Chapter III

PROCEDURE

In this chapter the selection of subjects, selection of variables, reliability of data, design of the study, collection of data and statistical techniques for analysing the data are described.

Selection of Subjects

The subjects for this study were the male secondary school students of Kendriya Vidyalaya No.1, Gwalior. A table of random numbers was used for the selection of subjects and thus, one hundred male students were selected as subjects following the suggestions of Steel and Torrie. The health records maintained by the school administration were checked by the investigator to ensure that subjects selected were physically and mentally sound to undertake motor fitness and psychological test choosen for this study. All the subjects were day scholar of the said school and were resident of Greater Gwalior. The average age of the subjects was 15.5 years ranging from 15 to 16 years.

Prior to the testing in different motor components and psychological tests, a meeting of all the subjects selected for this study, with their principal and physical education teachers, was called in which the purposes of the study, requirement of testing procedures, demonstration of various motor ability tests and psychological tests were explained to them in detail to make them understand about what they are actually required to do to fulfill the basic requirement of this research study. All the subjects agreed voluntarily to cooperate in the testing procedures explained to them. The Principal Kendriya Vidyalaya also exhorted them to put in their best efforts in the interest of the scientific investigation. Though no special techniques of motivation were used to motivate the subjects to put in their best efforts yet the subjects were very enthusiastic and cooperative throughout the project.

Selection of Variables

The physical, psychological and anthropometric variables which are considered as the basis of performance as gleaned from a review of professional literature and a feasibility analysis as to what are the variables that could be taken up for investigation in keeping with the availability of equipment, acceptability to the subjects and the legitimate time that could be devoted for tests as well as to keep the entire
study unitary and integrated, the following variables were selected and they were classified into two categories i.e. dependent and independent variables.

Dependent Variables

The Ratings for the three somatotype components, viz., endomorphy, mesomorphy and ectomorphy were selected as dependent variables.

Independent Variables

The independent variables selected were classified into two categories i.e. psychological and selected motor ability variables. The variables under each category were as follows:

(A) Psychological Variables

1. Personality Traits
2. Self Concept Dimensions
3. Reaction to Frustration.

(B) Motor Ability Variables

1. Speed
2. Strength
   (a) Arm and Shoulder Strength
   (b) Abdominal Strength
   (c) Explosive leg strength
3. Cardio-respiratory Endurance
4. Agility
5. Dynamic Balance
6. Flexibility

   (a) Trunk Flexibility
   (b) Spine Flexibility

7. Kinesthetic Perception
8. Two Hand Coordination
9. Reaction Time
10. Movement Time

**Reliability of Data**

The reliability of data was ensured by establishing the instrument reliability, tester reliability, reliability of tests and subject reliability.

**Instrument Reliability**

(a) **Psychological Instrument Reliability**

To measure personality traits, self concept dimensions and reaction to frustration, Jr. Sr. High School personality Questionnaire, by S.D. Kapoor and K.K. Mehrotra, Self Concept Questionnaire (SCQ) by Saraswat and Nairashya Maapa by Chauhan and Tiwari were choosen respectively. These tests were selected in consultation with Dr. S.D. Kapoor, a renowned psychologist at psycho centre, New Delhi and Dr. Gopal Garg, Head of
the department of psychology at M.L.B. College, Gwalior. These three tests are standard tests which had high reliability and objectivity and were accompanied by Indian norms; hence these tests were selected. The reliability of H.S.P.Q. test was .91, .87, .85, .87, .85, .89, .85, .88, .93, .84, .83, .85, .87 and .90 for factor A, B, C, D, E, F, G, H, I, J, O, Q₂, Q₃ and Q₄ respectively.² The reliability of self concept Questionnaire by Rajkumar Saraswat³ was .91 for the total self concept measures and for each dimensions i.e. physical, social, temperamental, educational, moral, and intellectual, the reliability established were .77, .83, .79, .88, .67 and .79 respectively. The reliability of frustration test by Chauhan and Tiwari⁴ was .88 for the total test. The reliability for


each mode i.e. Regression, Fixation, Resignation and Agression were .78, .92, .85 and .87 respectively.

(b) **Motor Ability and Anthropometric Instrument**

To measure selected motor ability variables, the instruments like stop watches, steel tape, yard stick, two hand coordination apparatus, reaction time apparatus and movement time apparatus and to rate the components of physique, the instrument like skinfold caliper, wall scale, broca plane, weighing scale, modified sliding caliper, and flexible steel tape, used in this study were obtained from standard firms which cater to the needs of various research laboratories in India and abroad. All the instruments were available in the Research Laboratory of Lakshmibai National College of Physical Education, Gwalior and their calibration was accepted as accurate enough for the purpose of the study.

