CHAPTER II
CHAPTER II

STUDY OF THE RELATED LITERATURE

After stating the area and the problem of the research, brief review of related literature have been presented.

Some historical landmarks in the field of research are presented in the first half of this Chapter. Another part consists of the researches made in the field of relationships.

Antropometric Measures:

A treatise was read to American Association for the Advancement of Physical Education in 1886 (Cozen P., 28). The treatise was named as "SHILPI SHASTRI", which was related to remote civilization of India. In this treatise the human body was divided into 480 parts. The ancient Egyptians also used a rough sort of antropometric measures during the period of 35th to 22nd Century B.C. They divided body into nineteen equal measures each of which has the length of the middle finger of a high priest.

At the beginning Ancient Greeks presented heavy type of strature but later on proved to be lighter and less robust. They wanted to present God like man. They tried to make the statues more perfect, in proportions. Polycletus after careful study fashioned a model called the "DORYPHOROUS" or "SPEAR THROWER" which by general concept represented absolute perfection in human proportion.
He pictured a perfect man as a fighter and athlete (Eby - p.246) broad chested thickset and square chested.

From these examples of sculpture it is known that the artists of those days did study the human figure, its outer physical form. This type lasted about 100 years, but as the art of sculpture advanced, McKenzie has pointed out that desire for more slender and elegant type was increased. Grace took the place of strength and skill took the place of power. Grace has some spectacular value while skill has the value of performance.

( Skill = means maximum performance within minimum efforts, elimination of errors and ease in execution )

Though they followed certain Greek canons, the Romans developed original lines of thought in connection with human perfections and proportions. The Greeks had mature judgement about human beauty which was mainly in the figure and form and especially in the strength and power.

One of the oldest references is given by Baron quoted by Bovard about height, strength, agility etc... which reveals the interest in measurement. Baron Quetlet in his works, "Man and the development of his faculties" and "Essay upon Social Physics", says that the determination of the average man in general makes an examination of all that relates to his life, his birth-death-strength height and agility.
In 1854, 'German Care' proposed an Anthropometrical basis for determining bodily proportions assuming the hand length as a unit of measure. As we measure by inches, feet, cm, and meters, German care tried to measure a man with the unit of a hand - length of that particular man.

The investigations in the modern world began from the physical measurement of adolescent boys since 1854 by zessing when he studied Belgian Children. Few years later in 1860 Cromwell contributed a study of the growth of Manchester School Children for the ages from 8 to 18 years. He discovered a general law, which has been verified by many authorities, since that date with the exception of Quetlet for normal children and Goddard for feeble minded children.

The law reads like this -

"Girls are taller and heavier than boys from the approximate ages 11 to 14. The boys then become taller and heavier and continue their growth longer".

Hitchcock has studied many aspects of the development of physique. He presented the measurements useful to judge person's age, height, weight, girth of chest, arm and forearm and strength of the upper arm as measured by pull-ups. It was Dr. D. A. Sargent who began a systematic studies of measurements in Physical Education, at Harvard University in 1880. He presented a percentile table of various age groups of the college life for men and women. Later on it was published in 1883.
About the Height and Weight:

The Steet developed the theory of proportionate growth of height and weight. As, the weight should be twice the inches of the height (if measured in pounds). Then it is supposed to be proper weight of a person that he should carry. (Height 70 inches Weight should be 70 x 2 = 140 lbs.)

Such measures were being established to judge the relation between the two variables.

Dr. Hastings W.W., from spring field, studied the growth of children from 5th birth day to 21st birth day in 1902. Then the manual about physical measurement was published.

As far as physical education is concerned it helped the people to present only physical measures of the body in order to study the size shape and symmetry. The terms like strength, stamina, power were yet to come in practice and theory.

General Motor Ability:

From 1880 onwards the concept to measure strength and its measurements was seen in the existence as expected in physical education. Dr. D. A. Sargent at Harvard and Hitchcock at Amherst used their extended series in determining norms for various ages.

In present psychology various theories are used to interpret the intelligence. As the General or 'G' factor theory of Spearman, General Motor ability theory has been pleaded in physical education.
Baumgartner and Jackson have worked it as "Physical educators have traditionally accepted the principle of generality of motor ability - which means the idea that performance of many different motor tasks may be predicted on the basis of a single or limited number of test items. This principle suggests that the individual who is skilled in one motor task will be skilled in another motor task. Further more Baumgartner compares Sargent's single test with 'G' factor theory in Psychology 4 as "Sargent's Physical Test of a Man, measures the height of the jump (in Jump and Reach) on the assumption that a single test is sufficient to measure motor ability. This proposition parallels the concept, which was accepted by psychologists that a 'G' factor theory or General Factory Theory in intelligence is adequate to represent human intellectual ability. It is accepted that motor learning and the measurement of motor ability are inter-related in the work of a physical educator, who measures students achievement of motor skills.

