CHAPTER – IV
CHAPTER-IV
METHOD AND PROCEDURE

4.1 DESIGN

Survey method of investigation was employed in the present study. In order to find out the nature and extent of the relationship of personality traits, intelligence, achievement in science, achievement motivation, interest in science, attitude towards education and parent child relationship with the variable of scientific attitude, product moment correlations were worked out. The technique of F-ratio and subsequently t-ratios was employed to find out the difference in scientific attitude due to difference in type of management, medium of instruction and sex differences.

4.2 SAMPLE

The proposed study was conducted on the sample of 789 student of IX class (220 from govt. schools, 174 from govt. aided schools, 212 from private (unaided) schools and 183 students from Navodaya Vidyalayas) selected on the basis of multi-staged randomization techniques. For wider applicability of the results, government, government-aided, private schools and Navodaya Vidyalayas as well as boys and girls institutions were included in the sample.

Description of the sample has been presented in Table 4.1.
Table 4.1
Details of Final Sample

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of School</th>
<th>Name of the school</th>
<th>Boys</th>
<th>Girls</th>
<th>Total no. Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Govt. School</td>
<td>Govt. Boys High school, Fazilka</td>
<td>38</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>&quot;</td>
<td>Govt. Senior Sec. School, Jagraon bridge, Ludhiana</td>
<td>22</td>
<td>24</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>&quot;</td>
<td>Govt. Girls Sen. Sec. School, P.O. Buttar, Moga.</td>
<td>45</td>
<td>45</td>
<td></td>
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<tr>
<td>4</td>
<td>&quot;</td>
<td>Govt. Girls School Sec-8, Chandigarh</td>
<td>47</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>&quot;</td>
<td>Govt. Boys Sr. Sec. School, Maneli Danoha, Fatehgarh</td>
<td>44</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Govt. Aided Schools</td>
<td>JSFH Khalsa Senior Sec. School Atta Jalandhar</td>
<td>22</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>&quot;</td>
<td>Mathura Das Dayanand Anglo Senior Sec. School for Boys, Moga</td>
<td>47</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>&quot;</td>
<td>S.D. High School, Fazilka</td>
<td>24</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>9</td>
<td>&quot;</td>
<td>Sargodha High School, Field Ganj, Ludhiana</td>
<td>20</td>
<td>19</td>
<td>39</td>
</tr>
<tr>
<td>10</td>
<td>Private schools</td>
<td>D.N. Model Sr. Sec. School Moga</td>
<td>21</td>
<td>19</td>
<td>40</td>
</tr>
<tr>
<td>11</td>
<td>&quot;</td>
<td>D.C. Model School, Fazilka</td>
<td>19</td>
<td>19</td>
<td>38</td>
</tr>
<tr>
<td>12</td>
<td>&quot;</td>
<td>Wylic Memorial Sr. Sec. School, Ludhiana</td>
<td>21</td>
<td>21</td>
<td>42</td>
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</tbody>
</table>

N=220
N=174

88
<table>
<thead>
<tr>
<th>No.</th>
<th>School Name</th>
<th>Location</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Atam Public School, Ludhiana</td>
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<td>22</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>14</td>
<td>D.A.V. Public School, Sec-8, Chandigarh</td>
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<td>26</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>Navodaya Vidyalaya JNV, Vill. Pojewal Teh.</td>
<td>Garshankar Distt. Hoshiarpur</td>
<td>22</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>16</td>
<td>JNV, Vill. Sandhwa Distt. Ropar</td>
<td></td>
<td>24</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>17</td>
<td>JNV, Farour, Distt. Fatehgarh Sahib</td>
<td></td>
<td>24</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>18</td>
<td>JNV, Vill. Massila RCF Road, Kapurthala</td>
<td></td>
<td>24</td>
<td>23</td>
<td>47</td>
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</tbody>
</table>

Total = 789

4.3 TOOLS USED

Following tools were used in the present study for data collection:

1. Scientific Attitude Scale (Kaur, 2002).
2. 16PF Questionnaire (Cattell and Eber, Indian Adaptation by Kapoor and Tripathi, 1981).
3. Group Test of General Mental Ability (Tandon, 1971)
4. Achievement in Science (This was noted down from the VIII class final results of the students)
5. Achievement Motivation Inventory (Deo and Mohan, 1985)
6. Science Interest Test (Dubey and Dubey, 1992)
7. Attitude Scale Towards Education Scale (Chopra, 1982)
4.3.1 Scientific Attitude Scale (Kaur, 2002)

The scale contains 61 items in the dimensions of curiosity, open-mindedness, faith in scientific method, cause and effect relationship, critical mindedness, seeks evidence, objectivity, suspended judgment and aversion to superstitions.

