smart and Smart (1963) to have earned higher scores on the Kraus-Weber fitness test than children who were characterized as immature.

In a study of children in grades three through six, Brown (1968) reported that physical performance, as measured by grip strength, standing long jump, and the 50-yard dash was not related to emotional development (personality as measured by social approachability and stability scores on the SAS Personality Test). It was found that physical performance and emotional development were discrete factors and had negligible reciprocal loadings in a factorial analysis and therefore were not related.

Using Cattell's Sixteen Personality Factor Questionnaire with high school boys, Tillman (1965) found that the boys who scored in the top 15 per cent on a physical fitness battery tended to be more dominant, more extroverted, more interested in people, more socially oriented than the boys who scored in the bottom 15 per cent of the battery.

The limited research available in this area tends to suggest that the child who is shy, withdrawn, introverted, less sure of himself, less proficient in motor skills, less physically fit and less popular with his peers also indicates greater anxiety. Children who are less proficient in physical skills are usually rejected by their peers which in turn may lead to greater anxiety and related symptoms.

In a complex motor skill task (basketball shooting for speed and accuracy) performed by children nine to eleven years old, McGowan (1965) found that under a competitive situation the high anxious children performed better than the low anxious children. Contradictory results were reported by Van Handel (1969), using the LaCrosse A-B Wall Test for basketball handling ability. He reported that as anxiety level increased (as measured by the IPAT Anxiety Scale) the skill proficiency decreased. In another study, Washington (1969) reported that although high anxious and low anxious rated college women demonstrated no significant difference on the motor performance tests the high anxious group did perform significantly better on the competitive stress task than on non-competitive task. She also found the anxiety level and the motor performance level of the high anxious group to be significantly related but no significance was found between the low anxious group's anxiety level and motor performance level. Keogh (1959) failed to find any significant

difference between motor ability or athletic participation and the California Psychological Inventory. One possible explanation why Keogh and Washington failed to find any significant differences between anxiety and level of motor performance may have been the fact that their subjects were college students whereas all the previous studies mentioned were conducted with children.

Since at least 1934 when Kuno (1934) published his classical work on human perspiration, it has been an established observation that palmar sweating reflects the existence of certain emotional states of tension and conflict within the human organism. Anatomically and functionally there are more sweat glands per square area on the palm secreting from five to ten times the amount of perspiration that is secreted by the rest of the body surface. Other areas of emotional sweating are the soles of the feet and under the arms. In a relaxed state, such as sleep, the palms are characteristically dry whereas in anxiety states excessive palmar sweating is clearly seen. Under ordinary conditions sweating of the palms is not influenced significantly by outside temperatures. Only when the subject reached the point where there was a danger of heat prostration or when the subject perceived such a danger, was there a significant influence of temperature upon palmar sweating (Kuno, 1934; Darrow, 1937). Palmar sweating is controlled by central autonomic impulses transmitted to peripheral nerves of the sympathetic system,

the terminal or post ganglionic fibers of which ramify between cells of the sweat glands and liberate acetylcholine at their endings (Dale, 1934). During emotional crisis the sympathetic system tends to discharge en masse. This does not mean, however, that parasympathetic reactions of which sweating is an example, are inhibited or inactive (Cannon, 1929). An increase in palmar sweat, in relation to sudden emotional change or sensory stimulation, has been observed repeatedly by many researchers using a variety of techniques. It has been used in experimental psychology and psychiatry as an indication of central autonomic activity or emotional change in psycho-neurotic patients.

Evidence for the validity of the palmar sweat test as a measure of anxiety is accumulating. A number of studies have demonstrated that the introduction of an arousing stimulus or the performance in an incomplete task has markedly increased the level of palmar sweating in subjects (Kuno, 1934; Mowrer, 1953; Davis, 1957; Haywood, 1961, 1962). Reliability indices from test-retest studies have been reported from .56 to .81 with .75 being the mean correlation (Ferreira et al., 1963; Davis, 1957; Beam, 1955; Silverman & Power, 1944). Lore (1966) obtained a reliability coefficient of .62 and a significant validity (.05) utilizing a palmar sweat test to measure anxiety changes in kindergarten children.

Winter and Ferreira (1963) reported that the factors of age and sex were relevant variables in palmar sweating in that females appeared as greater palmar sweaters than males at all age levels. The amount of palmar sweating was found to increase rapidly from birth to approximately age seven or eight when it started to decrease slowly with the years. The only other report of the sex variable found in the literature reported that males on the average had a higher palmar sweat level than females (Kawahata, 1960).

Several researchers (Calvin, 1965; Lotsof & Dowling, 1956; McGuigan, 1959; Winter et al., 1963) have attempted, without success, to correlate the palmar sweat index with various anxiety questionnaires. Although both types of measures validly reflect anxiety, they may be measuring two different facets of behavior. McGuigan (1959) hypothesized that the palmar sweat test was a better measure of situational, temporary anxiety while a questionnaire such as the Manifest Anxiety Scale was a better measure of anxiety as a stable characteristic of personality. Presumably the Manifest Anxiety Scale reflects the verbalized self-concept, which may be more permanent than the physiological inbalance reflected in the palmar sweat index. However, Winter et al. (1963) found the palmar sweat scores to be generally stable and characteristic of the subjects in all conditions. There seems to be no simple, adequate explanation available for the complex interrelationship of these two anxiety measures.

College subjects were required by Beam (1955) to learn a list of nonsense syllables prior to experiencing a life situation commonly considered to be anxiety-arousing. These stress situations were doctoral preliminary examinations, giving an oral report, and appearing in a dramatic production. The results indicated that anxiety created greater increments in palmar sweating and a detrimental effect in serial learning.

A study was designed by Davis (1957) to test directly the hypothesis that real-life stress can be related to the index of palmar sweat. The palmar sweat scores of college students were taken two weeks prior to an examination and two weeks later. The examination prints were found to be significantly higher than the other two prints. Davis took this to mean that palmar prints can be meaningfully related to conditions of real-life stress.

The available literature tends to support the Palmar Sweat Test to be a valid and reliable measure of anxiety or arousal whether in adults or children.

The literature generally reflects the notion that anxiety has a detrimental effect upon performance whether academic, verbal, or motor. The major problem seems to be the definition of anxiety which tends to be as varied as the reported studies. Some studies attempt to isolate the concept of anxiety by self-reporting questionnaires specifically related to anxiety whereas others attempt to cover the complete spectrum of personality with one all

inclusive test, i.e., the California Psychological Inventory. Psychologists seem to be more interested in anxiety and performance in respect to fine motor skills whereas physical educators attempt to determine the relationship in gross motor skills. The gross motor skills tend to vary all the way from complex sport skills to novel motor tasks.

CHAPTER III

RESEARCH METHODS

The purpose of this study was to investigate the relationship between anxiety and motor performance of young children. These relationships were also examined for possible race and sex differences among the children.

Experimental Design

The sample size of 100 boys and 100 girls each from kindergarten, grade one, and grade two was arbitrarily determined. Each of the 2,868 children in kindergarten, grade one, and grade two in the Battle Creek Public School system was assigned a number for random sampling purposes. This total number of children was then identified by school, grade, and sex. The sample was then randomly determined by proportional stratification by school. For example, in order to select the 100 boys required for the kindergarten sample, a percentage of the number of boys in the kindergarten classes in school A compared to the total number of kindergarten boys in all the schools was determined. This percentage in turn was taken of the desired 100 boys for the sample and the resultant number of boys was randomly

chosen from that particular school. This procedure was followed for both boys and girls in all three grades. The total sample, N=600, included K=200, I=200, and II=200.

The testing team was comprised of two Michigan State University physical education professors, the project team from the Battle Creek Public Schools, and a number of graduate students from Michigan State University.