In heavy gymnastics preliminary qualifications for proficient work is supposed to be the strength in arms to hold the weight of our body. One has to press his hands with a very firm grip while exercising on double bar, single bar, Roman rings, vaulting horse. He holds his weight at the same time he losses the grip in such-way he may change the direction and go on keeping his balance.

Not size but Capacity:

Dr. D. A. Sargent is the first physical educator who concluded that it is the capacity and not the size alone, which would be of
greatest practical value. After all external tape measurement does not tell us much about the individual capacity.

Mechanical Aids:

Mechanical Aids for objective measurements in Physical Education - Second stage in the development of measurement in physical education was the invention of mechanical aids to present the objective results of testing. Kellog emphasized the importance of exercise as a therapeutic measure. He invented the universal dynomometer, with which he was able to test the strength of many groups of muscles.

While undergoing any activity, the muscle needs power. It gets power from the blood and oxygen. Oxygen is supplied by lungs. They expand and contract at a fast rate. So the heart gets more blood in and pumps it out; then the blood is supplied to the muscle. The muscle gets the energy - the power to work more efficiently. So the investigators in the field thought, this whole human machine can be tested by testing heart and the lungs capacity. From then large strides have been taken in the development of the cardio functional tests.

Bovard has said about Mosso's work in the field that -

"He pointed out the essential relationship that the ability of a muscle to perform was related to the efficiency of circulatory system. He was the pioneer in establishing relationship between the physical condition and the muscular activity".
Functional Aspect in Testing:

Since then the functional aspect of the whole human body - human machine has caught the attention of physical educators. Experimentation began with attempts to find out more satisfactory indication of physical condition of a person. There was a big advance in the physiology of heart and circulation of blood. Special emphasis came to be put on the hygiene rather than the building up the muscles only.

There after the researchers started the study about the activity and heart rate, effect of exercise and the heart rate.

Carnpton has observed (in 1905) -

"The change in, from the horizontal to erect position, increases the heart-rate from zero to forty four beats per minute".

Then during last seven decades there has been ample study about the size of the heart and the total strength of a person, about the change in the cardio-vascular function and exercise, about the heart (size and function) of a common man and an athlete, and many other factors which are related to heart, such as lung-capacity, pulse-rate, blood-pressure etc.

It means research workers began to test the ability of a person by testing his more vital parts or organs or the functional aspects of the body.
In 1910 McCurdy presented his work on changes in heart rate and blood pressure of adolescents, with the results of which grew a simple test of condition.

In 1914 Heylon Foster and Barch reported about their tests for physical efficiency. During the first world war, Campbell presented his famous test - Campbell's pulse ratio test.

**Different Systems together:**

Thus the different research workers have proved that the body reacts as a whole, in a particular situation, and there is a good relationship among the different systems of the body. It is also judged that while measuring the ability of a person the functional aspect of various systems of the body is to be considered. In other words the physical educator must consider the total physical condition of a student while thinking of various systems or the various performances in physical activities.

It is thus observed that research workers started to find out better measures to estimate one's physical abilities.

**Development of Physical Ability Tests:**

The strength test was criticized on the ground that it was limited to measurement of endurance of heart and development of lungs. Further more the persons with ample strength became strongmen with short limbs, large chest, broad back and shoulders with great girth measurements of all the parts of the body. The athletes of those days thought that "this Strongmen phenomenon" has ruined them.
Testing of total Efficiency:

From the first decade of the present century the research workers began to test the total efficiency of a man.

Dr. D. A. Sargent devised a test which lasted for thirty minutes and would test various physical activities. Prior to this in about 1894 testing and classification was done in normal school of gymnastics at Milwaukee Melon of Columbia also set up tests in running, jumping, vaulting, climbing etc. in 1904.

Testing in public schools was continued under the guidance of Pierson S. Page in 1904 to 1908. In 1910 Cincinnati High School conducted physical efficiency Tests.

Thereafter testing of physical abilities of boys and girls by the play-ground and recreation Association of America was a milestone in this field. At the same time Athletic Badge was also published by the Association. The test battery, which could be easily administered was made successful by Brace in 1927. These motor ability tests proved to be excellent for classifying and evaluating the physical achievements. These tests are full of variety of items assessing the general co-ordination, agility, balance, control, flexibility and strength. This movement of testing the physical ability became interesting in schools and colleges and universities.

The University of California was the pioneer to administer these tests under the directions of Frank Kleeberger in 1915.
Test for Women and Girls:

The college Women Directors of Physical Education appointed a Committee in the Spring of 1923. One of the Senior Workers in the Physical Education of Women, Miss Wayman has reported about the testing of motor ability and physical efficiency of women. She has also reported about the physical fitness as disclosed by medical examination and certain anthropometric measures.

Mechanical Instruments:

Since 1930 onwards many research workers tried to measure physical fitness with mechanical instruments which would give accurate immediate and objective results. So more accurate and specific measures were found out to prove one's strength and ability of a particular part of the body and the particular skill required for a specific game.

