Chapter II

REVIEW OF RELATED LITERATURE

An attempt was made by the scholar to review the literature related to the present study on the inter-relationships among physical fitness, motor ability, health status and academic achievement of higher secondary boys belonging to different socio-economic groups, available in the library of the Lakshmibai National College of Physical Education, Gwalior. The selected studies have been abstracted in this chapter to provide the background material for this study.

Hill\(^1\) investigated the relationship between motor ability and physical fitness of children five through eight years old. He used one hundred and thirty three male and one hundred and twenty three female subjects and gave them Iowa Brace Test of Motor Ability and Glover Physical Fitness Test for physical fitness. Statistical treatment revealed that physical fitness had no value in the prediction of motor ability.

Lane\textsuperscript{2} conducted a study to determine the relationship between physical fitness and motor ability of high school girls. The AAHPER Youth Fitness Test and the Humiston Motor Ability Test were administered to 69 grade 9 girls, aged 14 years, before and after a planned physical fitness programme. The group improved on both tests, and the correlation between physical fitness and motor ability was higher after the planned fitness programme.

Merwe and Suzanne\textsuperscript{3}'s study determined the relationship between six fitness levels and psychological, mental health and health hazard appraisal profiles. 306 subjects were placed in very fit, good, moderately fit, moderately unfit, poor and very poor category by administering Canadian Home Fitness Test. Twenty women subjects were drawn from each fitness category (N=120) and data collected on Jackson's PRP-E, Lanyon's PSI, the Canadian Health Hazard Appraisal (Evalu-life) and the Activity Pattern Charts were key punched. Two separate one way multivariate analyses of variance were performed on the questionnaire variables,


\textsuperscript{3}Merwe and Suzanne, Dissertation Abstracts International, p.2024.
with the level of physical fitness as the independent variable. The findings suggest that physical fitness is positively related to health status.

Hein and Ryan\textsuperscript{4} reported that clinical observations and experimental studies point to definite values of exercise in preserving the health of the cardiovascular system and also prolonging the life. Report on active and sedentary occupations with both under stress, show that the death rate from coronary heart disease is the highest among the sedentary occupations. Physical activity appears to give cardiac protection.

Buckellew\textsuperscript{5} carried out a sectional and longitudinal study of various factors of growth and development of fifth, sixth, seventh and eighth grade boys. At each grade level, subjects were evaluated in physical fitness (AAHPER Youth Fitness Test) and educational achievement (Iowa Basic Skill Test). There was no apparent relationship between physical fitness and academic achievement.


fitness and academic achievement.

Harold⁶ determined the relationship of school success to physical fitness index. PFI and other tests were given to 246 pupils in grades 5-8 in rural schools. He concluded that there was no relationship between school success and the PFI. He obtained -.21 for the boys and +.10 for the girls, indicating no relationship between these two measures.

Hatcher⁷ carried out a study to determine the relationship between physical fitness and academic achievement. The sample consisted of 90 ninth grade boys. A moderate positive relationship was found between these two variables. Highest mean scores were recorded for the item measuring strength and endurance of the extensor muscles of the arms and shoulder girdle, and the item measuring paragraph meaning.

Bruce⁸ examined the relationship of physical fitness test scores to certain social, personal and academic factors.


⁸Robert Glen Bruce, "The Relationship of Physical Fitness Test Scores to Certain Social, Personal and Academic Factors Among Selected Ninth Grade Males," Completed Research in Health, Physical Education and Recreation 6 (1963):89.
Selected students of ninth grade were divided into above average, average, and below average groups on physical fitness. No significant relationship between physical fitness and personal or social factors was found since the above average physically fit students were equal to the other groups. The above average physically fit group scored higher on social factors than the other two groups.

Broekhoff\(^9\) made an effort to investigate the relationship between physical, socio-psychological and mental characteristics of thirteen-year old boys. He determined high PFI (Physical Fitness Index) boys tended to perform well in their school work, they showed interest in academic subjects and were favourably rated by their teachers.

Boespflug\(^10\) studied the relationship between physical fitness and academic achievement. Physical fitness of 50 track experienced subjects was measured by the AAHPER youth fitness test and academic achievement was represented by grade point average. Those subjects who obtained high physical fitness scores also had better academic achievement.

\(^9\)Broekhoff, Completed Research in Health, Physical Education and Recreation, p.94.

than those subjects with low physical fitness scores.