The initial round of testing began in March 1969. The subjects from each of the 16 elementary schools were transported to the Kellogg Community College gymnasium. In a two-hour testing period, physical growth, motor performance, and motor development measures were taken. Each testing station was under the direction of either a professor or a graduate student majoring in growth and development. Undergraduates from Kellogg Community College participated as assistants at the various stations. Testing in the areas of social-psychological development, self-concept, and the various make-up tests were completed at the individual schools.

A description of each motor performance test utilized in the Battle Creek Project may be found in Appendix B. The motor performance test battery used for this study included the following variables:

a. Agility . . . . . .40-yard shuttle run
b. Power . . . . . .30-yard dash
standing long jump
c. Flexibility . . . . . .Well's Sit and Reach
d. Endurance . . . . . .400-foot shuttle run

e. Static Balance* . . . . . .one-inch rail balance right foot, left foot
f. Strength* . . . . . .hand dynamometer
g. Reaction Time . . . . . .Athletic Performance Analyzer

In an effort to find an anxiety test that would relate to a motor performance battery of tests, four anxiety measures, the Palmar Sweat Test, the General Anxiety Scale for Children, the Test Anxiety Scale for Children and the Teacher Rating Scale, were chosen. The Palmar Sweat Test attempts to measure the physiological level of anxiety or arousal in the individual. The two self-reporting tests, the GASC and the TASC attempt to measure a psychological basis of anxiety, the former considered general and latter more specific. The Teachers Rating Scale was an attempt to measure the child's level of anxiety as seen by another person.

Palmar Sweat Test

The materials, preparation and measurement procedures of the palmar sweat test used in this study were similar to those by Ferreira and Winter (1963). Three steps were involved: (1) painting the palmar surface of the middle finger tip with a solution of ferric chloride,

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*During the data collection it was observed that the majority of the children were unable to register a reading on the hand dynamometer and that most children were unable to balance on the one-inch rail. Preliminary analysis of the data revealed that the results of both items were badly truncated. The decision was made to drop the data of these items from the motor performance battery and subsequent analysis.

(2) placing the finger in contact with the paper which was impregnated with tannic acid for two minutes, (3) determining the amount of ferric tannate left on the paper. Palmar sweat dissolves the ferric chloride solution and the latter reacts with the tannic acid, leaving a permanent stain on the paper which varies in color from light grey to dark purple. The relative darkness or density of the print is directly proportional to the amount of sweating and anxiety, and was measured with a densitometer. This instrument quantifies print density by measuring the relative amount of light that can pass through the print. The apparatus used was similar in design to that used by Mowrer (1953), and Ferreira and Winter (1963).

Measurements of Prints

The prints are read by adjusting the light intensity to give a full scale reading (20 microamperes) when an unused portion of the filter paper is over the 0.25-inch hole where the photocell is located. The stained area is placed over the photocell opening and the darkest portion of the print is found by adjusting the paper portion manually, as dictated by visual inspection. This reading is then subtracted from the full scale reading of twenty and the difference is recorded as the subject's anxiety score. To determine the reliability of the print readings,

Dr. Imogene Popejoy[1] read 100 sample prints. An inter-judge reliability coefficient of .98 was calculated.

Anxiety Scales

The anxiety tests used in the study were developed by Sarason et al. (1956). The battery included the General Anxiety Scale for Children, the Test Anxiety Scale for Children, and the Teachers Rating Scale. An average positive correlation of .55 was reported between the TASC and the GASC and a low average positive correlation of .20 between the TASC and the Teachers Rating Scale. Descriptions of these tests may be found in Appendix A.

Test Anxiety Scale for Children

Thirty questions are asked, twelve of which use the word "test." The children respond by either circling the appropriate "yes" or "no" on the answer sheet provided. Their anxiety score is the total number of "yes" responses. This test was developed for elementary school children excluding kindergarten.

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[1]Dr. Imogene Popejoy is a member of the faculty in the Health, Physical Education Department at Michigan State University. While at the University of Illinois she perfected her technique in palmar sweat reading.

General Anxiety Scale for Children

The original test consisted of 45 items but due to its length and its high inter-item correlation only 30 questions were used including eight questions that are considered "lie scale" questions. Lie scale questions refer to experiences that are essentially universal among children: i.e., all children, if they are able to report their experiences without distortion, would answer "yes" to most if not all of the questions. The word "ever" is used to further clarify the situation for the child, i.e., "Do you ever worry?" Sarason reported that many of the children who obtained relatively low scores on the anxiety scale scored high on the lie scale thus distorting the anxiety scores. In an attempt to more accurately measure anxiety only the scores of those children who scored three or less on the lie scale were used.

The anxiety score is the total number of "yes" responses. Since kindergarten children are not tested nor familiar with the word "test," they were not administered the Test Anxiety Scale for Children.

Teacher Rating Scale

The teacher was required to rate each child on a scale from (1) the child is very often like this, to (5) the child is hardly ever like this, for 17 questions.

Statistical Treatment of the Data

A multiple regression analysis was employed to estimate relationships between each dependent variable and a set of independent variables. The dependent variables were the motor performance items and the independent variables included the anxiety measures, sex, race, and race-sex interaction. Normalized weights (beta weights) were assigned to each independent variable as a means of indicating the contribution of each in accounting for the variation of the dependent variable above that accounted for by its mean. In using such an analysis one may not only determine which relationship is significant but to what extent it is significant, i.e., a ranking of the importance of each relationship.

To determine the effect of race and sex upon the relationship of the dependent and independent variables, motor performance items and anxiety measures respectively, a similar multiple regression analysis was used.

CHAPTER IV

RESULTS AND DISCUSSION

The purpose of this study was to investigate the relationship between anxiety and motor performance of young children. These relationships were also examined for possible race and sex differences among the children.

Hypothesis One

Hypothesis One: No significant relationships will exist between anxiety measures and level of motor performance.

Each motor performance item was compared to each anxiety measure with F-tests being calculated from the multiple regression analysis. Table 1 indicates the F-test value for each relationship. Those values followed by a positive sign in parentheses indicate a facilitating effect of anxiety upon motor performance.[1] All other

[1]An intercorrelation matrix for the dependent and independent variables may be found in Appendix C. The regression equations for each dependent variable may be found in Appendix D.

values indicate a detrimental effect of anxiety upon the level of motor performance as indicated by low performance levels.

TABLE 1.--F-tests calculated from the multiple regression analysis of anxiety and motor performance scores for boys and girls (N=370)[a] in kindergarten, grades one and two.

	Palmar Sweat	GASC	TASC[b]	TRS
Shuttle Run	1.03	1.09(+)	.01	1.42
Standing Long Jump	1.07	1.77	.29(+)	1.09
30-Yard Dash	.00	.06	.30	7.08**
Well's Sit & Reach	12.33**	.09	.04(+)	4.37*
400-Foot Shuttle	2.60	2.53(+)	2.07	4.73*
Reaction Time (N=241)[c]	.09	.97	2.28	1.38

*Significant at the .05 level
**Significant at the .01 level
(+)Indicates facilitating affect of anxiety upon motor performance.

[a]The lie scale embedded in the GASC was responsible for reducing the original sample (N=600) by 163 subjects. The remaining 67 subjects were dropped due to incomplete data in the motor performance battery and anxiety measures as well as in other areas of the test battery. In order that a proper analysis could be run, a score on each test was required for each subject.

[b]The TASC was not administered to the kindergarten children. Sarason (1956), suggested that it was not really applicable to children at this level since they were not really aware of the "testing experience." The TASC data presented was run only for grades one and two.

[c]Due to the length of time required for administering reaction time not all subjects were tested.

Although only four significant F-values are indicated among anxiety measures and performance levels, individual power tests indicated that the majority of the relationships may be placed in the reserve judgment region. This suggests that the higher the level of anxiety, on any particular measure, the lower the level of motor performance. Twenty of the 24 F-values indicate a detrimental effect of anxiety upon the level of motor performance.