The responses given by the students are classified separately for each statement, into five categories of responses used in the scale. The five points are quantified by giving a score ranging from 1 for strongly disagree to 5 for strongly agree for positive statements. The other categories of responses such as disagree, undecided, agree were given 2, 3, and 4 scores. The statements were given scores of 1, 2, 3, 4, and 5 for strongly agree, agree, undecided, disagree and strongly disagree responses. Negative statement were given scores of 1, 2, 3, 4, and 5 for strongly agree, agree, undecided, disagree and strongly disagree responses. The scale values given by the researcher were multiplied with the scores.

The coefficient of correlation between two test scores was found by test retest method to be 0.70. The scale was validated against the criterion of “content validity”.

4.3.2 16PF Questionnaire (Cattell and Eber, Indian Adaptation by Kapoor and Tripathi, 1981)

The 16 PF is an objectively scorable test devised for basic research in the filed of psychology to give the most complete coverage of the personality possible in brief time. This test was designed for use with individuals aged 16 and above for literate individual whose educational level is roughly equivalent to that of a normal high school student.
In Form C and Form D, there are eight items for factor B scale, seven items for the motivational distortion scale and six items for each of the remaining scale.

Three alternatives answers are provided for each of the questions since the two alternatives ‘forced-choice’ situation forbidding any ‘middle of the road’ and may produce aversion to the test on the part of the examination.

**Reliability**

Equivalence co-efficient of the test form for each trait

<table>
<thead>
<tr>
<th>Form</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>L</th>
<th>M</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>C with D</td>
<td>0.35</td>
<td>0.49</td>
<td>0.48</td>
<td>0.39</td>
<td>0.36</td>
<td>0.44</td>
<td>0.55</td>
<td>0.47</td>
<td>0.16</td>
<td>0.25</td>
<td>0.16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Form</th>
<th>O</th>
<th>$Q_1$</th>
<th>$Q_2$</th>
<th>$Q_3$</th>
<th>$Q_4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>C with D form</td>
<td>0.51</td>
<td>0.35</td>
<td>0.40</td>
<td>0.33</td>
<td>0.37</td>
</tr>
</tbody>
</table>

**Validity**

The validity of the scale can be evaluated directly by correlating the scale with the pure factor it was designed to measure.

**Scoring**

Two cardboard stencil scoring keys are used, one covers factors (traits) A, G, F, H, I, N, $Q_1$, and $Q_3$, and other factors B, E, G, I, M,
Q₂ and Q₄. Simply fit the stencil over the answer sheet and count the marks visible through the holes. For Factor A, allowing either 2 or 1 indicated by the number printed adjacent to the hole. Sum these scores and enter the total in the space indicated by the arrow on the stencil for factor A (raw score), but the factor is peculiar in that each correct mark visible in a hole gives a score of 1 only. Similarly for other factors.

**Interpretation of the Primary Factors**

Predictions of scores on various criteria, and assignment of individuals to various diagnostic clinical groups, can be carried out actually by computation from standard scores, using methods discussed in detail in the handbook and elsewhere. Where no correlations with criteria are known, knowledge of the psychological nature of the factors must guide initial prediction until empirical studies can be done in a particular situation. Moreover, even where correlational, actuarial evidence about a certain criterion is available, it is desirable to add psychological judgment to immediate statistical computations to allow for changes of personality with learning, maturation etc. or for anticipated changes in life situation.

Each of the primary factors measured by the 16PF has an alphabetic designation (A through Q₄) a technical title (which is given in parentheses in the following descriptions), and a brief less technical title (given here in bold-face) which the practitioner will most commonly use.

In the present study, personality factors E, M and Q₁ were taken because these were the factors which could go with the development of scientific attitude among children.
Description of the Factors Used

Factor E

Humble, Mild, Accommodating, Conforming vs. Assertive, Independent, Aggressive, Competitive, Stubborn.

The person who scores low on Factor E tends to give way to others to be docile, and to conform. He is often dependent, confessing, and anxious for obsessional correctness. This passivity is part of many neurotic syndromes.

The person who scores high on Factor E is assertive, self-assured and independent-minded. He tends to be austere, a law to himself, hostile or extrapunitive, authoritarian (managing others), and disregards authority.

Factor M

Practical, Careful, Conventional, Regulated by External Realities, Proper vs. Imaginative, Wrapped up in Inner urgencies, Careless of Practical Matters, Absent-minded.

The person who scores low on Factor M tends to be anxious to do the right things, attentive to practical matters, and subject to the dictation of what is obviously possible. He is concerned over detail, able to keep his head in emergencies, but sometimes unimaginative.