Tester Reliability

(a) **Anthropometric Variables**

Reliability of the investigator in measuring the anthropometric variables was tested by computing co-efficients of correlation between the scores obtained by an expert on 20 subjects. The co-efficients are presented in Table 1.
TABLE 1

COEFFICIENTS OF CORRELATION FOR TESTER RELIABILITY
OF ANTHROPOMETRIC VARIABLES

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variable</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Triceps Skinfold</td>
<td>.98*</td>
</tr>
<tr>
<td>2.</td>
<td>Subscapular Skinfold</td>
<td>.98*</td>
</tr>
<tr>
<td>3.</td>
<td>Suprailliac Skinfold</td>
<td>.99*</td>
</tr>
<tr>
<td>4.</td>
<td>Calf Skinfold</td>
<td>.98*</td>
</tr>
<tr>
<td>5.</td>
<td>Biepicondylar Diameter of Humerus</td>
<td>.99*</td>
</tr>
<tr>
<td>6.</td>
<td>Biepicondylar Diameter of Femur</td>
<td>.98*</td>
</tr>
<tr>
<td>7.</td>
<td>Biceps Girth</td>
<td>.98*</td>
</tr>
<tr>
<td>8.</td>
<td>Calf Girth</td>
<td>.99*</td>
</tr>
<tr>
<td>9.</td>
<td>Height</td>
<td>.99*</td>
</tr>
<tr>
<td>10.</td>
<td>Weight</td>
<td>.98*</td>
</tr>
</tbody>
</table>

N = 20

F.01 (18) = .56

*Significant at .01 level of confidence.

Apart from this, the investigator practiced the method of measurement under the supervision of expert on 10 subjects at the research laboratory of the Lakshmibai National College of Physical Education, Gwalior.
(b) **Skinfold Measurements**

Test-retest reliability of skinfold measurements was established according to the method suggested in the Text.\(^5\) Two consecutive measures were obtained for each site and if the second measure differed from the first by more than 5 percent, a third measure was obtained and the average of two closest measures was recorded as the score for that site.

**Reliability of Tests**

(a) **Motor Ability Variables**

Reliability of tests was established by the test-retest method. The data was collected by the investigator on twenty subjects randomly selected from the total group of one hundred. Coefficients of correlation were computed for each test, which are presented in Table 2.

TABLE 2
RELIABILITY COEFFICIENTS OF TEST
RETEST SCORES

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Tests</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>50 Yard Dash</td>
<td>.89*</td>
</tr>
<tr>
<td>2.</td>
<td>Pull Ups</td>
<td>.83*</td>
</tr>
<tr>
<td>3.</td>
<td>Sit Ups</td>
<td>.86*</td>
</tr>
<tr>
<td>4.</td>
<td>Vertical Jump</td>
<td>.92*</td>
</tr>
<tr>
<td>5.</td>
<td>Cooper's 9 Minute Run/Walk Test</td>
<td>.98*</td>
</tr>
<tr>
<td>6.</td>
<td>Agility Test</td>
<td>.88*</td>
</tr>
<tr>
<td>7.</td>
<td>Johnson Modification of Bass Test</td>
<td>.82*</td>
</tr>
<tr>
<td>8.</td>
<td>Sit and Reach Flexibility Test</td>
<td>.84*</td>
</tr>
<tr>
<td>9.</td>
<td>Bridge Up Flexibility Test</td>
<td>.86*</td>
</tr>
<tr>
<td>10.</td>
<td>Scott M. Gladys Kinesthetic Distance Perception Test</td>
<td>.93*</td>
</tr>
<tr>
<td>11.</td>
<td>Two Hand Coordination Test</td>
<td>.86*</td>
</tr>
<tr>
<td>12.</td>
<td>Reaction Time Test</td>
<td>.98*</td>
</tr>
<tr>
<td>13.</td>
<td>Nelson Speed of Movement Test</td>
<td>88*</td>
</tr>
</tbody>
</table>

N = 20

r .01 (18) = .56

* Significant at .01 level of confidence.
(b) **Anthropometric Variables**

In as much as the measurement of anthropometric variables has the inherent difficulties of limb placement and locating of landmarks, test retest reliability was established for height, weight, biepicondylar diameters of humerus and femur and girths of biceps and calf muscles. The coefficient of correlation are presented in Table 3.

**TABLE 3**

**TEST RE-TEST RELIABILITY COEFFICIENTS IN ANTHROPOMETRIC VARIABLES**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Variables v</th>
<th>Coefficient of Correlation</th>
<th>Recommended Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Height</td>
<td>.99</td>
<td>r</td>
</tr>
<tr>
<td>2.</td>
<td>Weight</td>
<td>.98</td>
<td>r</td>
</tr>
<tr>
<td>3.</td>
<td>Biepicondylar diameter of Humerus</td>
<td>.99</td>
<td>.92 to .98</td>
</tr>
<tr>
<td>4.</td>
<td>Biepicondylar diameter of Femur</td>
<td>.99</td>
<td>.92 to .98</td>
</tr>
<tr>
<td>5.</td>
<td>Biceps Girth</td>
<td>.98</td>
<td>.92 to .98</td>
</tr>
<tr>
<td>6.</td>
<td>Calf Girth</td>
<td>.99</td>
<td>.92 to .98</td>
</tr>
</tbody>
</table>
Subjects Reliability

The above test re-test coefficient of correlation method also established that subjects reliability was significant at .01 level of confidence, as the same subjects were used under similar conditions by the same tester and no motivational techniques were used. In the case of psychological variables, it was stressed that their responses will be kept confidential and these tests have nothing to do with grading in their respective classes and they should express their frank and open hearted response which suits best to their own psychological make up.

Design of the Study

This was a status study involving relationship of somatotype component i.e. endomorphy, mesomorphy and ectomorphy to personality traits, dimensions of self concept, modes of reaction to frustration and selected motor ability variables. The relationship between the dependent and independent variables was investigated using one hundred male secondary school students of Kendriya Vidyalaya, No.1, Gwalior.

Administration of Tests and Collection of Data

The data was collected by administering the tests for the chosen variables. All the tests were administered in the Research Laboratory, Gymnasium and Track and Field of
Lakshmibai National College of Physical Education, Gwalior.