The Nathaniel Hawthorne junior high school project by Clarke\textsuperscript{11} showed that the improvement of the physical fitness index had a positive effect upon academic work.

Mall and others\textsuperscript{12} made comparative analysis of physical fitness with some physical and socio-psychological variables of school boys. One hundred and fifty male students who secured 60% and above marks in the previous annual examination were taken from the IX and X classes. They were divided equally ($N = 50$) according to three age groups i.e. 13, 14, and 15 years. Age, height, weight, three skinfold measures and parents' annual income were recorded. All the subjects were given six PF tests of Fleishman Battery. For intergroup comparison, 't' tests were administered at .05 level of significance.

The mean percentile total P.F. score of the three age groups was less than 48.7 and thus much below the academic achievement. 13 year age groups scored significantly higher in total percentage P.F. as well as in the


five out of six P.F. factors. 14 years group was significantly better in flexibility. 15 years group scored the lowest in all the P.F. tests. The performance of all the groups in flexibility was very low. In academic achievement, the mean of all the age groups was above 60%. The 13 year age group secured 64%, highest among the groups. Although the difference was not significant, it showed the trend that the students possessing better P.F. might also be better academically. However, the mean percentile total P.F. score of 48.7 of 13 year age group cannot be considered as good. The middle income group scored the highest in total percentile P.F. score as well as in Balance, Endurance, Speed, Arm Strength and Flexibility. The low income group scored better in coordination. The differences were however not significant. In the academic achievement all the three income groups were equal.

Lincoln\textsuperscript{13} undertook the study of relationship between physical fitness and grade point average. The Washington State Physical Fitness Test Battery for Junior - Senior High School Boys was administered to 173 boys in grade 10. Their mean physical fitness scores and grade point average correlated positively and significantly at the .05 level. The

high and low grade point average groups differed significantly at the .05 level in physical fitness. The mean physical fitness of the total group matched that of the middle grade point average group.

Jorndt\textsuperscript{14} investigated the relationship between physical fitness and academic achievement. Freshman and senior high school boys (N = 358) who ranked in the upper and lower 25 percent of their respective classes were used as subjects. The physical fitness test was constructed by the Maine West Physical Education Department. Class rank was determined by grade point average. No significant differences (.05 level) were found between physical fitness and academic achievement for either freshman or senior boys.

Hays\textsuperscript{15} attempted to study the relationship between physical fitness and academic grades of high school boys. He administered Washington Physical Fitness Test to all male students at Lincoln High School. The boys were divided into four groups on the basis of the McCloy Classification

\textsuperscript{14} George S. Jorndt, "The Relationship Between Physical Fitness and Academic Achievement," \textit{Completed Research in Health, Physical Education and Recreation} 10 (1968):36.

Index and samples were drawn by lot from each group. Fitness test scores were correlated with average academic grade in each group during the fall semester of 1961. Three of the correlations were positive and the fourth was negative but none was significant at the .05 level. The negative correlation apparently resulted from the high number of seniors who were repeaters in physical education.

McCollum, with other variables, compared physically fit and physically unfit in intelligence and academic achievement. The AAHPER Youth fitness test was administered to 172 male students in Greene County Technical High School, Paragould, Arkansas. The 28 students with the highest scores were considered the "fit" group and the 28 with the lowest scores were considered the unfit students, with approximately equal numbers in the 4 grades. Comparison of intelligence based on the California Test of Mental Maturity, grade point average, and attendance were made with t at the .05 level of confidence. The mean difference in intelligence between the fit and unfit group (96.3 and 95.4) was not significant.

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Hart\textsuperscript{17} attempted to study the relationship between physical fitness test scores and grade point average for high school students. The average percentile scores obtained on the California Physical Fitness Test were correlated with intelligence quotients and semester grade point average of the 192 male SHS subjects. Subjects were divided into groups according to class level. There was no significant correlation between physical fitness test scores and intelligence quotients; the correlation between physical fitness test scores and grade point averages for the sophomore, senior and total groups showed positive but insignificant tendencies, and junior class obtained an \( r \) of \(-.43\) (\( P < .057 \)).

Fahrner\textsuperscript{18} compared the results of the AAHPER Physical Fitness Test for 45 tenth grade boys with the boys' records of out of school physical activity, their grades in academic subjects and their IQ's as measured by the California Test of Mental Maturity. No relationship was found between

\textsuperscript{17} Edward D. Hart, "Relationships Between Physical Fitness Test Scores, Intelligence Quotients and Grade Point Average for Selected High School Students," \textit{Completed Research in Health, Physical Education and Recreation} 12 (1970):87.

physical fitness and any of the other three measures.