The person who scores high on Factor M tends to be unconventional, unconcerned over everyday matters, self-motivated, imaginatively creative, concerned with “essentials”, and physical realities. His inner-directed interests sometimes lead to unrealistic situations accompanied by expressive outbursts. His individuality tends to cause him to be rejected in group activities.
Factor $Q_1$

Conservative, Respecting Established ideas, Tolerant of Traditional Difficulties vs. Experimenting, Critical, Liberal, Analytical, free thinking.

The person who scores low on Factor $Q_1$ is confident in what he has been taught to believe, and accepts the “tried and true”, despite inconsistencies, when something else might be better. He is cautious and compromising in regard to new ideas. Thus, he tends to oppose and postpone change, is inclined to go along with tradition, is more conservative in religion, is more conservative in politics and tends not to be interested in analytical “intellectual” thought.

The person who scores high on Factors $Q_1$ tends to be interested in intellectual matters and has doubts on fundamental issues. He is skeptical and inquiring regarding ideas, either old or new. He tends to be more well informed, less inclined to moralize, more inclined to experiment in life generally, and more tolerant of inconvenience and change.

4.3.3 Group Test of General Mental Ability (Tandon, 1971)

As a measure of verbal intelligence the Hindi version of the Group Test of General mental ability (Tandon, 1971) was used in the present study. This test was preferred to other as it is a well known test and is widely used in India. Moreover, being a group test, it can be administered conveniently on a number of students at a time.

The present form of the test is a second revision of Test of General Mental Ability – Form A, which was prepared and first used in
1950. Since then, it has been used on a number of students studying in B.H.U. and other Indian colleges and Universities.

The test contains 100 questions. Besides, it employs 10 items for practice in the beginning. Each item has been framed in such a way that it provides mostly five alternatives to each question. This has been done with a view to make scoring more objective. The test consists of sub-tests namely number series, mathematical instructions, following instructions, vocabulary similars, vocabulary opposites, classifications, analogies, best answers and reasoning. Some of these sub-tests have been found highly suitable for measuring general ability in Indian conditions.

The reliability co-efficients of the test determined by three methods are
(i) Split-half method = 0.91
(ii) Kuder – Richardson formula = 0.91
(iii) Item reliability index and item variance = 0.90

The present form (20/52) of the test correlates 0.28 with the Rev. Minnesota Paper form board test series AA. This shows that there is some presence of an ability of spatial relations in this test. Further value of correlations=0.35 with the academic examination marks and 0.67 with the ‘Samooohik Mansik Yogyata Pariksha (1/61)’, the Hindi adaptation of 20/52 scale. In addition to these, g-saturations worked out by Spearman’s technique, for all the sub-tests range from 0.30 to 0.87. The presence of some general factor has further been confirmed by the factorial analysis of the test using Thurstone’s centroid technique. A few subsidiary factors have also been found but their identifications are yet to be confirmed by further investigations.
The test provides some simple directions in the beginning which are to be read carefully by the prospective investigator. To minimize the work of writing on the part of an examinee the answers have been framed in a manner to provide an answer to a question in a digit form of the figure only. This test proper is administrated for 25 minutes only. Another 20-25 minutes are usually required for seating the candidates, distributing of test booklets and answer sheets, and later collection of test material. Hence, this test can be administered in a period of 30 to 40 minutes. The answer sheets are scored with the help of a scoring key provided for this purpose. Total of raw scores of candidate is his total number of right attempts.

4.3.4 Achievement in Science

Achievement in science was measured from the result of Eight class Annual examination of the students conducted by Punjab School Education Board for the session 2000-2001.

4.3.5 Achievement Motivation Scale (Deo and Mohan, 1985)

The author initially started with 115 statements but after item analysis only 50 items were left for the final draft of the scale out of which 13 items are negative and 37 items are positive in nature.

Various important dimensions of the scale are – academic motivation, need for achievement, academic challenge, achievement anxiety and so on.

Reliability of the scale was found to be 0.69 on a sample of 51 boys and girls which was calculated with the help of test-retest method.
Validity of the scale was calculated by correlating the marks of the student's between the scale and the projective test which was found to be 0.54.

For scoring, two stencils are used. One for positive items and another for negative items. For positive items a score of 4, 3, 2, 1, 0 were given for categories of always, frequently, sometimes, rarely and never. For negative items scoring procedure was reversed. The total score is the summation of all the positive and negative items scores.

4.3.6 Science Interest Test (Dubey and Dubey, 1992)

There are 64 statements in the test, 32 statements show liking for science subjects, while 32 statements indicate disliking for the subject. Every statement has two alternative choices- ‘Yes’ and ‘No’.

The test can conveniently be administered in a group of 30 to 40 students. 20 minutes time is required to complete this test. The test has been standardized on a sample of 1100 students of 7th and 10th standards of rural, urban schools having boys and girls.