When the contribution of each of the variables is held constant in the comparison, the relationship between the Well's Sit and Reach measure of flexibility and the Palmar Sweat Test is highly significant at the .01 level. This indicates that children who demonstrate a high level of anxiety with a high score on the Palmar Sweat Test score significantly lower on the Well's Sit and Reach flexibility test.

Muscles normally exhibit a very mild state of contraction referred to as tone or tonus, which in skeletal muscles is dependent upon connections with the central nervous system which in turn would increase the level or effect of muscle tone (DeCoursey, 1961). The high level of muscle tonus together with reduced joint flexibility that has been identified in tense individuals may be a plausible explanation for such a finding. The Palmar Sweat Test, purported to be a physiological measure of anxiety or arousal, could certainly identify such a relationship. Although several of the relationship levels are not

statistically significant, the Palmar Sweat Test did indicate the detrimental effect on all performance measures.

The Teachers Rating Scale indicated significant relationships with three performance measures, the 30-Yard Dash (.01), the Well's Sit and Reach (.05), and the 400-Foot Shuttle (.05) when the contribution of each of the variables is held constant, i.e., accounting for the variability of the other variables. All three relationships as well as the remaining non-significant relationships indicated that the higher the level of anxiety in the child as viewed by the teacher, the lower or poorer were the levels of performance. Tense or highly anxious individuals have, almost without exception, restriction in joint flexibility (Rathbone, 1957). This inflexibility may be due to the inability of the muscles to relax sufficiently to make a full range of movement possible. Such restriction may account for the detrimental effect on anxiety upon performance in the 30-Yard Dash, the 400-Foot Shuttle Run and the Well's Sit and Reach flexibility test.

In summary, the hypothesis that no significant relationship will exist between anxiety measures and level of motor performance is rejected. Twenty of 24 relationships indicate a relationship between a high level of anxiety and a low level of motor performance with four relationships being significant. This is consistent with most findings in the literature where level of performance has been negatively related to anxiety level.

Implication

Children who display a high level of anxiety may require a different teaching approach. The teacher or coach may attempt to "relax" these children, either by a period of light or moderate activity or by complete inactivity. It may be that some children will respond to one method and not the other. Regardless of techniques employed, one must be aware of the detrimental effect that anxiety has upon performance for many children, whether in the classroom or on the athletic field and attempt to overcome this problem.

Hypothesis Two

Hypothesis Two: No significant differences due to sex and race will be found in the relationship between the level of anxiety and level of motor performance.

In order to determine the effect of anxiety upon the level of motor performance due to sex and race, F-test were calculated from the multiple regression analysis for each of the combinations of sex and race. Table 2 indicates the F-value for each relationship for female-Negroes.

Two relationships, the Teachers Rating Scale with the 30-yard dash and the Palmar Sweat Test with the Well's Sit and Reach flexibility test were significant at the .01 and .05 levels, respectively. For female-Negroes, the

TABLE 2.--F-tests calculated from the multiple regression analysis of anxiety and motor performance scores for female-Negroes (N = 46).

	Shuttle Run	Standing Long Jump	30-Yard Dash	Well's S & R	400-Foot Shuttle	Reaction Time[a]
Palmar Sweat	.17(+)	.52(+)	.52(+)	4.88*	.21(+)	.11(+)
GASC	.01(+)	.51	.11	.36	.18	.30(+)
TRS	1.04	2.68	7.07**	3.28	.53	.00(+)

*Significant at the .05 level of confidence.
**Significant at the .01 level of confidence.
(+) Indicates facilitating affect of anxiety upon motor performance.

[a]Reaction time N=31.

higher the score on the Palmar Sweat Test, the lower the level of performance in flexibility. The higher the level of anxiety, depicted by the Teachers Rating Scale, the lower the level of proficiency in the 30-Yard Dash. Ten of 18 relationships indicate an inverse relationship between anxiety and performance.

The results of the F-tests calculated from the multiple regression analysis for female-whites are presented in Table 3.

The only significant relationship in this table was between the Teachers Rating Scale and Reaction Time. The higher the level of anxiety in the student, as purported by the teacher, the poorer was the level of performance

TABLE 3.--F-tests calculated from the multiple regression analysis of anxiety and motor performance scores for female-whites (N=144).

	Shuttle Run	Standing Long Jump	30-Yard Dash	Well's S & R	400-Foot Shuttle	Reaction Time[a]
Palmar Sweat	.89	1.66	2.93	1.63	.00	.00(+)
GASC	.04	.48	.28(+)	.14	.47	.01(+)
TRS	15	.03(+)	.64	1.58	.70	3.85*

*Significant at the .05 level.
(+)Indicates facilitating affect of anxiety upon motor performance.

[a]Reaction time N = 87.

in reaction time. Although this was the only significant relationship, 14 of 18 relationships indicate a detrimental relationship between anxiety and the level of performance.

The results of the F-tests calculated from the multiple regression analysis for male-Negroes are presented in Table 4.

The only significant relationship for male-Negroes was between the Palmar Sweat Test and the Shuttle Run (.05). This indicates that the higher the score on the Palmar Sweat Test, the poorer the level of performance on the Shuttle Run. Thirteen of 18 relationships, suggest that the higher the level of anxiety, the more detrimental the relationship with level of performance.

TABLE 4.--F-tests calculated from the multiple regression analysis of anxiety and motor performance scores for male-Negroes (N=40).

	Shuttle Run	Standing Long Jump	30-Yard Dash	Well's S & R	400-Foot Shuttle	Reaction Time[a]
Palmar Sweat	5.50*	.63	.19	1.20	.01(+)	.01(+)
GASC	2.03	2.87	3.08	.46(+)	.20	2.47
TRS	.58	.20(+)	.98	.98	.01	2.09(+)

*Significant at the .05 level.
(+)Indicates facilitating affect of anxiety upon motor performance.

[a]Reaction time N=26.

The results of the F-tests calculated from the multiple regression analysis for male-whites are presented in Table 5.

Significant relationships are indicated between the Palmar Sweat Test and the Well's Sit and Reach (.01) and the 400-Foot Shuttle (.05). The higher the score on the Palmar Sweat Test, the poorer the performance level in the Well's Sit and Reach (flexibility) test and the 400-Foot Shuttle.

The General Anxiety Scale for Children and two performance measures the Shuttle Run and the 400-Foot Shuffle indicated significant relationships at the .01 level. The higher the score on the GASC the better the performance

TABLE 5.--F-tests calculated from the multiple regression analysis of anxiety and motor performance scores for male-whites (N=138).

	Shuttle Run	Standing Long Jump	30-Yard Dash	Well's S & R	400-Foot Shuttle	Reaction Time[a]
Palmar Sweat	.03(+)	.25	1.96(+)	6.85**	3.81*	.18
GASC	6.60**(+)	.29	.00(+)	.02	7.08**(+)	.75
TRS	.00(+)	.63	.95	1.46	3.39	.43

*Significant at the .05 level.
**Significant at the .01 level.
(+)Indicates facilitating affect of anxiety upon motor performance.

[a]Reaction time N=97.

level on the Shuttle Run and the 400-Foot Shuttle Run. This was the first and only time that significant relationships between a measurement of anxiety and a performance measure failed to indicate a detrimental relationship. This was also the only time that the GASC indicated any significant relationship with any of the performance measure. Why the GASC was significant with some performance measures for only the male-whites is not readily explainable. Twelve of 18 relationships, indicate that the level of anxiety has an inverse relationship with the level of performance.