Popp\textsuperscript{19} in the case study of Sophomore high school boys with high and low physical fitness indices found that eight of the 20 boys with the lowest physical fitness indices did not graduate from high school; only two of the 20 boys with highest physical fitness indices failed to graduate from high school.

It was reported in the 1941 annual report of school of Brookline, Massachusetts\textsuperscript{20} that the average physical fitness index for the 126 boys whose names appeared on the high school scholarship roll was 117, exceeding the national third quartile of 115.

Baker\textsuperscript{21} studied the relationship of physical fitness to academic achievement and other variables. The subjects were 74 boys from 12 to 18 years old in opportunity classes in the public schools at Edmonton, Alberta.

\textsuperscript{19}James Popp, "Case Study of Sophomore High School Boys with High and Low Physical Fitness Indices," Research Quarterly 32 (May 1961):156.

\textsuperscript{20}"Report of the School Committee and Superintendent of School of Brookline, Massachusetts, December 31, 1941," cited by Clarke and Jarman, Research Quarterly, p.156.

\textsuperscript{21}Baker, Completed Research in Health, Physical Education and Recreation, p.107.
The correlation of physical fitness with academic achievement was positive and significant, but low.

Dahl\textsuperscript{22} carried out an investigation to study the relationship between academic achievement and physical fitness of white and Negro students at two different levels. Three sub-tests (Sit ups for cardiorespiratory endurance, standing broad jump for muscular explosiveness and softball throw for gross body coordination) of AAHPER Youth Fitness Test were used. Academic achievement was determined by the composite score on the Stanford Achievement Test. Correlation was obtained between physical fitness and academic achievement. At elementary level white boys obtained a low positive correlation between academic achievement and physical fitness while negro boys obtained a low negative correlation. These findings were reversed at the high school level, with the Negro boys obtaining a low positive correlation and the white boys obtaining a low negative correlation.

Sighultz conducted a survey study to determine the relationship between athletic achievement and academic achievement of high school athletes. He discovered that the participation in athletics did not adversely affect academic achievement. Athletes achieved greater academic success than non-athletes. The better athletes were higher academic achievers than the average athletes. The additional time required for the better athletes to participate in practice games and sports had no apparent ill effects on their academic achievement.

Roebuck in the comparative study of intelligent quotient and academic achievement of athletes and non-athletes compared senior male athletes (115) at Jonesboro High School with senior non-athletes in graduating classes since 1959 on the basis of school records using 't' at the .01 level. Athletes had higher I.Q.'s and grades than non-athletes. The grades of athletes in relation to mental ability were as high or higher than non-athletes.

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Gross\textsuperscript{25} undertook a study to determine the relationship of physical fitness to scholastic achievement. The subjects were 113 male students enrolled in tennis, golf and swimming classes at Pensacola Junior College, Pensacola, Florida. Test used was the Navy Standard Physical Fitness Test and the scholastic achievement was determined from total grade point average for one semester. No significant relationship was found between physical fitness and scholastic achievement.

Thomas\textsuperscript{26} studied the relationship of physical fitness to selected aspect of intellectual and academic performance, co-curricular participation and socio-economic status. His subjects were seventh and eighth grade girls and a two celled study model was used in conducting this project and combination of analytical and statistical methods in completing this study. A series of comparisons were made in order to evaluate the relationship between physical fitness and the selected variables. The findings with regard to the Eighth Grade Group were;


i) A low correlation was found between physical fitness and a seven semester grade-point average \( (r = .37) \). The correlation indicated significance at the .01 level. ii) The correlation between physical fitness and occupational level of the subject's parents resulted in a correlation which was negative \( (r = -.003) \). In case of the Seventh Grade Group, i) A low correlation was found between physical fitness and a seven semester grade point average \( (r = .49) \). The correlation indicated significance at the .01 level, ii) The correlation between physical fitness and occupational level of the subject's parents resulted in a negative relationship which was found to be \( r = -.08 \). Although a positive relationship was found between physical fitness and grade point average, physical fitness cannot be used as a predictive device for academic performance nor can academic performance be used for prediction of physical fitness. The findings of this study did not indicate that one socio-economic status group was significantly more physically fit than any other group.

