CHAPTER-III

METHODOLOGY
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This chapter consists of procedure adopted with selection of subjects, selection of tests, experimental design, criterion measures, reliability of data, instrument liability, tester reliability, reliability of the tests and subject reliability, administration of tests and collection of data, development and implementation of physical fitness programme, physical fitness programme schedule and statistical technique employed for testing of hypothesis.

SELECTION OF SUBJECTS

The study was conducted at Kendriya Vidyalaya Naval Base No. II and Kendriya Vidyalaya No. I. As the primary screening AAHPERD Health Related Physical Fitness Test was administered to male students of 7th, 8th and 9th standards. Ages of the tested students were between 12 years to 14 years. Three hundred and forty one (341) students were tested as detailed below in Table 3.1.
TABLE - 3.1

TOTAL NUMBER OF STUDENTS TESTED WITH AAHPERD
HEALTH RELATED PHYSICAL FITNESS TEST

<table>
<thead>
<tr>
<th>Standard</th>
<th>Kendriya Vidhyalaya Naval Base No. II</th>
<th>Kendriya Vidhyalaya Naval Base No. I</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>64</td>
<td>46</td>
<td>110</td>
</tr>
<tr>
<td>VIII</td>
<td>60</td>
<td>48</td>
<td>108</td>
</tr>
<tr>
<td>IX</td>
<td>78</td>
<td>45</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total 341</td>
</tr>
</tbody>
</table>

Before beginning the testing programme, the objective of the testing programme was explained to the students. Moreover, after intimating details of the programme in printed form through students, a prior permission was obtained from all the parents.

The entire initial testing programme was carried out at the same fortnight in both the schools. Helps from the regular Physical Education teachers at Kendriya Vidhyalaya Naval Base II and Kendriya Vidhyalaya Naval Base I was also utilized for getting the better control and sincere performance from the students.

Out of 341 students, tested only 274 students performed all the tests. The raw data on four selected test items were
compared to find out corresponding normative scores according
to AAHPERD Test HRPFT manual.

As per the AAHPERD HRPF Test Manual, a remedial
individualised fitness programme should be developed for all
students who scores below 25\textsuperscript{th} percentile on any of the fitness
test items (AAHPERD Test Manual). The 50\textsuperscript{th} percentile
represents a level of physical fitness that most students can
achieve with proper motivation and conditioning. This represents
an average level of performance for the population with which
the student is being compared.

A pool of students failed to meet at least 25\textsuperscript{th} percentile in
any of the four test items (body fat, one mile run, sit and reach,
sit ups) on AAHPERD health related physical fitness test
standards were identified as low fit group in each school for their
age. Details of the initial test results are presented in Table 3.2
and 3.3.
TABLE - 3.2

DETAILS OF THE INITIAL TEST RESULT ON AAHPERD
HEALTH RELATED PHYSICAL FITNESS TEST AT
K.V. NAVAL BASE II

<table>
<thead>
<tr>
<th>STD</th>
<th>No. of students participated in the test</th>
<th>No. of students completed the test</th>
<th>No. of students Passed in all tests</th>
<th>No. of students Failed in 1 test</th>
<th>No. of students failed in 2 tests</th>
<th>No. of students failed in 3 tests</th>
<th>No. of students failed in all tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>68</td>
<td>51</td>
<td>9</td>
<td>20</td>
<td>10</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>VIII</td>
<td>64</td>
<td>42</td>
<td>5</td>
<td>11</td>
<td>17</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>IX</td>
<td>80</td>
<td>55</td>
<td>4</td>
<td>10</td>
<td>16</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>212</td>
<td>148</td>
<td>18</td>
<td>41</td>
<td>43</td>
<td>24</td>
<td>22</td>
</tr>
</tbody>
</table>

TABLE - 3.3

DETAILS OF THE INITIAL TEST RESULT ON AAHPERD
HEALTH RELATED PHYSICAL FITNESS TEST AT
K.V. NAVAL BASE I

<table>
<thead>
<tr>
<th>STD</th>
<th>No. of students participated in the test</th>
<th>No. of students completed the test</th>
<th>No. of students Passed in all tests</th>
<th>No. of students Failed in 1 test</th>
<th>No. of students failed in 2 tests</th>
<th>No. of students failed in 3 tests</th>
<th>No. of students failed in all tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>46</td>
<td>43</td>
<td>9</td>
<td>19</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>VIII</td>
<td>48</td>
<td>46</td>
<td>4</td>
<td>15</td>
<td>15</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>IX</td>
<td>45</td>
<td>39</td>
<td>2</td>
<td>16</td>
<td>7</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>128</td>
<td>15</td>
<td>50</td>
<td>27</td>
<td>27</td>
<td>9</td>
</tr>
</tbody>
</table>