In summary, the hypothesis that there will be no significant differences due to sex and race in the relationship between the level of anxiety and level of motor performance is rejected. The dichotomy of race and sex and the subsequent analysis indicates that there are several significant differences between the level of anxiety and level of motor performance. Male-whites indicated four significant relationships; the Palmar Sweat Test with the Well's Sit and Reach and the 400-Foot Shuttle Run; the GASC with the Shuttle Run and the 400-Foot Shuttle. The Palmar Sweat Test indicated a detrimental relationship between the level of anxiety and level of motor performance whereas the GASC indicated a facilitory relationship. A possible explanation for such a contradictory finding may be that each anxiety test may actually be measuring a completely different aspect of anxiety--one more physiological, the other more psychological. The male-Negroes indicated one significant relationship, the Palmar Sweat Test with the Shuttle Run, where the level of anxiety had a detrimental relationship with the motor performance level. The female-whites exhibited one significant relationship, the TRS with Reaction Time where again the high level of anxiety had a detrimental relationship with performance. The female-Negroes demonstrated two significant relationships, the Palmar Sweat Test with the Well's Sit and Reach, and the TRS with the 50-Yard Dash. Both relationships indicated the detrimental association of anxiety with

performance. Surprisingly only one relationship was duplicated, the Palmar Sweat Test with the Well's Sit and Reach flexibility test, and that was between the male-whites and the female-Negroes. No explanation is offered to account for such a finding or the absence of any pattern.

An an attempt to determine whether any one of the eight significant relationships was significantly different from its opposite race counterpart, a t-statistic was calculated using the regression coefficients. For example, the regression coefficient of the significant relationship (.05) between the Palmar Sweat Test and the Well's Sit and Reach Flexibility Test for female-Negroes was compared to the regression coefficient of the non-significant relationship between the same variables for females-whites (see Tables 2 and 3).

$$t = \frac{\beta_{fn} - \beta_{fw}}{S_{diff}} \qquad \text{where:} \quad S_{diff} = \sqrt{S_{F_{fn}} + S_{F_{fw}}}$$

and where:

β_{fn} equals the regression coefficient of female-Negro in relation to the Palmar Sweat Test and the Well's Sit and Reach Test.

β_{fw} equals the regression coefficient of female-white in relation to the Palmar Sweat Test and the Well's Sit and Reach Test.

S_{diff} equals the square root of the sum of the standard errors of the regression coefficient for female-Negro and female-whites in relation to the Palmar Sweat Test and the Well's Sit and Reach Test.

The value of t = 1.41 was not significant at the .05 level, thus indicating that the relationship between the Palmar Sweat Test and the Well's Sit and Reach Flexibility Test was not significantly different for female-Negro and female-whites. This may have been expected since both relationships were out in the tail of the probability curve and in the same direction.

In comparing the significant relationship (.01) between the Teachers Rating Scale and the 30-Yard Dash for female-Negro and the non-significant relationship for the female-white, the t-value = 1.73 was significant at the .05 level. This indicates a significant difference in the relationship between the Teachers Rating Scale and the 30-Yard Dash for the female-Negro than for the female-white. Thus the level of anxiety as determined by the Teachers Rating Scale seems to have a greater detrimental relationship with the level of performance in the 30-Yard Dash for the female-Negro than for the female-white.

In comparing the significant relationship (.05) between the Teachers Rating Scale and Reaction Time for female-white with the non-significant relationship for the female-Negro the t-value = 1.07 was not significant at the .05 level. The level of anxiety as depicted by the Teachers Rating Scale does not significantly distinguish between female-white and female-Negro in speed of reaction time.

In comparing the significant relationship (.05) of the Palmar Sweat Test and the Shuttle Run for the male-Negro with the non-significant relationship for the male-white, the t-value = 2.16 was significant at the .05 level. The level of anxiety as indicated by the Palmar Sweat Test seems to have a significantly greater relationship to the level of performance in the Shuttle Run for male-Negro. This detrimental relationship was not demonstrated for the male-white.

In comparing the significant relationship (.01) between the Palmar Sweat Test and the Well's Sit and Reach Flexibility Test for male-white with the non-significant relationship for male-Negro, the t value = .01 was not significant at the .05 level. The relationship between the level of anxiety as indicated by the Palmar Sweat Test and the performance level on the 400-Foot Shuttle was not significantly different between male-white and male-Negro.

In comparing the significant relationships between the General Anxiety Scale for Children with the Shuttle Run (.01) as well as the 400-Foot Shuttle (.01) for the male-whites with the non-significant relationships of the same variables for the male-Negro, the t values were 2.48 and 2.07 respectively. Both are significant at the .05 level. These results indicate that the high level of anxiety as measured by the GASC has a significantly greater relationship with the level of performance in the Shuttle Run and the 400-Foot Shuttle Run for male-white than for

male-Negro. The results surprisingly indicate that the higher the anxiety the better the level of performance for the male-white.

In summary, four of the eight t-tests indicated a significant difference in relationship between a specific anxiety measure and a motor performance item for the opposite counterpart in the race-sex analysis. Two of the relationships as indicated by the Palmar Sweat Test and Teachers Rating Scale demonstrated a detrimental association of anxiety with motor performance level. The Palmar Sweat Test was able to significantly distinguish between male-Negroes and male-whites in the performance of the Shuttle Run. The TRS was able to significantly distinguish between female-Negroes and female-whites in the performance of the 30-Yard Dash. It is interesting to note that both significant t-tests were between Negroes and whites and both motor performance items involved running. The indication suggests that Negroes were more adversely affected by the level of anxiety than whites in the performance of running. The remaining two relationships as indicated by the General Anxiety Scale for Children demonstrated the facilitory effect of anxiety level upon motor performance level. The GASC was able to significantly distinguish between male-whites and male-Negroes in the performance of the Shuttle Run and the 400-Foot Shuttle Run. Why the GASC demonstrated a significance for male-whites is not readily

explainable unless the male-whites were more expressive of their anxiety than the male-Negroes in the GASC.

Supplementary Findings

Although the study was not directly concerned with the comparison of Negroes and whites, in regard to levels of motor performance or anxiety, the data are nevertheless interesting. There is a paucity of studies dealing with the comparison of Negro and white children in anxiety measures as well as motor performance items. The following data are therefore included in this writing for further information.

The means and standard deviations for the combinations of race-sex in relation to the anxiety measures are presented in Table 6.

Table 6 indicates that males have a higher mean score on the Palmar Sweat Test than females but a t-test analysis indicated that the difference was not significant. In the only two studies reporting sex differences, Ferreira and Winter (1965) found that females were greater palmar sweaters than males whereas Kawahata (1960) reported that males on the average had a higher sweat level than females. Racial differences are also evident with whites indicating a significantly greater Palmar Sweat Test mean score than Negroes. A two sample t-test indicated that male-whites and female-whites demonstrated significantly greater Palmar Sweat Test scores than male-Negroes and female-Negroes

TABLE 6.--Means and standard deviations for race-sex in relation to anxiety scales.

Anxiety Scales*	Male-White		Male-Negro		Female-White		Female-Negro	
	X	s.d.	X	s.d.	X	s.d.	X	s.d.
Palmar Sweat	8.21	4.82	5.71	4.15	7.61	4.45	5.28	4.12
GASC	16.62	5.16	18.35	5.09	19.55	4.38	19.91	3.71
TRS	34.46	11.56	38.58	13.00	35.17	10.79	38.11	12.45

*Units of measurement:
Palmar Sweat Test: microamperes
GASC: number of affirmative responses in 30 questions
TRS: cumulative score of 17 questions on a 1-5 scale

respectively. The GASC and the TRS did not demonstrate significant differences for either sex or race. Studies by Malmo (1965) and Juniper (1967) with adult subjects and using finger sweating and finger sweat-gland counts respectively reported racial differences with whites being higher in both categories than Negroes. This difference in the level of sweating was hypothesized as being due to a greater number of sweat glands for Negroes. However, studies by Thomson (1954) and Johnson (1965) failed to demonstrate any significant differences in number of active sweat glands between the races.

On the self-reporting GASC and on the Teachers Rating Scale, sex and race differences are also indicated but failed to reach an acceptable level of significance. Males indicate less anxiety than females and whites indicate less anxiety than Negroes on both the GASC and the TRS. The sex differences are in agreement with Sarason's findings in that males scored lower than females on both the GASC and TRS. No comparison studies were found for racial differences in these tests of anxiety.