Meeks\(^{27}\) in her study compared physically fit and physically unfit girls in their academic achievement with other variables. The AAHPER Youth Fitness Test was administered to 264 girls at Holman Junior High School, St. Ann,

Missouri. The 27 girls who scored lowest were designated as the "unfit group." These groups were compared in academic achievement by grade point average. The physically fit students made better grades than the physically unfit students.

Robinson\textsuperscript{28} examined the relationship between physical fitness, scholastic achievement and sports participation among selected secondary school girls. Physical fitness was determined by the California Physical Performance Test; grade point average for all courses taken for the school year represented scholastic achievement. When all grade levels were combined the correlations were significant ($P > .01$).

McMillan\textsuperscript{29} investigated the relationship of fitness, as measured by the New York State Physical Fitness Test, to success in scholastic attainment of high school girls. He found a correlation of .36 between these two variables.


\textsuperscript{29} Betty Jo McMillan, "A Study to Determine the Relationship of Physical Fitness as Measured by the New York State Physical Fitness Test to the Academic Index of High School Girls," \textit{Research Quarterly} 35 (October 1961):445.
Knutson compared the physical fitness and sports skills performance and academic achievement. He used one hundred and fifty-five subjects, 82 boys and 73 girls, in sixth grade classes in three elementary schools. Each subject was administered the overhand softball throw for distance, underhand softball pitch for accuracy, pull up, jump and reach, rope skipping, sit up, Hanson shoulder test, 50 yard dash, standing broad jump and 600 yard walk-run. One hundred and twenty-six of the original 155 subjects completed the Iowa Test of Basic Skills, of whom 64 were boys and 62 were girls. From the physical fitness and sports skills data it was found that the subject's adjusted mean performance was significantly higher under the leadership of classroom teacher on the overhand softball throw for distance, underhand softball pitch for accuracy, Hanson shoulder test, standing broad jump, and the 600 yard walk-run. For the sit up and 50 yard dash, the subject's adjusted mean performance was significantly higher under the classroom teacher physical education consultant approach. The leadership of the physical education specialist resulted in the highest adjusted mean performance on the jump and reach. The boys' adjusted mean performance was significantly

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higher than that for girls on the overhand softball throw for distance, underhand softball pitch for accuracy, pull up, jump and reach, and the Hanson shoulder test. The girls' adjusted mean performance was significantly higher than that for the boys on rope skipping and there was no significant difference between boys and girls on the sit up, 50 yard dash, standing broad jump and 600 yard walk-run. On the tests which involved the learned skills of throwing and pitching, the boys' adjusted mean performance was significantly higher than for the girls. The girls' adjusted mean performance was significantly higher than the boys' for rope skipping. From the academic achievement data, it was found that the difference in adjusted mean performance under the various types of physical education leadership was not significant. This was also true between the sexes.

Giauque,31 in an attempt to study the correlation between physical fitness and scholastic standing, concluded that there was no reasonable relation between scholarship and physical fitness. The casual or effective relation between physical fitness and scholarship though positive, is so small that it does not show any measurable effect on each other.

Coefield and McCollum\textsuperscript{32} conducted a case study on 78 male freshmen at the University of Oregon with the lowest physical fitness indexes during the 1954 fall term and determined that they were definitely low in scholastic accomplishment as compared with all men at the university.

Mack\textsuperscript{33} investigated the relationship of physical fitness to grade point average of freshmen at Washington State University. He collected fitness test scores, grade point averages, and raw linguistic, raw quantitative and total A.C.E. scores for 200 randomly selected freshman male students. The physical fitness test showed a lack of relation with the A.C.E. mental ability examination and the grade point average during the first semester. None of the fitness test items was a general predictor of academic success.

Page\textsuperscript{34} in case studies of college men with low physical fitness indices, found that 83 percent of the


\textsuperscript{34}C. Getty Page, "Case Studies of College Men with Low Physical Fitness Indices," Research Quarterly 32 (May 1961): 156.
freshman male students dismissed from Syracuse University in 1940 because of low grades had physical fitness indexes below the National average of 100; 39 percent of these students had Physical fitness indexes below 85 (the national first quartile score).

Jones\textsuperscript{35} determined the relationship of physical fitness to academic success. Fleishman's Basic Fitness Tests were administered to 101 randomly selected college freshman men volunteers. Using the data for the whole group showed no significant correlation between physical fitness and the other variables, although a low correlation between grade point average and scholastic aptitude was significant when the men were separated into high, average, and low groups on physical fitness, the only significant correlations were for the high group where academic aptitude was negatively related to both physical fitness and the amount of athletic participation in high school.