Details of students identified as low-fit are presented in Table 3.4.
TABLE - 3.4

DETAILS OF THE STUDENTS IDENTIFIED AS LOW-FIT AT K.V. NAVAL BASE I AND K.V. NAVAL BASE II

<table>
<thead>
<tr>
<th>STD</th>
<th>K.V. Naval Base II</th>
<th>K.V. Naval Base I</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>VII</td>
<td>42</td>
<td>35</td>
<td>77</td>
</tr>
<tr>
<td>VIII</td>
<td>37</td>
<td>42</td>
<td>79</td>
</tr>
<tr>
<td>IX</td>
<td>51</td>
<td>37</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>244</strong></td>
</tr>
</tbody>
</table>

Out of the 244 students found in the low-fit group, 235 students volunteered to be the programme participants. Among this 70 students from each standard were randomly selected and divided into control and experimental groups. Although no attempt was made to control the physical activity habits of the participants beyond what the programme participants received in the fitness programme. None of the children reported being involved in an outside school physical activity programme. Prior consent was also obtained from the parents before implementing the programme.

**SELECTION OF TEST**

After reviewing the various test batteries of similar nature, AAHPERD Health Related Physical Fitness Test was selected as a tool to scientifically evaluate health related physical fitness
status of students. The following criteria were utilized for selecting this test battery.

1. Tests are reasonably familiar to students.

2. Requires little or no equipment.

3. Will measure different dimensions of health related physically fitness and

4. Would allow self-testing by the student.

The test consists of four measures intended to assess status on three components of physical fitness. The components and test items are presented in Table 3.5.

**TABLE - 3.5**

**AAHPERD HEALTH RELATED PHYSICAL FITNESS TEST**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Fitness Dimension Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Mile Run</td>
<td>Cardio-respiratory function</td>
</tr>
<tr>
<td>Modified Timed Sit-Ups</td>
<td>Abdominal and low back-hamstring and musculoskeletal function</td>
</tr>
<tr>
<td>Sit and Reach</td>
<td></td>
</tr>
<tr>
<td>Sum of triceps and sub-scapular skinfolds</td>
<td>Body Composition (leanness / fatness)</td>
</tr>
</tbody>
</table>
EXPERIMENTAL DESIGN

Random group design was used to conduct the study. 42 and 35 students from standard 7th, 37 and 42 students from standard 8th and 51 and 37 students from standard 9th of K.V. Naval Base II and K.V. Naval Base I respectively were identified as low-fit children. From the total 244 students, 235 students volunteered to be the programme participants. Among this 70 students from each standard were randomly selected and divided into control and experimental groups, were A1 and A2 for standard VII, B1 and B2 for standard VIII, C1 and C2 for standard IX. A1, B1 and C1 were treated as control group and A2, B2 and C2 were treated as experimental groups. No attempt was made to equate the group in any manner.

CRITERION MEASURES

The test items chosen as criterion measures were found most reliable and are widely used all over the world for assessing health related physical fitness of school children. These tests appear to provide adequate procedure for determining the level of health related physical fitness status and could be used for identifying the students who need special consideration in Physical Education classes.
The following tests were used as criterion measures:

1. To measure maximal functional capacity and endurance of the cardio respiratory system, One Mile Run test was used and time recorded in $1/10^{th}$ of a second.

2. To evaluate the level of fatness in school age boys and girls, sum of skinfolds were used. Each reading recorded to the nearest 0.5 mm.

3. To evaluate the abdominal muscular strength and endurance, modified timed sit-ups were used. The numbers of correctly executed sit-ups that are completed in 60 seconds were recorded.

4. To evaluate the flexibility (extensibility) of low back and posterior thighs, the Sit and Reach test were executed. The most distant point reached on the fourth trial measured to the nearest centimetres was recorded.