The adoption of these tests changed the whole idea of assessing very accurately the physical abilities of an individual.

PART II

Integrated Development:

The concept of integrated development which implies inter-relationship between the non-intellectual (especially motor, emotional and social) and intellectual aspects, forms the foundation of number of theories of child development. There are many research workers, who have thought over this problem and presented their opinions and findings.
Some of which are quoted hereunder to stress the relationship between physical or motor fitness and the intelligence.

Keplhart in his work has stressed the importance of considering the complete perceptual motor development, while Doman and Delacato have emphasized, neurological organization as an essential feature in child development.

Ismail H. H. has reached conclusion that this is a positive association between some motor items (like co-ordination and balance in long jump, and jump and reach) and well established measures of intelligence and scholastic ability. He has also considered speed and strength as two of the factors in his testing non-intellectual variables. Coefficient he has worked out ranges from \( r = 0.05 \) to 0.43. An important observation is that all intellectual items have positive loading with all of the balance and co-ordination items. (In the present work long jump and jump and reach are items which require balance and co-ordination). Other relationships like rhythmic perception, intelligence and various measures of motor performances were also studied by Bond. He found the relationship between the range \( r = 0.24 \) to 0.36. Solan Williams studied mentally defeated children and has found out the relation between motor proficiency and intelligence. He administered the Lincoln Adaptation of Gesetky Tests of Motor Proficiency and 1937 version of stanford Binet test of intelligence.

Th.: 5794
Study of the relationship - Psychomotor & academic achievement:

De Houx L. has studied psychomotor area in Education and has stated that when a parallel is drawn between the progress in academic studies and physical education, it is found that sports exercises and all the forms of physical education are indispensable in building character and allowing man to attain his highest intellectual potential.10

About Female Subjects:

Some special work has been done in the area involving female subjects only. Afflerbach Halen Jean11 has studied perceptual motor ability and academic achievement in her work - "The Relationship of intelligence, reaction time, using large muscle groups and motor ability of 125 High School girls enrolled in physical education classes at Denton High School, Denton Texas.

About Reading and Throw-catch:

Jealyn J. Plack13 has also studied 172 subjects. The Iowa Tests of basic skill were used to determine the reading achievement and Johnson Motor Achievement Battery was employed to measure achievement in selected motor skills. The Pearson Product moment coefficient of correlation was applied to compute the relationships between the reading and motor achievement variables. Highly significant correlations were found between achievement in reading and Throw and Catch Test and Zigzag run.
About P.E. Activities and Number Concept:

James Humphrey\textsuperscript{16} has conducted a different research. He intended to know whether some of the physical education activities help to learn the number concepts at an early age. He administered a pre-test to thirty five children of first grade. The "equated score", 20 children were selected. Eight physical education activities were selected as learning media for the development of mathematics concepts. In every case he found significant difference between the means of the first test and the re-test scores. This type of research proved that the physical education activities do help for the learning in general.

Longitudinal Study:

The other area has been touched by James M.D. Nucci\textsuperscript{15} having Longitudinal Analysis of various aspects such as academic achievement, intelligence and physical variables. He studied the relationship between academic achievement, intelligence and the maturity physique type, body size, muscular strength endurance and motor ability of boys from 9 to 17 years. He studied 55 boys from 3rd to 11th grade. The correlations he found ranged from 0.28 to 0.70.

Significant Correlations:

a) Ma Rhina Spencer Daniels\textsuperscript{16} has studied sixth grade girls. The purpose of the research was to determine the relationship of physical fitness, academic achievement and I.Q. of sixth grade girls. An additional purpose of this research was to determine the level of confidence of correlation co-efficients and provide a general concept of their significance. Daniels administered
some portions of AAHPER (50 yds dash, sit ups, long jump, shuttle run) to test the physical fitness of 90 girls of Std. VI. SRA test (School Record Achievement) of educational ability by students' permanent record was used to determine intelligence factor for measuring the academic achievement records from the final examination were used. The relationship established by Pearson Product moment correlation coefficients between the physical fitness and the intelligence was \( r = 0.39 \) significant at the 0.01 level; physical fitness and academic achievement coefficient of correlation was \( r = 0.26 \) significant at the 0.05 level.

Hatcher Edward \(^\text{17}\) had also found the same results. Moreover, while studying the boys from ninth grade he studied strength of extensor muscles of arm and the item measuring paragraph reading.

b) About College Women:

In 1961 and 1962 Domingo \(^\text{18}\) and Hart Mania \(^\text{19}\) studied the relationship between selected motor fitness scores and academic aspects and physical fitness indices and academic indices of college women respectively. Correlation index showed by coefficient of 0.50 to 0.63 with mathematical and verbal parts of SAT (Scholastic Achievement Tests) to PFI (Physical Fitness Index) was found by Hart Mania.