Leathers\textsuperscript{36} used male students (N = 1070) from 5 classes for the study of the relationship between physical


performance and academic achievement. A factorial analysis was used to investigate the relationship between physical and mental performance. Multiple regression equations and analysis of variance were also utilized to discover whether the results of the factor analysis were in agreement with other statistical procedures. It was concluded that this investigation has not definitely established relationships between components of physical performance and academic achievement.

Neece\textsuperscript{37} examined the effects of participation in professionally related areas of physical education on the scholastic achievement. The study included 61 percent of the male junior and senior physical education majors who had been enrolled at Eastern Illinois University between Fall, 1962 and Spring 1966. The grades received during the periods of high participation were compared with those received during periods of low participation. Participation involved intercollegiate athletics, intramurals and professional club activity. Significantly better grades were earned during periods of low participation.

Carlson\textsuperscript{38} conducted a study to examine the relationship between physical fitness attainment and academic achievement. He used difference in composite centile scores from the Iowa physical fitness test taken before and after enrollment in a physical conditioning class to determine physical fitness attainment. Academic achievement was the grade point average during the semester. The correlations between physical fitness attainment and academic achievement for a group equated physically (.13) and a group equated physically and mentally (.22) were significant at the .05 level.

Stewart\textsuperscript{39} carried out a study to determine the relationship between the athletic success of the varsity football teams and the academic success of the members of the teams from 1965-1966. He found that the athletic success of the varsity football teams of the big ten correlated highest with the (a) In 1965, the mean grade point average of three year later winners (b) In 1966, the percentage of student athletes who earned their degrees in four years.


Arnett\textsuperscript{40} undertook a study to determine the inter-
relationships between selected physical variables and
academic achievement of college women. He gave physical
fitness test to 827 college freshmen women which comprised
the standing broad jump, flexed arm hang, curl ups, and
the 3 minute step test. Grade point averages determined
for each fitness classification revealed statistically
significant differences in GPA among those who were high,
fair, or poor in physical fitness achievement. Those
groups achieving higher GPA's also were high on the fitness
scores. The relationship was not high enough to be pre-
dictive, but the results suggest that greater health and
vitality of a student aids him in achieving his academic
potential.

Hart and Shay\textsuperscript{41} used 60 sophomore women from Springfield
college to determine the relationship between physical
fitness and academic success. Each student was tested at
the beginning of her freshman year and retested during the
spring term. The SAT (Scholastic Aptitude Test) scores were

\textsuperscript{40}Arnett, Research Quarterly, p.227.

\textsuperscript{41}E.M. Hart and T. Clayton Shay, "Relationship Between
Physical Fitness and Academic Success," Research Quarterly 35
obtained from the admission office, the cumulative academic index of the subjects from the registrar and physical fitness index scores were collected from the Springfield College Physical Education Tests and Measurements laboratory. The relationship between academic success and physical fitness was significant beyond the .01 level of confidence.

Weber\textsuperscript{42} studied the relationship of Physical Fitness as measured by the Iowa Physical Efficiency Profile, to grade point average and found a correlation of .41 which was significant beyond the .01 level of confidence.

Jarman\textsuperscript{43} studied the interrelationship between academic achievement and selected maturity, physique, strength and motor measures of fifteen year old boys. The academic achievement criteria were the Iowa tests of Educational Development and grade point averages. Subjects (N = 105) were given 21 tests of maturity, physique, body size, muscular strength and endurance and motor ability.

\textsuperscript{42}John R. Weber, "Relationship of Physical Fitness to Success in College and to Personality," Research Quarterly 24 (1954):471.

\textsuperscript{43}Jarman, Completed Research in Health, Physical Education and Recreation, p.78.
Most of the significant correlations between academic achievement and other variables were negative.

Blaylock conducted a study on relationship of school and college ability test scores to Barrow motor ability test scores for 100, 16 and 17 year old boys. The scores of the former, including the quantitative and verbal parts, were correlated with the Barrow test and each of its items. None of the correlation coefficients was significant (p> .05).