The means and standard deviations for the combinations of race-sex in relation to level of motor performance are presented in Table 7. The t-test statistic was utilized to test the statistical significance of the motor performance items.

TABLE 7.--Means and standard deviations for race-sex in relation to motor performance items.

Motor Performance Tests	Male-White		Male-Negro		Female-White		Female-Negro	
	X	s.d.	X	s.d.	X	s.d.	X	s.d.
Shuttle Run (seconds)	13.53	1.51	13.52	1.42	14.24	1.55	14.25	1.77
Standing Long Jump (inches)	42.33	8.88	42.60	8.45	38.27	6.81	37.80	7.75
30-Yard Dash (seconds)	5.69	.80	5.39	.37	6.12	.90	5.84	.80
Sit and Reach (inches)	11.54	2.01	11.80	2.18	12.07	1.89	11.54	2.22
400-Foot Shuttle (seconds)	47.04	7.74	46.07	5.69	48.45	5.25	48.69	5.38
Reaction Time (1/100 seconds)	3.81	1.20	4.07	1.78	4.23	1.26	4.17	1.15

Table 7 indicates a general sex trend with males demonstrating a significantly higher motor performance level in the Shuttle Run, Standing Long Jump, 30-Yard Dash, and the 400-Foot Shuttle. Although females tended to be more flexible than males, the difference was not statistically significant. Similar to the findings of this study, Keogh (1965) reported that males of similar age to the subjects of this study had a higher mean performance level ($\bar{X}$ = 42.6) than females ($\bar{X}$ = 40.9) in Standing Long Jump whereas girls were better in the Shuttle Run ($\bar{X}$ = 13.40 versus $\bar{X}$ = 13.45). In opposition to the findings of this study where boys were significantly faster than girls in the 30-Yard Dash, Keogh found the means for boys and girls were similar.

In reference to racial differences, white children performed better than Negro children in the Standing Long Jump, Flexibility, 400-Foot Shuttle, and Reaction Time although the differences were not significant. Negro children attained higher scores in the Shuttle Run and the 30-Yard Dash with only the difference in the 30-Yard Dash being significant. The apparent race differences were due at times to the larger differences between white and Negro females than the differences between white and Negro males. At other times the apparent race differences were due to the larger differences between white and Negro males than between white and Negro females.

Although not significantly different, the male-white performed better than the male-Negro only in Reaction Time. The male-Negro performed significantly better than the male-white only in the 30-Yard Dash. The female-white performed better than the female-Negro in the Shuttle Run, Standing Long Jump, Flexibility, and the 400-Foot Shuttle although none of the differences were significant. The female-Negro performed better than the female-white in Reaction Time and the 30-Yard Dash with only the 30-Yard Dash indicating a significant difference. Malina (1966) reported that Negroes performed better in the 35-Yard Dash than their white counterpart. In the Standing Long Jump whites (boys $\bar{X}$ = 40.7; Girls $\bar{X}$ = 38.8) indicated a higher level of performance than Negroes (Boys $\bar{X}$ = 38.4; Girls $\bar{X}$ = 34.8) of both sexes. The results of this present study agree with those of Malina with the exception of the male-Negro who performed better than the male-white in the Standing Long Jump. Ponthieux and Barker (1967) reporting on fifth and sixth grade children found that Negro males and females scored higher than whites on the Standing Long Jump, 50-Yard Dash and the Shuttle Run. Hutinger's (1959) research indicated that Negro children tend to surpass white children in the performance of the 35-Yard Dash. The results of this present study agree with that of both Ponthieux and Barker and Hutinger with the exception of the white-females who out-performed the Negro-females on the Shuttle Run and the Standing Long Jump.

In summary, the findings of this present study generally agree with the available research with few exceptions. The male-Negro tends to perform better than the male-white in most motor performance items. The findings for females are not as conclusive. Contradictions are evident between this study and the research literature. It is clear, however, that Negro-females do perform significantly better in the test of speed, the 30-Yard Dash, than white-females.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the relationship between anxiety and motor performance of young children. These relationships were also examined for possible race and sex differences among the children.

Two hypotheses were proposed: (1) no significant relationships would exist between anxiety measures and level of motor performance; (2) no significant differences due to sex and race would be found in the relationship between the level of anxiety and level of motor performance.

The sample of 100 boys and 100 girls each from kindergarten, grade one, and grade two was randomly determined by proportional stratification by school in Battle Creek, Michigan.

Each child was administered the Motor Performance Battery which included items for agility, power, flexibility, endurance, and reaction time. Strength and static balance items, originally included, were excluded from the final statistical analysis due to truncation of the data.

Anxiety measurements were obtained by the Palmar Sweat Test, the General Anxiety Scale for Children, the Test Anxiety Scale for Children and the Teacher Rating Scale. Kindergarten children were not administered the Test Anxiety Scale for Children as they had not yet encountered the "testing experience."

A multiple regression analysis was employed to estimate relationships between each dependent variable and a set of independent variables. The dependent variables were the motor performance items and the independent variables included the anxiety measures, sex, and race. The same statistical technique was employed to determine the effect of race and sex upon the relationship of the motor performance items and the anxiety measures.

The results of the present study suggest that a high level of anxiety has a detrimental effect upon motor performance of young children. The analysis also indicated that race and sex are significant factors in some relationships of anxiety and motor performance, namely the Sit and Reach, the 30-Yard Dash, and the 400-Foot Shuttle Run.

Conclusions

From the results of the analyses of the data, the following conclusions were drawn:

1. The results, although placed in the reserve judgment region, indicate a high level of anxiety

has a detrimental effect upon the level of motor performance.

2. The Palmar Sweat Test and the Teacher Rating Scale indicated that the higher level of anxiety the lower the level of proficiency in motor performance.
3. Race and sex variables had a significant effect upon the relationship of level of anxiety and level of motor performance.
4. The Palmar Sweat Test was able to significantly distinguish between male-Negroes and male-whites in the performance of the Shuttle Run.
5. The Teachers Rating Scale was able to significantly distinguish between female-Negroes and female-whites in the performance of the 30-Yard Dash.
6. The GASC was able to significantly distinguish between male-whites and male-Negroes in the performance of the Shuttle Run and the 400-Foot Shuttle Run.
7. Whites indicated significantly higher Palmar Sweat Test scores than Negroes.
8. Males demonstrated a significantly higher motor performance level than females in the Shuttle Run, 30-Yard Dash, 400-Foot Shuttle, and the Standing Long Jump.

9. The female-Negro performed significantly better than the female-white in the 30-Yard Dash.
10. The male-Negro is significantly faster than the male-white in the 30-Yard Dash.

Recommendations

Future research concerned with the effects of anxiety upon motor performance in young children should consider the following points:

1. The Motor Performance Battery in addition to the gross motor items of agility, flexibility, power, strength, endurance, reaction time, etc., should include fine motor skill items. Such items as pencil-star or maze tracings, various peg-board tests and finger pick-up skills may be more affected by anxiety and muscular tension.
2. The anxiety measures need to be re-tested with the possible exception of the Test Anxiety Scale for Children which tends to be rather task-specific.
3. Repetitions of the Palmar Sweat Test should be required to assure a proper physiological base-line measurement of anxiety.
4. A test of open palmar sweat pores in comparison to the amount of sweat emitted as indicated by the Palmar Sweat Test would enhance the physiological measures.

5. Attempts should be made to equalize the sample size in regard to race-sex.

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APPENDICES

APPENDIX A

ANXIETY MEASURES

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ANXIETY MEASURES

The Test Anxiety Scale for Children (TASC) and The General Anxiety Scale for Children (GASC)

Instructions:

My name is _____. I'm going to be asking you some questions--questions different from the usual school questions for these are about how you feel and so have no right or wrong answers. First I'll hand out the answer sheets and then I'll tell you more about the questions. . . .