In the same year 1962 Hays Richard Ernest \(^\text{20}\) studied more about the relationship between physical fitness and academic grades for selected High School boys. He administered Washington State
Physical Fitness Test in Lincoln High School to average academic grade boys. He found three positive correlations though the fourth was negative he pleads that it was because of those boys who had more failures and who were overaged.

Before Daniels study about Sixth grade girls Colefied J. R. studied the relationship in great detail for the 12 years old boys of Std. VI. Some of his findings are as mentioned below:

a) PFI (Physical Fitness Index) Correlated 0.946 with General learning potential.

b) PFI (Physical Fitness Index) Correlated with General learning capacity as the 0.896.

c) JCR & CPIT: For 9th, 10th, 11th & 12th

Further more Burton M. J. included some other factors in his research work. He gave Phillips, JCR (Jump and Reach, Chinning up, Running dash) and California Psychological Inventory Test (CPIT) to determine the relationship between motor ability and personality traits to the boys of 9th, 10th, 11th & 12th grade.

He says "Persons who are high in motor ability tend to be better adjusted than the persons who are low in motor ability".

Other Aspects as Social and Cultural etc.

1) Bosapflug Leroy R. of South Dakota University has included few more aspects for finding out the various correlations of 50 subjects. He measured physical fitness by AAHPER Youth Fitness Test. Their sociability was tested by Cowell Personality distance ballot. Social adjustment was tested by Cowell Social behaviour trend index. The intelligence of the subjects was tested by Hermon Nelson Test of Mental Ability and the Academic School Achievement was taken as from school grades.
He pleads that subjects who obtained high physical fitness scores appeared to be more socially accepted, more socially adjusted and had better academic achievement than those with low physical fitness.

Kock Linda\textsuperscript{24} has selected her subjects as \textit{girls} from 9th, 10th and 11th grades (whereas Burton has studied the \textit{boys} of the same grades). She pointed out that the subjects who had high I.Q. had high physical performance and the girls who had low I.Q. had low physical performance.

Neuromuscular co-ordination is one of the important aspects of physical education. So Herndon Daisy E.\textsuperscript{25} studied the problem in the area of Kindergarten children. The Peerman Modification of Lincon Revision of Oseretsky Motor Development scale and Singer Brunk Figure Reproduction Test as modified by Herndon and Kulmann Anderson Measure of academic potential were given to 50 Kindergarten children correlations indicated that perceptual tests correlated highly. (\( Y = 0.69 \)) and that the modified Singer Brunk Figure Reproduction Test appears prefential in relating perceptual ability of Kindergarten children was significant (\( P < .01 \)).

While searching for related literature about the subject of the thesis, it is also found that there are one or two references in which the research workers have not found positive and significant relation between intelligence, academic achievement and motor ability or physical fitness.
Not only were intelligence and motor abilities studied to find out the relationship but many other aspects were also studied to find out the relationship among the physical fitness, motor ability, intelligence and many other personality factors.

Peggy Thomas, of South west Missouri State College has studied many aspects of personality.

She pleads that AAPHER Youth Fitness Test Scores showed statistically significant relationship with mental ability and academic achievement. Socioeconomically status group was not significantly more physically fit than the other group. Relationship of physical fitness with selected mental ability were significantly positive.

c) Bruce’s Study:

Bruce, R.F., Warven, R.J., and Julia, A. Johnson had a very big research project. They studied over 6,000 children for about twelve years (i.e., from 1957 to 1969). After giving a certain programme to the children in a special clinic they found significant improvement in perceptual motor measures and significant improvement in performance of Intelligence Quotient.

d) Study at Chile:

Very recently in Chile a novel research was done by Dr. Stern in the field of relationship among sports moral and political socialization of High School youths in Chile. He found positive relations with willingness to legal means, confidence, social trust and sports. But he did not find positive relationship with moral judgement, political tolerance, maturity and sports.
In one of the researches results about perceptual motor tests were significantly correlated with Otis Lennon Mental Ability Test and the \( r \) was = 0.71.

e) Balance & Intelligence:

Owen, J. A.\(^{30}\) and Zuccato, P. C.\(^{31}\) had another field of research. They worked on a static and dynamic balance as related to intelligence. Intelligence and dynamic balance were correlated positive and significantly. The coefficient of correlation was \( R = 0.30 \). I. Q. scores were measured by California Short Form Test of Mental Maturity. Scolastic achievement tests also were used for academic performance was compared and related with the intelligence.

f) Hand Reaction time and Binet's Test of I. Q.:

Taylon Elizabeth R.\(^{32}\) of Trinity University has studied selected First grade students. She administered the Standard Achievement Test Primary Battery and Nelson Hand Reaction Time Test. She found a significant and positive correlation between perceptual (spatial and speed) and Primary Mental Ability.

C. Douglas Yarnall\(^{33}\) worked on the problem of relationship between measures of popularity and physical fitness. The relationship was found positive and significant.

g) Minimum Muscular Fitness & Social Acceptance etc.:

Persons like Haines James E.\(^{34}\) tried to detect the relationship between minimum muscular fitness and social acceptance or emotional stability of an individual. For the same reason he detected the
relationship of Kraus Weber - Minimal Muscular Fitness and Roger's Physical Fitness Index Tests with social acceptance and emotional stability in selected fifth grade pupils.