Page compared the academic achievement of boys as related to selected non-academic factors. Groups equal in IQ but high and low on 20 maturity, body size, strength motor ability, and personal-social measures were formed from 296 boys in the Medford, Oregon public schools. Grouping by strength and motor ability did not produce significant differences in academic achievement at 10, 13 and 16 years of age. The high sociogram group at 10 years of age had significantly higher grade point average.


Hawkers investigated the relationship of motor ability to academic success. Composite T Scores on the Brigham Young University Motor Ability Test were correlated with cumulative grade point average for 103 women majors from 1957 through 1964. The total group showed an insignificant correlation of .034. The only significant correlation at the .05 level was -.444 for the 1961-62 group, but this indication of a significant negative relationship was atypical. Determining the relationship of academic success and motor ability on this basis was virtually impossible since college senior women were a selected group and senior majors normally had high motor ability.

Richardson conducted the study to determine the relationship in college women of high and low motor ability to scholastic achievement and other variables. The purpose was to better understand students with problem in learning movement. Highly skilled students surpassed the low skilled in status, sociability, social presence, tolerance, 

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aptitude scores and scholastic average. They participated more in sports and associated with people who were more sport minded.

Johnson undertook the study of the relationship between physical skills and the general intelligence. 310 college freshmen (both men and women) were given a test to determine their academic status and to determine physical skill, Johnson physical skill test was administered. The coefficient of correlation between the Johnson test and the earned academic grades was .068 for the men with a standard error of correlation of .07, and a coefficient of correlation of .075 for the women with a standard error of correlation of .075. There was no significant relationship between physical skills and academic grades.

Rarick and McKee in their study of twenty 3rd grade children exhibiting extreme levels of achievement on tests of motor efficiency studied the scholastic capabilities of two groups of third grade children; one group


scored high and the other scored low in motor proficiency. They reported that the superior motor performance group demonstrated better scholastic adjustment, as evidenced by the larger number with high intelligence and excellent or good rating in reading, writing and comprehension.

Appleton\textsuperscript{50} examined the relationship between physical ability and success at the U.S. military academy. He found no significant relationship between entrance physical ability and scholastic success as measured by academic grades among those cadets who were successful in continuing at the academy past the year.

Domingos\textsuperscript{51} determined the relationship of selected motor fitness scores of freshmen college women to their academic achievement. He used 643 freshmen college women to determine the relationship between motor fitness as measured by their averages in a battery of tests and academic achievement as measured by their scores on the entrance examination and their grade point averages for

\textsuperscript{50}Appleton, Research Quarterly, p.156.

the two semesters of their freshman year. Analysis of data did not show any relationship between motor fitness and academic achievement.

Conly in his comparative study of the scholastic achievement of athletes and non-athletes at the university of New Mexico mentioned that grade point averages of athletes who were on scholarship and/or had own letters were compared with those of a random sample of non-athletes in 1962-63. The non-athletes were superior but not significantly superior to the athletes at the .01 level. Mean grade point averages for athletes in physical education, arts and sciences and business did not differ significantly at the .01 level but those in physical education differed significantly from those in university college. Grades of non-athletes in university colleges were significantly lower but those of students in the other three colleges did not differ significantly. Comparision between teams showed that the basketball players were highest and tennis players lowest but no difference was significant. Differences between athletes in team and individual sports were not significant.

The purpose of Cowell's study was to analyze the relationship between health status and academic achievement. The health assessment measures consisted of parent reported history, teacher assessment, physical examination report, physical fitness tests and report of absenteeism. The study was conducted in two suburban parochial schools. The sample consisted of 191 third and fifth grade students. Academic achievement data and I.Q. scores were reviewed. Parent and teacher assessment sources were significantly related to academic achievement before controlling for I.Q. A hierarchical regression analysis was then used to account for the variance explained in academic achievement while controlling for I.Q. While I.Q. explained 44.3% of the variance in achievement, the addition of the other health variables only accounted for 3.3% of additional variance while controlling for I.Q. While the power of I.Q. diminished the significance of health in explaining the variance in achievement several important questions emerge concerning the findings. The I.Q. test was administered as part of the achievement battery and might be influenced by this. The sample was homogeneous by design because the thesis of

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the study suggested that health contributed significantly to achievement, even controlling for I.Q. The relationship is obviously not very strong and a heterogeneous sample may illuminate an indirect relationship. The reliability and validity of the assessment measure was not analyzed. Until reliability and validity of health assessment measures is identified, the relationship between health and achievement is not fully explained.