**RELIABILITY OF THE DATA**

Instrumentation reliability, tester reliability, reliability of tests and subject reliability were established using appropriate methods for ensuring the reliability of the data.
**Instrumentation Reliability**

The 1/10 sec. electronic stop watch (Casio Japan) was used to take the time of one mile run and sit-ups. Lange (Cambridge Scientific Industries, MD) skinfold callipers was used for obtaining skinfold measures. The characteristics of this skinfold calliper include accurate calibration capability and a constant pressure of 10 gm/mm² throughout the range of skinfold thickness. Care was taken to ensure that instrument is properly calibrated and that when in the closed position it registered zero. Standardized steel scale (Freemans, India) calibrated in centimetres was fixed on modified sit and reach box.

**Tester Reliability**

Reliability of the investigator in measuring the Health Related Physical Fitness variables were tested by computing coefficient of correlation between the scores obtained by an expert on 10 subjects. The co-efficient are presented in table 3.6.
TABLE - 3.6

COEFFICIENT OF CORRELATION FOR TESTER RELIABILITY ON HEALTH RELATED PHYSICAL FITNESS VARIABLES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient of Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>One mile run</td>
<td>0.81*</td>
</tr>
<tr>
<td>Skinfold thickness</td>
<td>0.77*</td>
</tr>
<tr>
<td>Sit-Ups</td>
<td>0.86*</td>
</tr>
<tr>
<td>Sit and Reach</td>
<td>0.88*</td>
</tr>
</tbody>
</table>

N= 10, r,.01 (8) = 0.765, *significant at 0.01 level of confidence.

Reliability of Tests

Test reliability refers to both the precision of test has measuring instrument and consistency with which the test measured a particular ability. The reliability of the items obtained from Technical Manual AAHPERD Health Related Physical Fitness test is presented below in table 3.7.
### TABLE - 3.7

**TEST-RETEST RELIABILITY COEFFICIENT OF CORRELATION OF TESTS ON HEALTH RELATED PHYSICAL FITNESS VARIABLES**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient of Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>One mile run</td>
<td>0.87*</td>
</tr>
<tr>
<td>Skinfold thickness</td>
<td>0.95*</td>
</tr>
<tr>
<td>Sit-Ups</td>
<td>0.94*</td>
</tr>
<tr>
<td>Sit and Reach</td>
<td>0.90*</td>
</tr>
</tbody>
</table>

*Technical Manual AAHPERD Health Related Physical Fitness test.

**Subjects Reliability**

The test items were administered on 10 randomly selected subjects on alternate days and their performance was recorded. The performance of alternate days correlated to find out the subject reliability. The coefficient of correlation obtained between the performances of subjects first and second is presented in table 3.8.
TABLE - 3.8

COEFFICIENT OF CORRELATION FOR SUBJECTS RELIABILITY ON HEALTH RELATED PHYSICAL FITNESS VARIABLES

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient of Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>One mile run</td>
<td>0.95*</td>
</tr>
<tr>
<td>Skinfold thickness</td>
<td>0.93*</td>
</tr>
<tr>
<td>Sit-Ups</td>
<td>0.96*</td>
</tr>
<tr>
<td>Sit and Reach</td>
<td>0.94*</td>
</tr>
</tbody>
</table>

N= 10, r_{.01} (8) = 0.765, *significant at 0.01 level of confidence.

Since very high correlations from 0.93 to 0.96 were obtained for the variables, the results of subject reliability are viewed as satisfactory.

DESCRIPTION OF TEST ITEMS

One-Mile Run

Purpose

The purpose of the one-mile run is to measure maximal functional capacity and endurance of the cardio-respiratory system.
Test Description

Standardized procedures and norms are provided for one mile run for time.

One Mile Run

Students were instructed to run one mile in the fastest possible time. The students begin on the signal, "ready, start". As they cross the finish line, elapsed time should be called to the participants (or to their partners). Walking is permitted, but the objective is to cover the distance in the shortest possible time.

Equipment and Facilities

Either of the two distances run tests can be administered on a 400-meter track, measured area. Examples of appropriately measured areas are the 100-meter straightaway, other outside fields, or an indoor court area.

Scoring

One mile run was scored to the nearest second. Performances should be recorded on a scorecard.
Administrative Suggestions

In order to obtain valid and reliable results, students must be adequately prepared for the test. First, assurance should be obtained so that no children with known medical problems that would contraindicate vigorous exercise are allowed to take the test. Secondly, students should be allowed to practise with emphasis placed on the concept of pace. Most uninstructed children will run too fast early in the test and then be forced to walk during the latter stages. Results are usually better if the child can maintain a constant pace during most of the run, walking for short periods only if necessary, and perhaps using a strong closing effort. Thirdly, students should be properly motivated. This test, like many other physical education tests, is only as good as the effort provided by the participant. The purpose or the rest should be fully explained to the students.