Write your name at the top of the first page, both your first and your last name. . . . Also write a "B" if you're a boy or a "G" if you're a girl.

As I said before, I am going to ask you some questions. No one but myself will see your answers to these questions, not your teacher or your principal or your parents. These questions are different from other questions that you are asked in school. These questions are different because there are no right or wrong answers. You are to listen to each question and then put a circle around either "yes" or "no." These questions are about how you think and feel and, therefore, they have no right or wrong answers. People think and feel differently. The person sitting next to you might put a circle around "yes" and you may put a circle around "no." For example, if I asked you this question: "Do you like to play ball?" some of you would put a circle around "yes" and some of you would put it around "no." Your answer depends on how you think and feel. These questions are about how you think and feel about school, and about a lot of other things. Remember, listen carefully to each question and answer it "yes" or "no" by deciding how you think and feel. If you don't understand a question, ask me about it.

Now let's start by everybody putting their finger on Number 1. Here is the first question. Number 1. "Do you worry when _____?" (Repeat this procedure of introducing the questions for several of them and continue throughout to say the number of the question before reading it.)

Test Anxiety Scale for Children

1. Do you worry when the teacher says that she is going to ask you questions to find out how much you know?
2. Do you worry about being promoted, that is, passing from the ____ to the ____ grade at the end of the year?
3. When the teacher asks you to get up in front of the class and read aloud, are you afraid that you are going to make some bad mistakes?
4. When the teacher says that she is going to call upon some boys and girls in the class to do arithmetic problems, do you hope that she will call upon someone else and not on you?
5. Do you sometimes dream at hight that you are in school and cannot answer the teacher's questions?
6. When the teacher says that she is going to find out how much you have learned, does your heart begin to beat faster?
7. When the teacher is teaching you about arithmetic, do you feel that other children in the class understand her better than you?
8. When you are in bed at night, do you sometimes worry about how you are going to do in class the next day?
9. When the teacher asks you to write on the blackboard in front of the class, does the hand you write with sometimes shake a little?
10. When the teacher is teaching you about reading, do you feel that other children in class understand her better than you?
11. Do you think you worry more about school than other children?
12. When you are at home and you are thinking about your arithmetic lesson for the next day, do you become afraid that you will get the answers wrong when the teacher calls upon you?
13. If you are sick and miss school, do you worry that you will do more poorly in your schoolwork than other children when you return to school?
14. Do you sometimes dream at night that other boys and girls in your class can do things you cannot do?
15. When you are home and you are thinking about your reading lesson for the next day, do you worry that you will do poorly on the lesson?

16. When the teacher says that she is going to find out how much you have learned, do you get a funny feeling in your stomach?
17. If you did very poorly when the teacher called on you, would you probably feel like crying even though you would try not to cry?
18. Do you sometimes dream at night that the teacher is angry because you do not know your lessons?

In the following questions the word "test" is used. What I mean by "test" is any time the teacher asks you to do something to find out how much you know or how much you have learned. It could be by your writing on paper, or by your speaking aloud, or by your writing on the blackboard. Do you understand what I mean by "test"--it is any time the teacher asks you to do something to find out how much you know.

19. Are you afraid of school tests?
20. Do you worry a lot before you are taking a test?
21. Do you worry a lot while you are taking a test?
22. After you have taken a test do you worry about how well you did on the test?
23. Do you sometimes dream at night that you did poorly on a test you had in school that day?
24. When you are taking a test, does the hand you write with shake a little?
25. When the teacher says that she is going to give the class a test, do you become afraid that you will do poorly?
26. When you are taking a hard test, do you forget somethings that you knew very well before you started taking the test?
27. Do you wish a lot of times that you didn't worry so much about tests?
28. When the teacher says that she is going to give the class a test, do you get a nervous or funny feeling.
29. While you are taking a test do you usually think you are doing poorly?
30. While you are on your way to school, do you sometimes worry that the teacher may give the class a test?

General Anxiety Scale for Children

1. When you are away from home, do you worry about what might be happening at home?
2. Are you afraid of mice or rats?
3. If you were to climb a ladder, would you worry about falling off it?
4. Do you worry about whether your mother is going to get sick?

5. Do you get a funny feeling when you see blood?
6. Are you frightened by lightning and thunderstorms?
7. Are you afriad of things like snakes?
8. When you are in bed at night trying to go to sleep, do you often find that you are worrying about something?
9. When you were little, were you ever scared of anything?
10. Are you sometimes frightened when looking down from a high place?
11. Do you get worried when you have to go to the doctor's office?
12. Do some of the stories on radio or television scare you?
13. Have you ever been afraid of getting hurt?
14. Do you get a scary feeling when you see a dead animal?
15. Has anyone ever been able to scare you?
16. Without knowing why, do you sometimes get a funny feeling in your stomach?
17. Are you afraid of being bitten or hurt by a dog?
18. Do you ever worry about something bad happening to someone you know?
19. Are you afraid of being too near fireworks because of their exploding?
20. Do you worry that you are going to get sick?
21. Are you ever unhappy?
22. When your mother is away from home, do you worry about whether she is going to come back?
23. Do you ever worry about what is going to happen?
24. Do you get scared when you have to go into a dark room?
25. Do you dislike getting in fights because you worry about getting hurt in them?
26. Have you ever had a scary dream?
27. Are you afriad of spiders?
28. Do you sometimes get the feeling that something bad is going to happen to you?
29. When you are alone in a room and you hear a strange noise, do you get a frightened feeling?
30. Do you ever worry?

General and Test Anxiety Scale for Children

Answer Sheet

Instructions: Draw a circle around either the word "YES" or "NO" as the answer for each question that is asked. Be careful that you circle your answer for the proper question number. Remember there are no right or wrong answers to these questions.

Example: Do you like to play ball? Yes No

1.	YES	NO	16.	YES	NO
2.	YES	NO	17.	YES	NO
3.	YES	NO	18.	YES	NO
4.	YES	NO	19.	YES	NO
5.	YES	NO	20.	YES	NO
6.	YES	NO	21.	YES	NO
7.	YES	NO	22.	YES	NO
8.	YES	NO	23.	YES	NO
9.	YES	NO	24.	YES	NO
10.	YES	NO	25.	YES	NO
11.	YES	NO	26.	YES	NO
12.	YES	NO	27.	YES	NO
13.	YES	NO	28.	YES	NO
14.	YES	NO	29.	YES	NO
15.	YES	NO	30.	YES	NO

_____

Name

Teacher Rating Scale--Anxiety

As every teacher is aware, children differ widely in their reactions to tests and classroom recitations. However, relatively little is known about how frequently such reactions occur and what their general significance may be. This study, is an attempt to determine as carefully as possible the nature and frequency of children's reactions to tests and classroom recitations. Through such a study we hope to gain an increased understanding of the school child as he adjusts to the everyday classroom situation. At present we have opinions about reactions to tests and classroom recitations--what we need are facts. We are therefore asking your cooperation in rating the children in your class on various kinds of behavior related to tests and classroom recitations. For example, we would like to know how often the child stammers or stutters when he is called on to recite his lessons in class. We have devised a five-point scaling system whereby you can indicate by the use of a number from one to five how characteristic this behavior is for the child in question. We have prepared a number of such questions on which we would like you to rate your students. Accompanying the questions we have prepared a form which will permit you to express your ratings of each child. You will first read a question, e.g., Question #1: Does the child perform less well in school than your evaluation of his intelligence would lead you to expect? You will circle the rating you would assign him.

The rating scale is as follows:

1	2	3
ALMOST NEVER (The child is hardly ever like this; it is not characteristic of him.)	OCCASIONALLY (The child is like this once in a while; it is only slightly characteristic of him.)	SOMETIMES (The child is sometimes like this; doesn't do it often, but there are times when he is like this. It is somewhat characteristic of him.)