Before the administration of tests the subjects were given a chance to practice the prescribed tests to make them familiar with the tests and to know exactly what was to be done. The methodology for each apparatus was explained to the subjects prior to the administration of tests. To ensure uniformity in testing conditions, the subjects were tested only during the morning i.e. from 8.0 AM to 10.30 AM. The data was collected for the chosen independent and dependent variables as per the procedure mentioned below:

Somatotype Components

The ratings for the three somatotype components were obtained by the Heath Carter Anthropometric Somatotyping Method. The anthropometric variables used and the procedures for measuring were as follows:

Height

Instrument: Wall Scale and Broca Plane.

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Definition of the Measurement: Erect body length from the soles of the feet to the vertex.

Posture: Erect standing, feet together with heels, buttocks, upper back, and rear of head in contact with the wall scale.

Technique: As the square was brought on the subjects vertex, he was instructed to take a deep breath and to stretch up to his full height. Height was recorded to the nearest one tenth of an inch.

Weight

Instrument: Weighing scale (balance type).

Technique: Weight to the nearest half pound was recorded with the subject standing in the centre of the scale platform. Only shorts were worn by the subjects.

Sub-cutaneous Fat: General Instructions

Instrument: Lange Skinfold Caliper

Technique: The purpose was to measure the thickness of a complete double layer of skin and sub-cutaneous tissue without including any underlying muscle tissue. A double layer of skin and sub-cutaneous tissue was grasped with the thumb and forefinger, the fold being large enough to get a complete double layer, but not so large as to get so much skin and fat
as might cause excessive amounts of tension beyond the finger
tips. The fold of the skin was held somewhat loosely while
the centres of the caliper faces were one centimeter from
the edges of the thumb and forefinger.

The readings on the dial of the caliper were taken
after applying full spring pressure of the instrument for
all measurements. Time was allowed for the full pressure
of the caliper to take effect, but not so long that the fat
could be "Squeezed out" of the skinfold. The measurement
was recorded to the nearest one tenth of a millimeter.

**Triceps**

Posture: The subject stood with the arm by the side and
elbow extended but relaxed.

Technique: The skinfold was raised with thumb and forefinger
of the left hand over the triceps muscle on the back of the
right arm, half way between the acromion and the elbow, the
skinfold running parallel to the long axis of the arm. The
muscles fibers were excluded, whenever necessary, by locking
the elbow joint momentarily in full extension. (Fig. 1).

**Subscapular**

Posture: The subject stood with shoulders erect but relaxed
and arms by the sides.
Fig. 1. Skinfold Measurement: Triceps.
Technique: The skinfold was raised with the thumb and forefinger of the left hand lateral to the inferior angle of the right scapula, the skinfold running downward and outward in the direction of the ribs. (Fig. 2).

**Suprailiac**

Posture: The subject stood in normal erect posture.

Technique: The subject was instructed to draw in a medium breath and hold it. The skinfold was raised with the thumb and forefinger of the left hand in a position one to two inches above the right anterior superior iliac spine so that the fold run forward and slightly downward.

**Calf**

Posture: The subject sat on the chair with his foot on the floor and lower leg vertical.

Technique: The skinfold was raised with the thumb and forefinger of the left hand on the medial side of the right calf just above the level of the maximum calf girth, the fold running vertically.

**Bone Diameters: General Instructions**

Instrument: Modified sliding calipers.

Definition of Measurement: Bi-epicondylar diameter of the distal extremity of the humerus and femur.
Fig. 2. Skinfold Measurement: Subscapular.
Land Marks: The points on either epicondyle of distal extremity of the humerus or femur most lateral to the medial plane of the bone.

Technique: The branches of the caliper were applied against the epicondyles in such a manner as to bisect the angle of the joint and to lie in the same plane as the limb. Firm pressure was applied and measurement was recorded to the nearest .05 centimeter. Measurements were taken on both limbs (left and right) and larger measurements were recorded.

**Humerus**

Posture: The arm of the subject was raised forward to approximately the level of the shoulder and the forearm was flexed upward at a right angle to the arm.

Technique: The caliper arm were applied to the epicondyles, bisecting the angle of the elbow and laying in the same plane as the arm and forearm.

**Femur**

Posture: The subject sat on a chair with his foot on the floor and the lower leg vertical.

Technique: The researcher took a kneeling position in front of the subject and applied the caliper branches to the epicondyles, bisecting the knee angle and keeping the branches in
a plane parallel to the thigh and lower leg.

**Muscle Girth: General Instructions**

**Instrument:** Flexible Steel Tape.

**Definition of Measurement:** The maximum girth of the muscle when measured at right angles to its long axis.

**Technique:** The steel tape was passed around the limb and the region of the muscle explored with the tape always at right angles, to the long axis of the bone, until the largest reading was obtained. The tape was in the light contact with the skin and maximum girth was recorded to the nearest one tenth of centimeter. Measurements were taken on both limbs, and the larger girths were recorded.

**Biceps**

**Posture:** The arm of the subject was horizontal. The forearm supinated and the elbow fully flexed. The subject was instructed to clench his fist and contract his biceps as strongly as possible.

**Technique:** The steel tape was passed around the arm approximately midway between the acromion and the elbow, at right angles to the long axis of the arm. (Fig.3).
Fig. 3. Measurement of Muscle Girth: Biceps.
Calf

Posture: The subject stood on a table with his feet six to nine inches apart and his weight equally distributed through both lower limbs.