Jones also while comparing physical strength and social acceptance found that boys with high physical strength indicated a tendency for strength to be associated with good physique, physical fitness, early maturity, social prestige and social stimulus value and an apparently satisfactory level of personal adjustment.

h) Psychological study between Athletes & Non-athletes:

Jack Schended studied psychological differences between athletes and non-athletes. In this results he concluded that when ninth grade athletes are compared with ninth grade not participants in athletics the results are as follows:

1. The athlete possesses more qualities of leadership and social initiative.
2. He possesses more qualities which lead to social status, greater sense of personal worth.
3. He has less self doubt.
4. He is more conventional in his responses to social situations.
5. He has more social maturity.
   The most important observation is:
6. He has greater intellectual efficiency.

Not only intellectual and academic achievement and their relationship with physical fitness or motor abilities but various of fields or relationship are also being studied.
1) **Other Areas**

Flint and Diel Bobbie reported a significant relationship between abdominal strength and trunk alignment, and low but significant relationship between back extensor strength and alignment of the trunk.

Leela C. Zion has tried to touch the basic problem of the body concept as outer part and the inner as one's personality - the structure of a man.

Through out the history man has been intrigued with the possibility that the outward characteristics of the body might reveal some how the inner structure of personality of a man. It has been assumed by Jersild Murphy and Diamond that a person's attitudes concerning his conception of himself, will influence and be influenced by his view of physical appearance and physical abilities.

While dealing with the physical education it is quite important to know how does the body influence other aspects of students' life, as well as what we are doing to the body concepts of our students.

Keith E. Beery found out positive correlations among form reproduction scores and those of the PMA subjects and totals eye, hand dexterity and chronological age. These suggest that form reproduction was related primarily to M.A. (mental age) than C.A. (chronological age) within the age-groups (grades 1st, 4th and 6th) of middle class, correlations ranged from 0.30 to 0.75 between M.A. and reproduction.
Early childhood is supposed to be quite important age for education in general and for sense training in particular. While reading about the related literature it has been seen that this area also is not left untouched. In the childhood intersensory integration is found quite high. Significant accuracy was found at the ages five and six.

Studies by Piaget and Inhelder Zuporosherts (1965) Abravanel (1968) document developmental progressions of perceptual activity i.e. in the means of detecting relevant spatial and figural properties of various objects. As such they attest to the changing nature of perceptual process during ontogenesis. 96 children of normal I.Q. between three to seven years were studied for the said research.

There are some other allied fields in which helpful investigations have been done to detect the relationship between the various physical activities and personality variables.

Aline H. Kidd of Mills College and Donal Beere of California State College at Los Angeles, in their combined work have tried to establish relationship between KFAE (Kinaesthetic Figural After Effect) and certain variables of personality traits.

Certain other correlations have been worked out quite recently in 1973. Correlation between combined supervisory ranking of satisfactory work performance of policemen and hand test variables.

Further, Rogers and Palmer's study showed that the improvement of the physical fitness index has a positive effect upon academic work.
This statement has made the researcher to find out the effect of physical activities on intelligence in Indian conditions.

The another study of the same type was completed by Hart M.E. and Clayton T. Shay. They say - "Although Physical Fitness is not a general predictor of academic success it has high effect to be considered as a necessary factor for the improvement of academic index in general education of the college student." 45-E.

**PART III**

**ABILITIES**

**a) Physical Abilities and Achievement Tests**

When a person has certain basic physical abilities he is supposed to be physically fit. These abilities are strength, stamina, power, endurance, speed, agility, balance. These abilities are measured through certain physical activities. Many have measured physical abilities through different physical abilities.

**b) Strength**

Strength is supposed to be one of the basic physical abilities. In the strength also there are three different areas as explosive strength, dynamic strength and static strength.

Brogden, Bruce and Lubin (1962; Coleman 1940; Cumbee and Harris, 1953; Haris (1937) Hempell and Fleishman 1955; Hutto, 1930, McCraw, 1949; Rarick, 1937; Shapira 1947; Carpenter 1941; Cousins 1955; Highmore 1956; Larson 1941, McCloy 1940 and 1956; Phillips 1949 and Sea Shore 1942, have studied about the explosive strength."46
c) **Power**:

This factor appeared to emphasize the ability to exert maximum energy in one explosive act. It has been called as energy mobilization or power or velocity.

The test of this factor includes broad jump, vertical jump and ball throw.

The common feature of tests of explosive strength is that one is required to jump or to project one self or to project some object as far or as high as possible.