Sum of Skinfold Fat

Purpose

The purpose was to evaluate the level of fatness in school age boys and girls.
**Test Description**

In a number of regions of the body, the subcutaneous adipose (fat) tissue may be lifted with the fingers to form a skinfold. The skinfold fat measure consists of a double layer of subcutaneous fat and skin the thickness of which was measured with a skinfold fat calliper. Two skinfold site (triceps and subscapular) have been chosen for this test because they are easily measured and are highly correlated with total body fat.

The triceps skinfold was measured over the triceps muscle of the right arm halfway between the elbow and the acromion process of the scapula with the skinfold parallel to the longitudinal axis of the upper arm. The subscapular site (right side of the body) was 1cm below the inferior angle of the scapula in line with the natural cleavage lines of the skin.

The recommended testing procedure was:

1. Firmly grasp the skinfold between the thumb and forefinger and lift up.

2. Place the contact surfaces of the calliper 1cm above or below the finger.
3. Slowly release the grip on the callipers enabling them to exert their full tension on the skinfold.

4. Read skinfold to nearest 0.5 millimetre after needle stops (1 to 2 seconds after releasing grip on calliper).

**Equipment**

The Harpenden (Quinton Instrument Company, Seattle, WA) and Lange (Cambridge Scientific Industries, MD) skinfold callipers are recommended for obtaining these measures. Characteristics of these skinfold callipers include accurate calibration capability and a constant pressure of 10 gm/mm² throughout the range of skinfold thickness. Care needs to be taken to insure that the instrument was properly calibrated and that when in the closed position it registers zero.

**Scoring**

The skinfold measurement was registered on the dial of the calliper. Each measurement should be taken three consecutive times with the recorded score being the median (middle) of the three scores. To illustrate: If the three readings were 18, 15 and 16 mm, the score recorded would be 16. Each reading should be recorded to the nearest 0.5 mm. Norms are provided to interpret
the skinfold measures. The recommended procedure was to use the sum of the two skinfolds; however, if it is possible to secure just one skinfold, the triceps should be the selected site.

**Administrative Suggestions**

The skin should be lifted by grasping the fold between the thumb and forefinger. This should be a firm grasp, but not so firm that the student experiences pain. One was cautioned not to place the callipers at the base of the skinfold. The base of the skinfold gave a reading that does not reflect the true thickness and will be too large. The correct distance from the crest was the point on the fold that true double thickness of skinfold fat exists; this was approximately mid-way between the crest and base of the skinfold. The calliper was placed about 1 centimetre from the point where the skinfold was held.

For testers who have not used callipers before, it was advisable to practice locating the sites and measuring them on several children. When reproducibility from 1-2 mm or less was consistently achieved, then the tester began evaluating skinfolds for school children. On occasions, consecutive measurements will differ by more than 2 mm especially in obese children, even with experienced testers. If that was the case, it was
recommended that an additional set of three measurements be taken. The average of the two middle scores were recorded.

Skinfold thickness was measured separately for each child without comment or display. Each child has the right to share or withhold the results of this test. In all cases, interpretation of the measurements was given individually.

For location of the triceps site, it was essential to locate the measurement at the midpoint of the back of the upper arm and avoid measuring above, below or to either side of the midpoint.

Whenever possible, it was recommended that the same tester administer the skinfold fat test on the same persons on subsequent testing periods.

**Modified Sit-ups**

**Purpose**

The purpose of the sit-up was to evaluate abdominal muscular strength and endurance.

**Test Description**

To assume the starting position, the student lies on his back with knees flexed, feet on floor, with the heels between 12
and 18 inches from the buttocks. The arms are crossed on the chest with the hands on the opposite shoulders. The feet are held by partners to keep them in touch with the testing surface. The student, by tightening his abdominal muscles, curls to the sitting position. Arm contact with the chest must be maintained. The chin should remain tucked on the chest. The sit-up was completed when the elbows touch the thighs. To complete the sit-up the student returns to the down position until the mid back makes contact with the testing surface.

The timer given the signal “ready-go”, and the sit-up performance was started on the word “go”. Performance was stopped on the word “stop”. The number of correctly executed sit-ups performed in 60 seconds was the score. Rest between sit-ups was allowed, and the student should be aware of this before initiating the test. However, the objective was to perform as many correctly executed sit-ups as possible in the 60-second period.