4	5
FAIRLY OFTEN (The child is frequently like this; it is fairly characteristic of him.)	VERY OFTEN (The child is very often like this; it is very chracteristic of him.)

It is understood that some of the ratings will be difficult, but you are asked to reach a decision in each case.

In the questions which follow we have used the word test in two ways. First we have used it in its usual sense: when one formally attempts to evaluate a child's progress in any area either by means of a standardized procedure (e.g., Stanford Achievement Tests) or one which you yourself have devised (e.g., an arithmetic or spelling quiz). Second, we have used the word test in a more general way to include any situation in which you are attempting to find out how much a child has learned or knows--such as when you ask him to read or send him to the blackboard. We have tried to indicate in each question which of the two ways we have used the word test. Where we have not indicated in which way we have used the word test, please use whichever meaning allows you to make the most confident rating. You will probably have noticed that the two ways in which we have used the word test are from a psychological standpoint essentially the same.

We most sincerely thank you for your cooperation. In any study involving school age children it is obvious that the observations which the teacher makes are absolutely crucial. Without your cooperation the most important source of data will be missing.

Name_____

Grade:_____Number:_____

School:_____

1.	Does the child perform less well in school than your evaluation of his intelligence would lead you to expect?	1	2	3	4	5
2.	Does the child stutter or stammer when called on to recite even though he does not stutter or stammer in ordinary conversation?	1	2	3	4	5
3.	Does the child bite his nails when taking a test or at those times when he may be called upon to recite?	1	2	3	4	5
4.	Does the child seem anxious about getting good marks on tests or on his homework papers?	1	2	3	4	5
5.	Does the child exhibit unwarranted fidgeting (e.g., squirming, restless behavior) when called upon to recite in class?	1	2	3	4	5
6.	Is the child nervous when he has to write on the blackboard?	1	2	3	4	5
7.	Does the child tend to become upset or anxious when a test is announced in class or he is called upon to recite?	1	2	3	4	5
8.	Does the child function better when working alone than when working before the class?	1	2	3	4	5
9.	Does the child's voice tremble when he is asked to recite?	1	2	3	4	5
10.	Does the child's hand show any sign of trembling when he is writing on the blackboard or when he is holding up a book to recite?	1	2	3	4	5
11.	Does a poor mark on a test or homework paper upset the child?	1	2	3	4	5

12.	Does the child become upset when he is told that the answer which he has given is wrong?	1	2	3	4	5
13.	Does the child worry about how well he has done on a test even when he is in no danger of failing?	1	2	3	4	5
14.	Does the child give an irrelevant answer when he is asked a question and does not know the correct answer?	1	2	3	4	5
15.	Does the child's illness or physical complaints tend to coincide with test days or class recitations?	1	2	3	4	5
16.	Does the child worry about promotion more than is warranted by his previous level of performance?	1	2	3	4	5
17.	Does the child work better in a situation in which he can take his time than in one in which there is time pressure?	1	2	3	4	5

APPENDIX B

MOTOR PERFORMANCE BATTERY

APPENDIX B

MOTOR PERFORMANCE BATTERY

Agility

Shuttle Run

Purpose: To measure agility (the ability to move the body rapidly with a change in direction).

Facilities and Equipment: The shuttle run should be administered on a hard surface. Children may attempt the test in gym shoes or bare feet. Equipment includes two blocks of wood (2' x 2' x 4") and stopwatches accurate to 1/10 second.

Procedures: Two parallel lines are placed on the floor with an interval of ten yards between them. Both blocks are placed on the line opposite the subject. Upon command the subject runs ten yards and picks up one block, returns to the starting line and places the block on the line. He then returns to pick up the other block. Upon returning with the second block he runs across the starting line instead of placing the block on the line.

Instructions to the Subject: Your task is to run as quickly as possible to pick up one block and place it on this line. You must then pick up the second block and run across this line with it. Your signals will be "Get ready" followed by "Go." Do not begin to run until I say "Go."

Instructions to the Examiner: Be sure the child is motionless before giving the command "Go." Each subject is permitted two trials. The first trial should be followed by a rest period of several minutes before administering the second trial. If a student commits an error such as dropping a block, falling while running, or forgetting to retrieve the second block until reminded to do so, substitute another trial.

NOTE: Children will tend to forget that a second trip is necessary. Be ready to encourage them to make the second trip.

Scoring: Record the time to the nearest 1/10 second for both trials.

Power

Standing Long Jump

Purpose: To measure power and balance.

Facilities and Equipment: The test should be conducted on a hard surface which provides adequate traction for bare feet or gym shoes. Tumbling mats should not be used for the jumping surface. A take-off restraining line is established. Another line marked in inches is laid down perpendicular to the restraining line.

Procedures: The subject starts with both feet behind the restraining line. Demonstrate the proper method of bending the knees and use of the arms as an aid in jumping. Each subject is allowed three trials.

Instructions to the Subject: You are to jump as far as possible. Be sure to begin and end the jump on two feet. You may jump whenever you are ready.

Instructions to the Examiner: Each child is permitted three attempts, taken in succession. If a child falls upon landing, disregard the jump and substitute another trial. The scorer should stand near the point where the child is expected to land. Do not permit preliminary movements such as shuffling of feet prior to take off.

Scoring: The score is the distance measured to the largest full inch between the restraining line and the heel closest to the restraining line. Record all three scores.

30-Yard Dash

Purpose: To measure power.

Facilities and Equipment: The test should be conducted in a space which permits linear movement for 40 yards. The course consists of 4 lines laid parallel to each other and perpendicular to the running course. A wall may serve as the first line. A second line is placed five yards from the first. The third line is placed 30 yards from the second and the fourth line is 5 yards from the third line. Timing of the race requires one watch accurate to 1/10 second.

Procedures: Each subject is timed after a five-yard running start. The starter is positioned at the five-yard line, while the timer-recorder is positioned 35 yards from the starting line. A chair or flag should mark the line

30-Yard Dash (continued)

Procedures (continued): five yards beyond the timer. Subjects are instructed to run to the chair or flag beyond the timer. When testing young children it is advisable to have a line or corridor to serve as a linear guide. This prevents the side-to-side weaving as the subject moves down the linear course.

Instructions to the Subject: You are to run as fast as possible until you reach the flag. Your signal to start the run will be "Ready," "Go." Begin to run when you hear me say "Go."

Instructions to the Examiners: The starter must stand at the extension of the five-yard line, with his hand raised. As the runner passes the line the starter moves his hand rapidly downward as a signal for the timer to start the watch. It is the timer's responsibility to obtain the time and the name of the runner. Each subject is allowed two trials, with a rest interval between trials.

Scoring: Record the scores of each trial to the nearest 1/10 second.

Flexibility

Well's Sit and Reach Test

Purpose: To measure flexibility of the trunk, hip, and knee joints.

Facilities and Equipment: The equipment consists of a bench which is at least 12 inches high. A 4" x 18" piece of plywood is attached so that it is perpendicular to the surface of the floor with the bench in an upright position. The piece of plywood is positioned so that 6" extend above the seat of the bench. A center line is placed on the piece of plywood so that it coincides with the upper surface of the bench seat. The plywood board is then numbered at one-inch intervals from the center line. The progression of numbers away from the floor surface is given -(minus) values while those progression toward the floor surface are given +(plus) values.

Procedures: The bench is placed on its side, with the plywood attachment away from the floor surface. The subject is seated on the floor with his feet against the seat of the bench. Knees are fully extended and remain extended during the test. The subject reaches forward with both hands, palms down, and slides his fingers along the plywood scale.

Well's Sit and Reach Test (continued)

Instructions to the Subject: Be sure to keep your knees straight. Reach forward as far as possible along the scale. You may take three "bobs" in order to prepare for the test. On the fourth try, you are to slide the hands forward slowly and hold the final position until I read the scale.