Technique: The steel tape was passed around the leg near the top of the calf muscle and was lowered until the greatest girth was located, at right angles to the long axis of the leg. (Fig. 4).

Procedure of Ratings for Somatotype Components

From these anthropometric variables, ratings for the somatotype components were obtained by using the Heath and Carter Somatotype Rating Method. The Heath and Carter somatotype rating form was used as shown in Fig. 5. The procedure adopted for rating all the subjects in the somatotype components was as follows.

Procedure for Rating Endomorphy (Steps 1 - 5)

1. Record pertinent identification data at top of form.

2. Record the measurements from each of the four skinfolds.

3. Sum the triceps, subscapular and suprailiac skinfolds and record in the box opposite total skinfolds.
Fig. 4. Measurement of Muscle Girth: Calf.
**HEATH-CARTER SOMATOTYPE RATING FORM**

**NAME:** D. C.  
**AGE:** 23.6  
**SEX:** M  
**OCCUPATION:** Phys. Ed. Student  
**ETHNIC GROUP:** Base  
**DATE:** May 1966  
**PROJECT:** A.T.P.

<table>
<thead>
<tr>
<th>Skinfolds (mm)</th>
<th>Upper Limit</th>
<th>Mid-point</th>
<th>Lower Limit</th>
<th>TOTAL SKINFOLDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triceps</td>
<td>24.0</td>
<td>10.4</td>
<td>8.9</td>
<td>24.0</td>
</tr>
</tbody>
</table>

**FIRST COMPONENT**

<table>
<thead>
<tr>
<th>%</th>
<th>1%</th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
<th>5%</th>
<th>6%</th>
<th>7%</th>
<th>8%</th>
<th>9%</th>
<th>10%</th>
<th>11%</th>
<th>12%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55.0</td>
<td>58.0</td>
<td>55.5</td>
<td>61.6</td>
<td>62.5</td>
<td>64.0</td>
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<td>67.0</td>
<td>70.0</td>
<td>71.5</td>
<td>73.0</td>
<td>74.5</td>
</tr>
</tbody>
</table>

**SECOND COMPONENT**

<table>
<thead>
<tr>
<th>%</th>
<th>1%</th>
<th>2%</th>
<th>3%</th>
<th>4%</th>
<th>5%</th>
<th>6%</th>
<th>7%</th>
<th>8%</th>
<th>9%</th>
<th>10%</th>
<th>11%</th>
<th>12%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27.7</td>
<td>29.3</td>
<td>30.1</td>
<td>30.8</td>
<td>31.6</td>
<td>32.4</td>
<td>33.2</td>
<td>33.9</td>
<td>34.7</td>
<td>35.5</td>
<td>36.3</td>
<td>37.1</td>
</tr>
</tbody>
</table>

**WEIGHT:** 137.0  
**Ht.:** 6' 8"

**TOTAL SKINFOLDS:** 24.0

**FIRST COMPONENT:** 17.1

**SECOND COMPONENT:** 33.9

**THIRD COMPONENT:**

<table>
<thead>
<tr>
<th>Anthropometric Somatotype</th>
<th>FIRST COMPONENT</th>
<th>SECOND COMPONENT</th>
<th>THIRD COMPONENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4/2</td>
<td>4/2</td>
<td>2</td>
</tr>
</tbody>
</table>

**RATER:** I. C.

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*Fig. 5 Heath-Carter Somatotype Rating Form.*

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4. Circle the closest value in the total skinfolds scale to the right. (Note: The scale reads vertically from low to high in columns, and horizontally left to right in rows. The rows, "Lower limit" and "Upper Limit" are to provide exact boundaries for each column and these values should only be circled when the total skinfolds are within a few millimeters of the limit. In most cases the value in the row "mid point" is circled).

5. Circle the value in the row first component which is directly under the column circled in number 4 above.

Procedure for Rating Mesomorphy
(Step 6 - 12)

6. Record the height (in inches) and the humerus and femur diameters in the boxes. Before recording the biceps and calf girths in their respective boxes, the corrections for skinfolds must be made. To do this subtract the triceps skinfold (convert to cm first by dividing by 10) from the biceps girth, and subtract the calf skinfold (convert to cm) from the calf girth.

7. Mark the point of the subject's height on the height scale which is directly to the right. (Note: Regard the height row as a continuous scale), place your arrow (if necessary between columns) to represent as accurately as possible the exact height.
8. For each bone diameter and girth, circle the figure in the proper row which is nearest the measurement (Note: If the measurement falls exactly midway between two values, circle the lower value. Because the largest girths and diameters have been recorded, therefore the conservative procedure is used.

9. Now, deal only with columns, not with numerical values. Find the column, or space between the columns, that is the average of the column deviations for the diameters and girth only. (not height). To do this

(a) Consider as the zero column the left most column containing a circled figure.

(b) From this zero column, add the total number of columns you must travel horizontally to reach each of the other three circled numbers.

(c) Divide this total by 4.

(d) Take the number obtained by this division and, starting at zero column, count this number of columns to the right and place a mark (e.g. asterisk) at that point (whether the point be in the middle of a column or a fraction of the way between one column and the next.
10. Still considering columns only, count horizontally the number of columns you must travel from the asterisk to the marked height (or vice versa).