Zimmerman\textsuperscript{54} used children ($N = 237$) to study the relationship between health factors recorded in school records and academic performance records on file in the school. Test scores from Scholastic Testing Service (STS) a battery of achievement tests and teachers grades were used for correlation studies with health factors. The result of the co-relational, ex-post facto design study, tested by statistical package for the social sciences (SPSS) showed several significant relationships between academic scores and health factors. The statistical significance of specific health factors indicates the need for further research on health factors as predictors of academic performance.

Marie conducted a study to investigate the relationship of adolescent health status to academic achievement. She assessed Health and Physical characteristics of students by self administered health questionnaire. Grade point averages and standardized test scores were from the students permanent record files, and school absence, attitude toward school, academic self concept, and socio-economic status measures were selected from various instruments. Correlation and multiple regression techniques were used to test the hypothesis. The results indicated that health problems associated with problems in educational achievement could be identified and indicated that health data is an integral component in a study of academic performance.

Brown and others studied the health variables and school achievement. Students who failed the Cognitive Skills Assessment Battery (CSAB) at the beginning of first grade were compared to those who passed on health factors, health history, family characteristics, socio-economic factors, health ratings by the classroom teacher and the


school nurse, and achievement on the Basic Skills Assessment Program (BSAP) at the end of first grade. Significant differences were found on family characteristics, birth history, and health ratings. Only ear problems were significantly related to the academic variables. Health problems were found to be moderately related to academic variables. This relationship was influenced by family socio-economic variables.

Wilson⁵⁷ attempted to study the personality traits, academic achievement and health status of men with low and high physical fitness scores. Ten men with the highest and ten men with the lowest physical fitness scores from the 1966 entering freshman class at the University of Oregon were given individual case studies. Low fitness students had more difficulties maintaining a satisfactory GPA compatible with their scholastic aptitude; low fitness students had 45 visits to the student health centre as contrasted with 35 visits by the high fitness students; on the Clarke health habit questionnaire, the low students checked a total of 125 health habits as compared with 74 for the high fitness group.

⁵⁷Peter G. Wilson, "Personality Traits, Academic Achievement and Health Status of University Freshmen Men with Low and High Physical Fitness Scores," *Completed Research in Health, Physical Education and Recreation* 10 (1968): 83.
Hinrichs\textsuperscript{58} studied the correlation between health and scholastic record and found, without exception, health to be an important factor in scholastic achievement. Low health scores were found among the largest proportion of the students with low scholarship ratings.

The purpose of the Chinn's\textsuperscript{59} study was to examine directly the relationship among health status, family and socio-economic factors and academic achievement. She found several significant interrelations between health problems and school problems including emotional cues, educational ranking, and social ranking. This study supported the assumption that health problems are related to classroom problems, but it indicated that relationship is unclear and needs further study. Findings moderately support the assumption that health problems are related to classroom achievement. A close examination of this relationship reveals that it is confounded by other variables, most of which can be grouped under family socio-economic status. The analysis indicated that the students from low income

\textsuperscript{58} Marie A. Hinrichs, "Some Correlations Between Health, Intelligence Quotient, Extracurricular Activities, and Scholastic Record," \textit{Research Quarterly} 12 (May 1941): 228.

families tended to have more problems related to nutrition and general health care, students who repeated a grade had parents with lower educational levels and lower family incomes, students who lived in homes with larger numbers of siblings made poorer scores on the reading test.

Health variables were more significantly related to school achievement. The data indicate that school districts should be encouraged to include instruction in health habits, nutrition and preventive medical care not only in public schools but also in adult and community education programmes.  

Brace carried out a study in Manchester, England, which revealed that only 2.35 percent of students who were below average in scholarship were below average in physique as evidenced by body measurements, but that 39.7 percent with poor scholarship were below average in physique. In Brace's report, Christopher, who examined 33,500 school children in St. Louis, found that dull children were

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generally lighter and bright children were generally heavier than average children and that intellectual mediocrity was associated with physical mediocrity.

Clarke and Jarma\textsuperscript{62} studied the scholastic achievement of boys as related to various strength and growth measures. The experimental design used in this study consisted of forming a series of high and low scoring groups of 20 boys each separately on the basis of three strength and two growth measures at each age 9, 12 and 15 years; each pair of high and low groups was equated by use of intelligence quotients. The academic achievements of the groups were then contrasted. A consistent and significant tendency for the high groups to have higher means on both standard achievement tests and grade point averages was noted. There were more and greater differences in scholastic achievement between the high and low physical fitness index groups than there were for the other strength and growth measures compared.