In this context, further reference of Modd Linda (1973) is worth quoting. She says in her abstract "Long jump and vertical jump in original are more predictive of leg strength". Tests that involve jumping for height or distance have been accepted by physical educators as a measure of power. Recent biomechanical research reported wide range of correlations (from $r=0.14$ to $0.51$) between jumping and mechanical power. Lawrence Mc Clements has said more or less about the power. He says, "The developments of fitness of total body, were equally effective in causing increase in the power of leg and thigh muscles used in the vertical jump".

This sort of strength factor appears distinguished from other strength factors requiring one short burst or effort rather than continuous stress on muscles or repeated exertion.

d) **Vertical Jump and Long Jump for explosive strength**:

In this research project two tests are used - one vertical jump - (jump and reach or known as sargent jump) and broad jump or long...
jump to measure the basic ability, explosive strength. Performance as the product of this strength is measured and the boys who have higher achievement in these achievement tests are compared with those boys who have less achievement in these tests items in relation with their achievement in intelligence test.

c) Paradigm of Muscular Strength and actual test items:

Many have studied about the muscular strength. Especially Andrew S. Jackson and Ronald J. Frankiewicz of Houston University, Texas, have presented a theoretical model of muscular strength, in the form of theoretical paradigm of muscular strength. They have presented three dimensions of the figure, which explain various aspects of the muscular strength.

a) On the base, they have placed force, power and work in three sectors.

b) On two sectors of vertical line body segments — arms and legs are presented.

c) Three horizontal sections are set on the cube to explain the types of contractions of the muscles.

In the sub-sections there are three areas of muscular strength as:

i) Dynamic,

ii) Explosive and

iii) Static
If one tries to find muscular strength of arms and legs either in the form of static or dynamic, horizontal section may be studied. If one wants to study the force, power or work of the body segments, (arms and legs) he may observe the vertical sectors from the right side.

One can study the cross sections and can interpret what tests can be used to test different types of muscular contraction:

1) Static Force - Arm shoulder extension - actual test - as ball throw

In this research project ball throw test was given.
2) Explosive power arm - arm power and body weight - actual test pull-ups.

3) Explosive work-legs - Vertical jump and broad jump.

4) Explosive power leg - Running-dash - 50 or 75 yds.

The contemporary authors of physical measurement and tests, Johnson and Nilson Jack K. (1974) have defined muscular strength as either static or dynamic.

For one important means of attending to major muscle tone, muscular strength has been utilization of the action potential. Karpovich indicates that muscles are electrically silent in a normal relaxed man. But this does not mean that there is no tone or strength present, since the tone the strength may also depend upon the passive elasticity of muscle tissue and turgor muscle cells.

Explosive strength also can be seen in short distance runs, especially when a person tries to get off the blocks as quickly as possible.

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Speed and Dynamic Strength:

These short distance-dash-runs - measure running speed of a person. Brogden, Burke and Lubin 1952; Cousins, 1955, Highmore 1956; McCloy 1956, Sills 1950 have accepted this principle in their literature. There is a good evidence that speed factor correlates with Dynamic Strength factor. Dynamic Strength seems to involve the strength of muscles in the limbs in moving or
supporting the weight of the body, repeatedly or a given period of time. The best test for this factor seems to be pull-ups (popularly called chinning-up) rope climb or dips.

In this research work test of pull-ups is used to measure the dynamic strength of a person in terms of the number of pull-ups.

9) **Endurance and Pull-ups**

Endurance is supposed to be one of the basic physical abilities of a person. Pullups or dips, when scored in terms of number completed by a person (without the time limit) is supposed to measure the endurance of that person. Endurance is a good means to plead one's maximal effort, and his resistance to fatigue.

**PART IV**

**VARIOUS TESTS AND THE TEST ITEMS**

Following different tests or test batteries were used to test one's physical fitness.

Phillips introduced JCR test in 1947. ( J = Jump and Reach) (C = Chinning up) and (R = Running - certain distance).

California Physical Performance Test was introduced in 1962. In this test, i) Standing broad Jump, ii) Pullups, iii) Bent-knee situps, iv) 50 yard dash and v) Soft ball throw - these five events were included. AAPHER also introduced their test of Physical fitness earlier to this (1958) but it was again revised in 1965. This test was prepared to measure strength, endurance, agility and proficiency in running, jumping and throwing. Meanwhile in 1964 Fleishman prepared his famous, Basic Fitness Battery.
Knowing about the human abilities to be tested and knowing about
the broad features of particular tests, a set of five tests was
selected to measure the physical abilities of the boys. It is
also worth to note that the local conditions, available equipment,
trained personnel and few other factors were considered. (Details
in Chapter III).

INTELLIGENCE:

Second important function of this research is to test intelligence
of the subjects already tested in physical achievement.

While doing any activity, performing any task an intelligent
person is immediately known even by his singlest act. As Gardner
Murphy says,\footnote{53, 54} Among a group of children (even) at play, we
spot out those who seem to be bright and those who seem to be
dull in catching on to the rules of game.

STUDY OF THE RELATED LITERATURE

SUMMARY

First half deals with progress of measurement and testing in
physical education. Second half deals with the related litera-
ture about the relationship, especially physical abilities,
physical achievements and academic achievement, intelligence
psychological, social and cultural development etc.