The test was scored as per the directions given in the manual of test. Statements showing liking with response ‘Yes’ should be awarded one mark and for response ‘No’ awarded zero mark. Statement showing disliking with ‘No’ response should be awarded one mark and for response ‘Yes’, awarded zero mark. All the marks should be added up.

The reliability of test is reported to be 0.68 with the help of test-retest method, whereas validity of the test is 0.63.
4.3.7 Attitude Towards Education Scale (Chopra, 1982)

Among the different techniques commonly used for construction of attitude scales are, Method of Paired Comparison, Method of Equal Appearing Intervals, Method of Successive Intervals, Method of Summated rating, Scalogram Analysis and the Scale Discrimination Techniques. For construction of the above test, a modified form of Thurstone and Chave (1929) techniques was used. The first step for the construction of the Attitude Scale was the collection of a large number of statements concerning the value of education and from these a preliminary selection was made. While selecting the statements an effort was made to avoid the statement that related to the past rather than the present, or were factual or could be termed factual or could be interpreted in more than one way, or were not relevant to the psychological object under consideration or were likely to be endorsed by almost everyone or by none. The statements selected were short and their language was simple, clear and direct and each statement contained only one complete thought and covered the entire range of the effective scale of interest.

From the initial group of the statements 22 statements having scale values equally spread along the psychological continuum and having fairly low Q values were selected. Both the forms of attitude scale were given to a group of fifty students. The coefficient of correlation between the two sets of scores was 0.93. The reliability of the scale was calculated by “Split-half” method also. The statements were ranked in order of scale values and then divided into two groups. The odd numbered statements were put in one group and the even numbered in the other. The r, corrected
by the Spearman – Brown formula was 0.89 and this also suggests that the scale is quite reliable.

Each of the respondent is asked to put a (√) in front of the statements with which he or she fully agrees and a cross (×) in front of the statements with which he or she is not in full agreement. Each statement is thus to be either ticked or crossed. The attitude of the individual is denoted by the mean scale values of the statements with which he or she fully agrees.

4.3.8 Parent-Child Relationship Scale (Rao, 1989).

The tool contains 100 items categorized into ten dimensions namely, protecting, symbolic punishment, rejecting, object punishment, demanding, indifferent, symbolic reward, loving, object reward and neglecting. Items of the scale are arranged in the same order as the dimensions and they rotate in a cycle through the scale. Each respondent scores the tool for both father and mother separately. Items are common for both the parents except for three items, which are different, in the father and mother forms due to the nature of variation in paternal and maternal relationship with children.

Respondents were asked to rate statements as to their perception of their relationship with either father or mother on a five point scale ranging from ‘always’ to ‘very rarely’ weighted 5, 4, 3, 2 and 1 on the scale points. The reliability co-efficient of the total test was significant at level of confidence greater than 0.01. In item analysis validity of co-efficient of correlation was significant at 0.05 level. The items of parent child relationship were scored according to scoring procedure given in the manual.
4.4 DATA COLLECTION

After having finalized the research tools, data collection was undertaken over a sample of students of IX class (government school students = 220, government aided school students =174, private school students = 212; Navodaya Vidyalaya students = 183).

First of all permission was sought from the heads of the institutions. Then to begin with a good testing rapport was established with the students before starting administration of the tests. All possible efforts were made to make the students feel at ease and respond to the various tests with full concentration. All their queries were answered so as to satisfy their curiosity and motivate them to answer the tests carefully. Students were told that their results would be kept strictly confidential and that their co-operation was essential towards the enrichment of research in the field of education.

After distributing the copies of the test, as well as response sheets, the students were asked to fill up all the preliminaries given at the top of the test booklets/or response sheets. Instructions were read in a loud voice for each test so that subjects fully understood how the responses were to be made. Subjects were made free to ask any question if any item or question was not clear to them.

Since all the tests were group tests, therefore, these were administrated on small groups at a time in their classrooms. The tests were administered in 2-3 sitting over a period of 1-2 days. After collecting the data, the response sheets were scored as per the directions given in their respective manuals.
4.5 STATISTICAL TECHNIQUES USED

In order to test the hypotheses, following statistical techniques were used for analyzing the data.

1. Descriptive statistics like mean and median were worked out to see the nature of score distribution.

2. To find the relationship of criterion variable of scientific attitude with that of the independent variables, i.e. intelligence, science achievement, achievement motivation, attitude towards education etc, the technique of Pearson's product moment correlations were worked out.

3. Technique of F-ratio and t-ratio was employed for locating differences in scientific attitude on the basis of sex-differences, type of management and medium of instruction.