11. From the number 4 in the row marked second component move this number of columns to the right or left, depending upon the direction of the asterisk from the height marker. If the asterisk is to the right of number 4, and if the asterisk is to the left, move left. Because columns in this row are in half-unit increments, the number of the columns and half unit increments (or decrements) are equivalent.

12. Circle the closest second component value determined in number 11 above. (If the point is exactly mid way between two ratings points, circle the value closest to the 4 on the scale. This regression toward the 4 is the conservative approach and is less likely to produce spuriously extreme ratings).

Procedure for Rating Ectomorphy
(Steps 13 - 16)

13. Record the weight (in pounds).

14. Refer to the nomograph\(^8\) to find out the height: Weight ratio (H.W.R. or height/cube root of weight).

Record height weight ratio in the box.

\(^8\)Ibid., p.219.
15. Circle the closest value in the H.W.R. scale (see note in number 4 above).

16. Locate the third component value below the column of the circled H.W.R. and circle it.

The somatotype components for each subject were calculated and the data pertaining to this is presented in Appendix-A.

Psychological Variables

Personality Traits: General Description

The recent advances based on extensive psychological research have made possible an instrument that gives an objective analysis of the individual personality. A survey was made of different standard tests to measure personality traits of the secondary school students. After discussion with the faculty members guiding research and a psychologist at the psycho centre, New Delhi, it was decided to used the Jr. Sr. High School Personality Questionnaire (or "HSPQ") prepared by Kapoor and Mehrotra. The H.S.P.Q. is a standardized, valid, reliable and objective test that can be given within a class period, to single individuals or in groups to yield a general assessment of personality development. This test has been widely used in psychological research in our countary. A major choice of this test was that S.D. Kapoor and K.K. Mehrotra has computed
norms for Indian population after establishing its validity and reliability under Indian conditions. Another reason for choosing this scale was that it can be easily administered and it measures fourteen distinct dimensions or traits of personality which have been found by psychologist to come near to covering the total personality. The reading level of the test is adapted to ages 11 or 12 through 18 years and scoring can be done rapidly by stencil key.

Procedure: The subjects were assembled in batches of twenty five each, in the sports psychology laboratory of Lakshmibai National College of Physical Education, Gwalior. The subjects were acquainted with the purpose of the questionnaire along with the introductory remarks for good rapport after which the booklet of H.S.P.Q.test form "A" which contains questions to be answered and separate sheet which is called as answer sheet were distributed to them. They were asked to write their name, age and sex on the top of the answersheet. They were asked to follow the instructions written on the test booklet while the research scholar read it aloud at dictation speed. After the instructions were read out, the examples given in the booklet were completed to make them understand that they should mark the answer for question 1 in one of the boxes beside the 1 on the answer sheet. After ensuring that all have understood clearly, how responses are to be made, they were
instructed to continue with one question after another, marking their answer to each question on the answer sheet. It was also told to the subjects to be sure that the number of the boxes on the answer sheet always matches the number of the questions you are answering in the booklet.

Scoring: The completed answersheet of each subject was first checked to make sure that subjects had not given double response to any question and have not omitted to answer any question. The answersheet was then scored by two streamlined hand stencil keys called as 1 and 2. Cardboard stencil key number 1 was placed on the left hand side of the answersheet, adjusting it to position by means of the two "check starts." There were seven raw scores which were obtained with each key, one given by each of the seven horizontal "layers" across the key. The answers seen through the wholes count either 2 or 1 as indicated by the number adjacent to the hole. To obtain the score for each factor, the weights for the answers visible in each factor in horizontal strip were added up and the sum of each factor was recorded in the answer sheet in the raw score column beside each factor. The raw scores of factors A, C, E, G, I, O and Q3 were obtained by key 1 and of factors B, D, F, H, J, Q2 and Q4 were obtained by key 2.

The sten scores corresponding to the raw scores were read from the norms for the Indian male subjects, compiled
by S.D. Kapoor and K.K. Mahrotra and entered against the corresponding raw scores on the test booklet. The sten scores of personality factors are presented in Appendix A.

Self Concept

General Description: Self concept is a dominant element in personality pattern, therefore the measurement of self concept becomes essential. A variety of methods and techniques have been developed to measure self concept. The problem of measuring self concept still remains unsolved. An examination of various instruments developed to measure self concept reveals that these measures have not incorporated many important components of self concept presumed in theory and in observation. These measures do not deal with all aspects of self concept, but provide narrow and limited information. A survey was made of different tests of self concept and after discussion with faculty members teaching and guiding research in psychology, it was decided to use self concept Questionnaire prepared and standardized by Rajkumar Saraswat. The reliability of the inventory was

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found by test retest method and it was found to be .91 for the total self concept measure.

This self concept inventory provided six separate dimensions of self concept viz., physical, social intellectual, moral, educational and temperamental self concept. The inventory contains 48 items. Each dimension contains eight items. Each item is provided with five alternatives.

Procedure: The subjects were assembled in the batches of twenty five each, in the sports psychology laboratory of Lakshmibai National College of Physical Education, Gwalior. The purpose of the Questionnaire was explained to establish good rapport. Subjects were assured that the responses obtained on the test will be kept secret. The self concept inventory booklets were distributed to subjects. The instructions were clearly read from the test booklet. It was told to them that there are forty eight items in this test. Against each item there are five responses. You are required to read each item carefully and respond to it by marking a tick (✓) on any one of the five responses given against that item, which you think desirable you well.