Huge body was supposed to be best physique, but later on grace
took the place of strength and skill took the place of power.
Bodily proportion was studied in the unit of hand length. Then
systematic studies of the development of body were started.
From 1880 onwards concept of measurement of strength took place. Norms for various age groups were being prepared. Then theory of general motor ability was being developed.

Near the second decade of 20th century Dr. D.A. Sargent concluded that it is the capacity and not the size alone which would be of greatest practical value.

Thereafter mechanical aids were used to measure one's physical capacity. Strength of various groups of muscles was measured through various mechanical aids.

Then the idea of 'Human Machine' got developed. While having any exercise or any activity, this machine - human body works as a whole and not only by particular parts.

Effect of exercise on various vital systems of the body was considered together. So the tests measuring pulse rate, lung capacity, blood pressure were prepared. The cardio functional tests took the place to test the total efficiency of a man were being invented. Then developed the technique to test the various basic physical abilities of a man (as strength, stamina, speed, endurance, agility, flexibility etc.) Some separate tests for women were developed by the committee of Women College Directors.

Then mechanical instruments were prepared to measure the physical fitness of an individual - as objectively as possible.

Part III deals with the study of related literature - about the relationship. The concept of Integrated development took place.
Intellectual and Physical areas were being compared, tested and correlated together. Relationship between physical fitness, motor ability, health habits and intelligence, academic achievement, social and cultural progress were being studied.

Relationship between perception, intelligence and physical and motor fitness was found positive. Solan Williams - after studying mentally retarded children found that mental age has positive relationship with physical fitness. He also found motor proficiency and intelligence were highly correlated.

Jealyn J. Plack's study proves highly significant correlation between achievement in reading and throw and catch test and zig-zag-run. Humphrey proved that physical education activities do help to learn number concept in mathematics in the kindergarten classes.

Nucci J. M.D. had longitudinal study of many boys in the area of academic achievement, intelligence and physical variables. The relationship between academic achievement, intelligence and maturity, physique type, body size, muscular strength, motor ability ranged from $r = 0.28$ to $0.70$.

Daniel and Coefied studied relationship of physical fitness, academic achievement and intelligence of girls and boys respectively.

In short relationship between physical fitness, motor skills, sports health, health habits - and academic achievement, intelligence, social and cultural development, personality traits
was studied for most of the age groups. For studying such relationship subjects from variety of groups (viz. mentally retarded, gifted, average and intelligent, culturally deprived, from various age groups, Kindergarten to College men and women) were studied. And the result with more or less in quotient was the positive and significant relationship existed between the two variables.

Persons like Bruce took much pains. He studied 6,000 children for 12 years (1957 to 1969).

In the Third Part of this Chapter a brief account of physical abilities and their tests has been given.

In the Part IV Various Tests and test items have been presented.

Part V Summary:

This review of allied literature with respect to the problem of the present research work indicates that there ought to be some relationship between physical achievements and mental ability.

In the next Chapter the procedure of the research work is being presented.
CHAPTER II : REFERENCES

1. Hitchcock, E. 

2. McKenna, R.T. 

3. Boward, J.F., Pedrick, W., Cosans & E. Pertrica Hogan 

4. Baugartner Ted A and Andrew E. Jackson 

5. Kephart, Netawo C 
   The slow learner in the Classroom; Columbus, Ohio, Charles, E. Merrill, Books 1960.

6. Delacato, Carl H. 

7. Ismail A.A. 

8. Bond, Hajone 

9. Solan, William 
9. Solan, William

Again referred in Annotated Bibliography in Physical Education, Recreation and Psychomotor Function of Mentally Retarded Persons 1975; No. 320.


10. Dehoux L.


11. Afflerbach Hallen Jean

"Relationship ... Denton".


12. Jeralyn J. Pack

"Relationship of Achievement in Reading to Achievement in selected Motor Skills in Children in I, II and IV grades. University of Minnesota, Minneapolis, Minnesota, March 19, 1966 at 1:15 p.m., p. 30.


13. Jaslyn J. Flack

Relationship of Achievement in Reading to Achievement in Selected Motor Skills in children in Grade I, III and IV. University of Minnesota, Minneapolis, Minnesota, March 19, 1966, at 1:15 p.m., p. 30.

14. James Humphrey

"A Study of the use of motor activity learning in the development of number concepts with first grade boys and girls."

University of Maryland, 9108 St. Andrews place, College Park, Maryland 27040
March 20, 1966 at 2:00 p.m. P. 52

15. James N. DiNucci

"Longitudinal Analysis of Academic Achievement and Intelligence of Boys 9 to 17 years of age as related to selected physical variables".

North Western State College, B. Harrison Clarke, University of Oregon, April 11, 1969, 3:30 p.m. P. 29

16. Ida Edwina Spencer Daniels


17. Hatcher Edward

"A Study of determine the relationship between Physical Fitness and academic Achievement of Ninth grade boys".