Instructions to the Examiner: Kneel on either side of the subject. Keep the hand nearest the subject on his knees to insure that they remain fully extended.

Scoring: The maximum distance reached is recorded as the measure of flexibility. Each subject receives two attempts, but he must rise and resume his position after each trial. When testing groups of children it is best to allow several other children to attempt the test before proceding to a second trial. Record both scores.

Endurance

400-Foot Shuttle Run

Purpose: To measure endurance.

Facilities and Equipment: The course is marked with two lines at 40-foot intervals. Waste paper baskets or chairs are placed at the inside edges of each line. One stop watch is required.

Procedures: The subject and timer-recorder stand at the starting line. The task of the subject is to make five complete trips around the baskets (or a distance of 400 feet) in as short a time as possible.

Instructions to the Subject: You are to make five trips around the baskets. Try to run so that you will be able to continue running the entire distance. If you become tired you may walk, but begin to run again as soon as possible. I will count the trips so that you know how many times you must circle to complete the run. Your signal to start will be "Ready" "Go." Wait until you hear me say "Go."

Instructions to the Examiner: It is advisable to show the younger children the proper method of running the course. A common error is to run close to one side of the basket and to deviate widely from a straight line on the other side. Each subject is permitted one trial. If the subject terminates the trial due to a misunderstanding of the rules the trial is discarded and after a rest period the run is repeated.

400-Foot Shuttle Run (continued):

Scoring: The score is the elapsed time to the nearest 1/10 second that it takes the subject to run the course a total of five times.

Reaction Time

Purpose: To determine the rate of response to an auditory and/or visual stimulus.

Facilities and Equipment: One table, three chairs, one Athletic Performance Analyzer.

Procedure: The subject is seated at a table, upon which the Athletic Performance Analyzer rests. The examiner and the recorder sit at the table on the side opposite the subject. The subject is told to remove his finger as quickly as possible from switch A after hearing the signal or seeing the light on the Performance Analyzer.

The subject is allowed 5 warm-up trials, during which time corrections and suggestions for improvement are made. These trials are recorded. At the conclusion of the 5 trials the subject engages in 25 successive trials of reaction time.

The determination of stimuli, whether auditory, visual, or both is made by random selection. The delay between the instructors command "ready" and the stimulus (0-2 seconds) is also randomly determined.

Instructions to the Subject: You are to place your finger on this button (switch). When you (hear) (see) the (sound) (light) you are to remove your finger as quickly as possible. I will say "ready" and shortly thereafter you will (see) (hear) the signal.

Instructions to the Examiner: Insure that the clock is reset after each trial. The pattern of times between the "ready" signal and the stimulus must also be observed and reset after each trial. The recorder should read the clock directly without verbalizing the score.

Scoring: Each trial is recorded to the nearest 1/100 second. If the subject is not ready or other disturbances interfere with the trial, its results and the explanation should be recorded and another trial should be substituted.

Strength

Grip Strength

Purpose: To measure the static strength of the right and left grip.

Facilities and Equipment: A dynamometer, adjustable to suit the hand size of the subject.

Procedures: The subject stands with the dynamometer at his side and the elbow fully extended. The dynamometer is squeezed in this position, and without reading the instrument, it is squeezed again after a pause of three seconds. The dynamometer is read at this point and switched to the opposite hand, where the procedure is repeated. Two trials are recorded for each hand.

Instructions to the Subject: "Adjust the dynamometer so that it fits your hand comfortably. Place the dynamometer at your side and squeeze it as hard as possible. Then relax for a few seconds and squeeze it again. After you have squeezed it a second time hand it to me."

Instructions to the Examiner: Assist the child in adjusting the dynamometer to the proper hand size. Be sure that the subject does not use arm or trunk momentum to aid in obtaining the maximum squeeze. Do not allow the arm or dynamometer to touch any body part except the hand. Be sure to return the indicator needle to zero after each reading.

Scoring: The reading is recorded to the nearest pound or kilogram. Two readings are recorded for each hand.

Static Balance

Rail Balance

Purpose: To measure static balance.

Facilities and Equipment: The balance rail is a piece of wood one and one-half inches high, one-inch wide and twenty-four inches long. The rail is mounted to a base.

Procedures: The subject should face a wall so that distractions by persons in the room are not a factor in the balance score. The student is to balance with one foot on the rail. The foot should be parallel to the long axis of the rail. The eyes are kept open and the arms and non-supporting leg may be used to assist in maintaining the balance, providing they do not touch the rail of the floor

Rail Balance (continued)

Procedures (continued): surface. Each subject is allowed two trials with each foot, beginning with the preferred foot and proceding to the non-preferred foot. The cycle is then repeated without interruption.

Instructions to the Subject: You are to balance as long as possible on one foot. As soon as you touch any other part of your body to the floor or to the rail the trial has ended. You may move your arms and free leg in any way to assist you in balancing on the rail, but you may not move your foot on the rail. I will start the watch whenever you have started your balance.

Instructions to the Examiner: Assume a position to the side and slightly to the rear of the subject. Start the watch when the subject removes his foot from the supporting surface. The trial ends if the foot on the rail shifts to and fro or any other body part touches the floor of the rail.

Scoring: Record the time in seconds that the balance is maintained on the rail. Four scores should be recorded for each subject.

APPENDIX C

INTERCORRELATIONS BETWEEN DEPENDENT AND INDEPENDENT VARIABLES

TABLE C-1.--Intercorrelations between dependent and independent variables (N=370).

		1	2	3	4	5	6	7	8	9
1.	Shuttle Run									
2.	Standing Long Jump	-.45*								
3.	30-Yard Dash	.55*	-.51*							
4.	Sit & Reach	-.10	.13	-.09						
5.	400-Foot Shuttle	.41*	-.33*	.41*	-.06					
6.	Reaction Time	-.03	-.04	.09	.02	.03				
7.	Palmar Sweat Test	-.01	.04	-.05	-.15	.05	-.08			
8.	TASC	.04	-.06	.02	-.02	.06	.02	-.02		
9.	GASC	.08	-.20*	.11	-.02	-.07	.05	-.08	.40*	
10.	TRS	.03	-.05	.10	-.17	.09	.03	-.10	.06	-.05

*.05 = .1946

APPENDIX D

REGRESSION EQUATIONS FOR EACH DEPENDENT VARIABLE

APPENDIX D

REGRESSION EQUATIONS FOR EACH DEPENDENT VARIABLE

1. (Shuttle Run) $\cong$ 15.40 - .73(Sex) - .11(Race) + .02(PSI) - .02(GASC) + .01 (TRS) - 1.30(Grade T1) - 1.68(Grade T2) - .04(RS Interaction)

2. (Standing Long Jump) $\cong$ 355.56 + 41.63(Sex) + 8.59(Race) - .85(PSI) - 1.36(GASC) - .34(TRS) + 64.83(Grade T1) + 100.65(Grade T2) - 3.12(RS Interaction)

3. (30-Yard Dash) $\cong$ 6.35 - .44(Sex) + .26(Race) + .00(PSI) + .00(GASC) + .01(TRS) - .95(Grade T1) - 1.18(Grade T2) + .01(RS Interaction)

4. (Sit & Reach) $\cong$ 12.86 + .33(Sex) + .67(Race) - .08(PSI) - .01(GASC) - .02(TRS) + .06(Grade T1) - .15(Grade T2) - .85(RS Interaction)

5. (400-Foot Shuttle) $\cong$ 52.07 - 2.44(Sex) - .56(Race) + .11(PSI) - .10(GASC) + .06(TRS) - 3.68(Grade T1) - 6.47(Grade T2) + .59(RS Interaction)

6. (Reaction Time) $\cong$ 4.19 + .02(Sex) - .01(Race) + .01(PSI) + .02(GASC) + .01(TRS) - .62(Grade T1) - 1.02(Grade T2) - .39 (RS Interaction)