The doubts and queries were invited regarding the Questionnaire and were made clear before they started responding the example items. The example given in the
inventory were explained to the subjects. A special care was taken at the beginning of the test to see that the examples had been marked in the right places. The research scholar went round and told the meaning of certain words which were not clear to the subjects.

Scoring: The respondent is provided with alternatives to give his responses ranging from most acceptable to least acceptable description of his self concept. The alternatives or responses are arranged in such a way that scoring system for all the items will remain the same i.e. 5, 4, 3, 2 and 1 whether the items are positive or negative. If the respondent put (✓) mark for first alternative the score is 5, for the second alternative the score is 4, for third alternative, the score is 3, for the fourth it is 2 and for the fifth and last alternative the score is one. The summated score of all the forty eight items provide the total self concept score of an individual. The score obtained against each question were transfered to the scoring table provided on the front page of questionnaire for each dimension separately where questions are classified according to the dimension of self concept which they measure.\footnote{Ibid.} The scores for each dimension, as obtained on
the scoring table were added up, which gave score for each dimension of self concept separately. The scores obtained in each dimension of self concept are presented in Appendix A.

Reaction to Frustration

General Description: The magnitude and quality of frustration in any area presupposes varying roles of the ego of a person. The ego has a multitude of functions and remains at the base of behaviour dynamics of a person. It organizes and controls motility of perceptions, serves as a potential barrier against hazards. Different methods have been used to study Reaction to Frustration. Study of behaviour through pictures (Britain, 1907; Libby 1908) resulted in a social situations Test (Schwartz, 1932). Then came the Rorschach and the TAT (Morgan and Muray 1935). The picture Frustration Test (Rosensweig, 1945), the MAPS (Shneidman, 1947), the CAT (Bellak and Bellak, 1949), the Mira Test (Mira, 1940), the Insight Test (Sargent 1953), the picture story test (Symonds, 1951).

The questionnaire method to study frustration was started long before (Dollard 1943, Shaffer, 1947). Similar test of Frustration was prepared and standardized by Chauhan and Tiwari for Indian population. The test

make use of ratings for ten items of each of four modes of Frustration i.e. Regression, Resignation, Fixation and Aggression. It studies the effect of Frustration upon the quality of a person's behaviour as a whole.

It has been widely accepted that projective devices measuring Frustration are valuable but suffer from being complex in collection and interpretation of data. Their utility as dependent variable, remains limited for research. The research scholar selected Frustration Test prepared and standardized by Chauhan and Tiwari keeping in mind the above intricacies of projective test. This test has one more advantage and that is the point scale system of the questionnaire, avoids dichotomy of "Yes" and "No" of scales such as that of anxiety. The scale consist of 40 items out of which each of four modes of frustration has ten items.

The reliability of Frustration test for each mode i.e. Regression, Fixation, Resignation and Aggression was .78, .92, .85 and .87 respectively. The reliability as a whole was .88 for this test. 13

Procedure: The subjects were assembled in batches of twenty five each, in the sports psychology laboratory of Lakshmibai

13 Ibid., p.19.
National College of Physical Education, Gwalior. The subjects were acquainted with the purpose of the questionnaire along with the introductory remarks for good rapport after which the booklet of Frustration Test which contains forty questions and each question has five answers (multiple choice) graded on 5 point scale on the positive dimension and a zero point on the negative dimension. The subjects were asked to write their name, age, education level, father's name and their home address on the front page of the questionnaire. They were asked to follow the instructions written on the test booklet while the research scholar read it aloud at dictation speed. They were told to read each question and accompanying answers very carefully before making a tick (✓) for the choice of reply. After ensuring that all have understood clearly, that how responses are to made, they were told to start replying questions one after another. The research scholar went round and explain the meaning of those words which were not clear to the subjects.

Scoring: The subjects were provided with alternatives to give their responses ranging from most liked to most disliked description of his frustration. The alternatives were arranged in such a manner that scoring system for all the items will remain same; i.e. 5, 4, 3, 2, 1 and 0 whether the items are positive or negative. If the
respondent put tick (✓) mark for the first alternative, the score is 5, for the second alternative the score is 4, for third alternative, the score is 3, for fourth alternative, the score is 2, for the alternative, the score is 1 and for the sixth alternative the score is zero. The score obtained against each question were transferred to the recording sheet, provided on the back page of the questionnaire for each modes of frustration separately where questions are classified according to the dimension of frustration question which they measure. The score for each modes of frustration as obtained on the recording sheet was added up, which provided quantitative value for each mode of frustration separately. The scores obtained in each mode of reaction to frustration are presented in Appendix A.

Motor Ability Variables

The motor ability tests were conducted at the Track and Field and Gymnasium of Lakshmibai National College of Physical Education, Gwalior. The procedure for each test is given below.

50 Yard Run (Speed)

The 50 yard run test was selected with a view that distances shorter than 50 yards are influenced by start
and distance longer than 100 yards are influenced by endurance. This test also requires less space and time and measures running speed and the effect of start, if any was minimized by permitting standing start only. The equipment needed were five stop watches and a clapper.

Five subjects were started together to have competitive performance. The subjects were asked to stand on the starting line and to take a standing start. The clapper was clapped after the caution "ready" was given to the subjects. The starter stood in such a position so that the 'V' of the clapper (open before clap) was visible to the time keepers. As the 'V' closed when the clap was executed, the time keepers at the finish line started the stop watches. The subjects sprinted as fast as possible across the finishing line and the stop watches were stopped, as and when the concerned subject covered the distance. The elapsed time, from the starting signal (clap) until the subject crossed the finish line was recorded to the nearest tenth of a second as the running speed score.