18. Domingo, Frances McKenzie

"The Relationship of selected Motor Fitness Scores of Freshmen College Women to Aspects of their Academic Achievement".

Completed Research, AAHPER 1961, No.135, p. 53.

19. Hart, Maria E.

20. Hayes Richard E.  
   "The relationship between Physical Fitness and Academic grade for selected high school boys".

21. Confield, John R.  
   Relationship between the Academic Achievement, Maturity, Physical and Personality measures of 12 year old Boys of Sixth Grade.
   Completed Research Abstracts, AAHPER 1964, No. 269, p. 80.

22. Burton, Merriman John  
   "The Relationship of Personality traits to Motor Ability."
   Ph.D. in Physical Education, 1959,

23. Roopflug Leroy R.  

24. Kock, Linda E.  
   "The trend of the relationship between Motor Ability and High and Low Intelligence Quotient of 9th, 10th, 11th Grade girls, N.S. in Physical Education, 1968.

25. Herndon, Daisy E.  
   "The Relationship of Perceptual Motor Ability and Intellectual ability in Kindergarten age Children".
   Texas Women's University, Denton, Texas, M.A. in P.E. 1970.
26. Pagy Thomas
Internships among Physical Fitness
Selected aspects of mental ability,
Socio-economic Status and Co-curricular
participation*. Department of P.E.
South-West Missouri, College, Springfield
Missouri 65802,
April 14, 1969, at 9:30 a.m.

27. Bruce, R.F. Warren, R.J and J.A. Johnson
"Intelligence and Perceptual Motor
Development as a function of therapec
tic play research conducted at Childrens'
Physical Development Clinic at
University of Maryland College Park.
Research Quarterly, Vol.40, No.4,

28. Stern B.B.
"The Relationship between participation
in Sports and Moral and Political
Socialization of High School Youths
in Chile, Oberlin College, Oberlin, Ohio
44074, Oberlin, March 27, 1972,
9:30 a.m. B. 97.

29. Thomas Jerry R.
The use of a Perceptual Motor Test
and a cognitive ability test to classify
1st Grade children into reading groups.
Div. of H.P.E.R. Georgia Southern
College, Georgia, April 13, 1973,
at 9:00 a.m. P.1. Abstracts 1974.

30. Owen, Jo Ann.

31. Zuccaro, Fay C.
"The Relationship of Selected Static
and Dynamic measures to intelligence
and Scholastic Achievement.

32. Taylor, Elizabeth R.
"Relationship of hand reaction-time
with Intellectual ability and academic
achievement of selected 1st Grade
Students*.
Trinity University, San Antonio, Texas.
Completed Research Vol.17, 1975,
No.346, p. 107.


37. Flint, M., Marilyn & Diel Bobbie: "Influence of Abdominal Strength and Trunk Strength balance upon Antero-Posterior alignment of Elementary School girls."


38. Leslie C. Zlon: "Body Concepts as it relates to self concept". Humboldt State College, Arcata, California, University of California, Berkeley 1963.


41. Zaporoshets, A.V.: "The Development of Perception in the Pre-school child".


(Referred again in Perceptual Motor Skill- 1966, p. 251-256).
42. Abarwade Eugene

"Intersensory Integration of Spatial Position during early Childhood".

43. Abarwade Eugene


44. A Line, H. Kidd & Donald Beere


45. Thomas M. Rand & Edwin K. Maynor

University of Akron.

45-A. Clarke, H. Harrison


45-B. Harica, K. Hart


46. Fleishman

Ibid p. 29.

47. Hudd Linda L. (1973)

Comparison of Tests of Static Leg Strength and Leg power.

48. Barlow, David A


Referred in Research Quarterly 1975 p. 208.
CHAPTER XI  : REFERENCES  : contd..

49. Lawrence, McClements  

  Power Relative to Strength of Leg and High Muscles.
  Ball State University, Research Quarterly, 1966, p. 71.

49-A. Considine, W.J.  

  A validity analysis of Selected Leg Power Tests, Doctoral Dissertation
  Indiana University 1970.
  Referred in Research Quarterly 1975 p. 208.

49-B. Considine, William J. and Sullivan W.J.  

  Relationship of Selected Tests of Leg Strength and Leg Power on College

50. Andrew S. Jackson and Ronald J. Franklin  

  Factorial Exploation of Muscular Strength, Theoretical Model -
  Paradigm of Muscular Strength.

51. Fleishman  

  Ibid p. 33.

52. Phillips, B.E.  

  The JSCR Tests
  Research Quarterly 18, p. 12-29, 1947
  Referred in Baumgartner ibid - 221.

53. Gardner Murphy  

  An Introduction to Psychology Oxford
  and IBM Publishing Co., Calcutta,
  New Delhi, Bombay. Indian Edition 1964
  p. 365.

54. Gardner Murphy  

  Ibid 330.