Stockdill\textsuperscript{63} in his study of junior high school boys


related physical fitness scores to the families' socio-economic status, size and type of occupation. All boys in 12 physical education classes for grades 7, 8 and 9 (N = 490) were given the AAHPER Youth Fitness Test. Socio-economic status of parents was determined from the rank of their occupation in the detailed classification of the Bureau of the Census, 1950. The correlation between physical fitness and socio-economic status of parents was too low for predictive purpose.

Panthieux and Barker\(^4\) made an effort to investigate the relationship between socio-economic status and physical fitness measures. They used 329 girls and 304 boys of ages 10, 11 and 12 years and used seven item AAHPER Youth Fitness Test to measure physical fitness and Warner, Meeker and Bells Index of status characteristics to measure socio-economic status. The relationships were determined by product moment co-efficient of correlation between each measure of fitness and each measure of socio-economic status. The correlations were computed separately for each sex, and co-efficients of .11 and .15 were considered significant at the .05 and the .01 levels of confidence.

respectively. Correlations involving timed items in which lower scores indicated better performances were reflected (reversed in direction) to give standard meanings to positive and negative correlations. There were indications that lower status girls were faster, were better coordinated and had more endurance but that upper status girls were stronger in arm and shoulder girdle strength, in abdominal and hip flexor muscles, and in muscular explosiveness. Lower status boys were faster and better coordinated but that higher status boys scored better in combined agility and speed and in strength of abdominal and hip flexor muscles.

Barker and Panthieux\textsuperscript{65} studied the partial relationships between race and the measures of physical fitness test. They used 633 pupils of grade 5 and 6. The statistical procedure employed was partial correlation. This study indicates statistically significant relationships between race and the measures of physical fitness test, with the effects of the variable of socio-economic status controlled, partialled out or held constant.

Williams made an effort to investigate the relationship of race and socio-economic status to motor ability and athletic skill in elementary school children. He drew the experimental sample by administering the Peabody Picture Vocabulary Test to over one hundred and fifty third grade boys from two racial groups. An index of status characteristics was tabulated to ascertain the social class position. Motor ability and athletic skill was determined by administering the Georgia Adaptation Children's Physical Development Scale and an Athletic Skill Survey. Data was subjected to an analysis of variance to ascertain the differences existing between dependent and independent variables and Duncan's New Multiple Range Test was employed to determine the exact location of the differences. In addition, Pears Product Moment Correlation Co-efficients were computed to determine the inter-relationships between motor ability and the four items comprising the Athletic Skill Survey. Results revealed that differences existed between Blacks and Whites, and between the three socio-economic status level on motor performance. Blacks were found to be significantly superior to whites as compared on motor ability scores. Blacks at each level of socio-

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economic status consistently demonstrated higher motor ability scores than did whites at comparable levels. As the level of socio-economic status increased for Blacks, motor ability scores also increased.

Amato used 2500 fraternity male students for the study of relationship between academic grades and intramural participation during each of the three academic terms of the year 1962-63 at the Pennsylvania State University and classified them into 3 participating groups and 1 non participating group. The results showed significant negative quardiserial correlation co-efficients for each phase of the study with the exception of the spring term, 1963. These coefficients, however, were too low to warrant any conclusion that academic grades were affected by intramural participation.

Terman after studying intellectual gifted children for 25 years, stated that: "The results of the physical measurements and medical examinations provide a striking

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contrast to the popular stereotype of the child prodigy, so commonly predicted as a pathetic creature, over serious, undersized, sickly, hollow chested, nervously tense and bespectacled. There are gifted children who bear some resemblance to this stereotype, but the truth is that almost every element in the picture, except the last, is less characteristic of the gifted child than of the mentally average.

York69 compared the aptitude and achievement of physical education majors and non-majors in teacher education. The data was obtained from 109 women physical education majors and 118 majoring in other branches of teacher education who graduated between 1957 through 1966 from the University of Washington. It was discovered that the physical education major students have aptitude for and achievement in scholastic work comparable to women students who major in Art, English, History, Home Economics and Sociology.

Mowen attempted to study physical fitness relationship between performances scores and knowledge scores. His subjects were 32 senior high school students. He concluded that relationship between knowledge scores and gain and loss in physical fitness scores between the 2 fitness tests was .30.