Pull Ups (Shoulder Strength)

The pull up test was administered on the metal horizontal bar of three centimeters diameter fixed at a convenient height so that subjects feet didn't touch the floor while he was hanging with arms straight. From this hanging position, he pulled himself up until the chin was above the bar and lowered himself until his arms were fully extended. The subject was instructed to avoid kicking and jerking movements. Maximum number of correctly executed pull ups was considered as subject's score.16

Bent Knee Sit Ups (Abdominal Strength)

From a lying position on the back, the subject flexed his knees over the yardstick while sliding his heels as close to his seat as possible. The yardstick should be held tightly under the knees until the subject was instructed to slowly slide his feet forward. At the point where the yardstick dropped on the mat, the tester would mark the heel line and seat line in order to indicate how far the feet should remain from the seat during the bent knee sit up exercise. The fingers of the subjects should be interlocked behind the neck and perform sit ups alternating a left elbow touch of the inside right knee and a right

16Ibid., p.101.
elbow touch of the inside left knee. The movement was performed as many times as possible.

The total number of repetitions were recorded as score of the subject. However, repetitions were not counted when finger tips did not maintain contact behind the head, when the knees were not touched, or when the subject push off the floor with the elbow.\(^{17}\)

**Vertical Jump (Explosive Strength of the Legs)**

Sargent Jump\(^{18}\) was used to assess explosive power. The object of the test was to measure the power of legs in jumping vertically upward.

A smooth wall surface of at least 12 feet from the floor was chosen. Marking were clearly made on the wall starting from four feet and six inches above. A measuring steel tape and several chalk pieces were used to mark the recording scale.

The subject stood with one side toward the wall with heel together and made his tips of fingers wet in water.

\(^{17}\)Ibid., p.120.

\(^{18}\)Ibid., p.201.
In this position the subject stretched his arm upward as high as possible and made a mark on the wall with the tips of fingers and then the subject jumped as high as possible and made another mark at the maximum height of his jump. Three trials were given.

The distance between the reach and the jump, measured to the nearest centimeter was the score and the best of the three trials was recorded.

Cooper's 9 Minute Run/Walk Test (Cardio-respiratory endurance)

The purpose of this test was to measure the cardio-respiratory endurance of the subject. For this test, the 400 metre track was marked into eight divisions of 50 metres each. The runners started behind a line, upon the starting signal, run and/or walk as many laps as possible around the track within the nine minutes. The official maintained a count of each lap, and when the signal to stop was given, they immediately ran to place at which their runners were at the instant when the whistle was blown. The score in metres was determined by multiplying the number of completed laps with the distance of each lap plus the distance of number of segments of an incomplete lap.\textsuperscript{19}

\textsuperscript{19}Ibid., pp.143-145.
Shuttle Run (Agility)

The purpose of shuttle run test\textsuperscript{20} was to measure the agility of the performer in running and changing direction. A measuring steel tape, stop watches and two blocks of wood size 2" x 2" x 4" were used in this test.

Each subject started behind the starting line on the signal "go". The subject ran to the blocks, which were placed exactly ten metres from the starting line and picked one of the blocks, returned to the starting line and placed the block behind the line. The same process was repeated with the second block. Three trials were given to each subject.

The score for each subject was the length of time that was taken by the subject to complete the distance of 4 x 10 metres, recorded to the nearest tenth of a second. The best of the three trials was taken as score for analysis.

Modified Bass Test of Dynamic Balance (Dynamic Balance)

The purpose of modified bass test of dynamic balance\textsuperscript{21} was to measure the ability to jump accurately and maintain

\textsuperscript{20} \textit{Ibid.}, p.215.

\textsuperscript{21} \textit{Ibid.}, p.233.
balance during movement and after movement. The equipment and materials needed were stop watches, 3/4 inches marking tape, and yard sticks. The subject stood with his right foot on the starting mark and leaped to the first tape mark with his left foot and tried to hold a steady position on the ball of his left for as many seconds as possible up to 5 seconds (both the stop watch and counts were used). The subject then leaped to second tape with right foot and so on, alternating the feet from tape to tape. The subject was asked to remain on each tape mark for as many seconds as possible up to a maximum of 5 seconds and the foot must be completely cover the tape so that it can not be seen.

The score for each mark successfully landed on was five points, and in addition, one point was awarded for each second the balance was held up to 5 seconds per mark. Thus, a subject may earn a maximum of ten points per marker or a total of 100 points for the test. The performer sacrifices five points for improper landing, failing to stop upon landing from the leap, or touching the heel or any other part of the body to the floor other than ball of the supporting foot upon landing or failing to completely cover the marker with the ball of the foot.
Trunk and Neck Extension Test (Trunk and neck flexibility)

The purpose of the test was to measure trunk and neck flexibility. The equipments required were the flexomeasure case with yard stick and ruler guide inserted. The trunk and neck length was measured by taking the distance to the nearest quarter of an inch between the tip of your nose and the seat of the chair the subject was sitting on. The position of the subject was made erect with the chin level as the zero end of the yardstick was placed between the legs on the seat level of the chair. Next, the flexomeasure case was raised until the bottom of the ruler guide touches the tip of your nose. The measurement was recorded at the bottom of the case.