**Equipment and Facilities**

Mats or other comfortable surfaces are recommended. A stop watch or sweep second hand from a wristwatch or clock may be used for timing.
Scoring

Recorded the number of correctly executed sit-ups that are completed in sixty seconds.

Administrative Suggestions

It was important that the heels are placed at proper distance (12-18 inches) from the buttocks. Tester used a measuring stick to ensure that the proper distance was maintained. Partners was used to count and record each other’s score, but the supervising tester carefully observed to ensure that the sit-ups are being done correctly. The reliability and validity of the test improved by providing sufficient instruction and practice in the correct sit-up technique prior to testing students. During testing the student’s feet were in contact with the testing surface. The partner hold the feet, ankles, or calves can ensured this.

Interpreting Test Results

Weak abdominal muscles were a contributing factor in the development of low back pain and associated problems. Students who score below the 50th percentile on this test item were encouraged to improve their abdominal strength and
endurance along with low back, hip, and posterior thigh flexibility. This was especially critical for students below the 25th percentile. For those students, an individualized remedial program was warranted. Improved strength and flexibility in the areas listed above were in the prevention of musculoskeletal problems in the abdominal, back, and hip areas of the body.

**Sit and Reach**

**Purpose**

The purpose of the sit and reach was to evaluate the flexibility (extensibility) of the low back and posterior thighs.

**Test Description**

To assume the starting position, pupil removed their shoes and sit down at the test apparatus with their knees fully extended and the feet shoulder-width apart. The feet should be flat against the end board. The arms were extended forward with the hands placed on top of each other to perform the test. The pupil reached directly forward, palms down, along the measuring scale four times and holds the position of maximum reach on the fourth trial. The position of maximum reach was held for one second.
Equipment

The test apparatus consists of a specially constructed box with a measuring scale where 23 cm is at the level of the feet.

Scoring

The score was the most distant point reached on the fourth trial measured to the nearest centimetre. The test administrator was remained close to the scale and noted the most distant line touched by the fingertips of both hands. If the hands reach unevenly, the test was re-administered. The tester placed one hand on the subject’s knees to ensure that they remain extended.

Administrative Suggestions

The reliability and validity of the tests were improved by providing sufficient time and instruction for warm-up. The warm-up included slow sustained static stretching of the low back and posterior thighs. The test trial was repeated if (1) the hands reach out unevenly or (2) the knees are flexed during the trial. Having a monitor place on his or her hands lightly across the knees can prevent the flexing of knees.
To prevent the test apparatus from sliding away from the student during the test, it should be placed against a wall or similar immovable object.

**QUALITY PHYSICAL FITNESS PROGRAMME**

The after school physical fitness programme for three permitted groups were conducted one hour per day, three days per week for 12 weeks. The programme intended to develop the knowledge and skills for a health enhancing level of fitness and regular habits of physical activity. Because of participation in this physical fitness programme students will be able to:

1. Perform and combine activity specific motor skills.

2. Use rhythmic and aerobic activities to maintain and improve fitness.

3. Maintain and / or improve the health related fitness component through a variety of physical activities.

4. Understand and assess personal health related fitness components.

5. Understand the value of lifelong participation in physical activity.
There is more to quality to physical education than just physical fitness activities, and thus a balanced programme would be the best approach. The programme focused on primarily aerobic rhythmic activities and consisted of a variety of games and activities. Muscular strength and endurance promoting activities were also incorporated. Each activity session began with a 10 min warm-up period consisting of loco motor activities and stretching and concluded with a similar 5 min cool down period.

The heart rate (HR) intensity goal of each exercise session was set at 160 to 180 beats /min. Heart rate was monitored during each session by pulse counting. The duration of activities ranged from 10 minutes to 20 minutes, depending on the task. The children were encouraged to maintain high heart rate at all times during activity. The investigator was present for all the sessions to supervise and control the activities. Three under graduates in Physical Education (BPE) assisted the investigator for implementing the programme successfully. The mean attendance of the programme was 89 ± 5.8%.
STATISTICAL TECHNIQUES EMPLOYED

To test the effects of the physical fitness programme of low-fit children in health related physical fitness variables, the Analysis of Covariance (ANCOVA) was used. ANCOVA was used because even with random assignment the mean and S.D. of the groups were not exactly equal in all selected variables. ANCOVA helps the research scholar to statistically control the differences between experimental and control groups on pretest and post-tests. So that the post-tests differences would not be due to initial differences, prior to training.