The subject assumed a prone position (face down) on a mat, with his hand resting at the small of his back, then he raised his trunk upward as high as possible off the floor. An assistant held the subjects hips by placing his hands on the back of the thigh (base of the buttocks). The research scholar positioned to the front, placed the zero end of the yardstick on the mat and slidethe flexomeasure case vertically upward until the upper edge of the ruler guide touched the tip of subject's nose. The reading to the nearest half centimeter was recorded.²²

²²Ibid., pp.84-85.
Bridge Up Flexibility Test  
(Spine Flexibility)

The purpose of the test was to measure trunk flexibility. The equipment required were flexomeasure case with yardstick and ruler guide inserted. The subject assumed a supine (back laying) position on the floor (or a mat) and tilt the head back as he pushed upward, arching of the back was done while walking the hands and feet as close together as possible. The assistant sitted at one side placed the zero end of the yardstick on the mat and slided the flexomeasure case vertically upward until ruler guide touched the highest point of arched spine. The reading to the nearest quarter of an inch is taken in the case window at lower line. The best store of three trials was recorded and then subtracted from the subject standing height (floor to the navel).\(^\text{23}\)

Distance Perception Test  
(Kinesthetic Perception)

The objective of the test was to measure ability to perceive distance by concentrating on the effort involved in a jump.\(^\text{24}\) The equipments required were steel tape

\(^{23}\)Ibid., pp.78-79.  

measure, blindfold and chalk. The subject was instructed to sense the distance between the two lines without a practice trial. The blind fold is then put on and the subject jumped from behind the starting line and tried to landed with the heels as close to the target line as possible. The subject was allowed to see where he landed on each trial. Ten trials were given. For each jump the distance to the nearest 1/4 inch from the target line to the farthest heel was measured and recorded. The score was the average of the total of ten jumps.

**Two Hand Coordination** (Coordination)

The two hand coordination ability of the subjects was assessed with the help of Two Hand Coordination Instrument (electrical) supplied by Anand Agencies, Pune. The chronoscope was attached to the instrument and switch was put on. The subject stood comfortably near to the apparatus while holding the side and centre handles with his left and right hand respectively. The side handle move the pin of the apparatus forward and backward and the centre handle move the pin to the sides. On the command of go the

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subject started moving the pin from left side to right side as per the design of the apparatus. The score was the time taken by subject for tracking out the pattern plus the error time recorded in the chronoscope. Three trials were given to each subject.

Reaction Time (Hand Reaction Time)

The purpose of this test was to measure the subjects hand reaction time. To measure hand reaction time, Electronic Reaction Time apparatus, supplied by Anand Agencies, Pune was used. The apparatus was set according to the prescribed procedure. The detachable screen was fixed in the desired holes, which divide the reaction time apparatus in two sides - one subject's side and other tester side. The subject sat in a chair on subjects side and the researcher stood on tester's side.

The subject was asked to press down the key with his index finger of strong hand and was also asked to lift his index finger as he receives stimulus in the form of red light infront of the key, as fast as possible. The tester said ready and then after giving some gap, stimulus key was pressed. As soon as the subject received the red light stimulus, he lifted his index finger. The time taken by the subject to react to the stimulus was recorded in the chronoscope.
The reaction time was recorded to ten thousand part of a second. Five trials were given to each subject and the average of the five trials was recorded as the score for hand reaction time.  

Nelson Speed of Movement Test (Speed of Movement)

The purpose of the test is to measure combined reaction and speed of movement of the hands. Some other references were made to the electrical circuit procedure for measuring speed of movement but the details of this were not available and hence could not be considered, and Nelson Speed of Movement Test was used to measure speed of movement. The equipment needed was a yardstick, a table, chair and a chalk piece.

The subject was seated in a chair, facing the table, with his hands resting on the edge of the table. The palm were kept facing each other with the inside border of the little fingers resting along two lines which were marked on the edge of the table, twelve inches apart. The research scholar held the stick near the top so that it hanged midway between the subjects palms with the "base line" of the stick positioned evenly with the upper edges of the

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subjects index fingers and subject looked on the concentration zone. After a preparatory command "ready" was given, the stick was dropped and the subject stopped it as quickly as possible with an inward horizontal movement of arms. Before measuring speed of movement all the details of the test were clearly explained to the subject and each subject was given five practice trials. Twenty trials were given and the distance the stick fell through the hands before it was stopped every time was recorded. The middle ten trials, after the five slowest and five fastest trials had been eliminated was taken as distance score.  

Statistical Techniques Employed

The relationship of each somatotype component, viz. endomorphy, mesomorphy and ectomorphy, to personality traits, dimensions of self concept, modes of reaction to Frustration and selected motor ability variables was established by computing Pearson's Product Moment Correlational Method.  

traits, dimensions of self concept, modes of reaction to frustration and selected motor ability variables each considered separately, to somatotype components viz. endomorphy, mesomorphy and ectomorphy, was obtained through using Wherry Doolittle Method of Multiple Correlation.\textsuperscript{29}

Further a Regression Equation\textsuperscript{30} was developed to predict somatotype components i.e. endomorphy, mesomorphy and ectomorphy, separately on the bases of personality traits, dimensions of self concept, modes of reaction to frustration and selected motor ability variables.

For testing the hypothesis, the level of significance was set at .05.\textsuperscript{31}

\textsuperscript{29} Clarke and Clarke, \textit{Advanced Statistics with Application to Physical Education}, p.60.


\textsuperscript{31} \textit{Ibid.}, p.453.