CHAPTER—V
METHODOLOGY

5.1 DESIGN OF THE STUDY

For the collection of data, descriptive survey method of investigation was employed.

The purpose of the present study was to know the relationship of emotional intelligence, creativity, learning styles and mathematical aptitude with academic achievement in Mathematics of 9th class students. There are four independent variables i.e. emotional intelligence, creativity, learning styles and mathematical aptitude. To find the relationship of independent variables—emotional intelligence, creativity, learning styles and mathematical aptitude with the dependent variable of academic achievement in mathematics, techniques of Pearson’s Product Moment Method of Correlation was employed. Differences in achievement due to different groups were found with the help of t-ratio technique.

5.2 METHOD

In the present study descriptive survey method of investigation was employed.

5.3 SAMPLE

Sample for present study was selected from schools located in different districts of Punjab state. For this students of 9th class studying in different government and private schools were selected. Sample comprised of both male and female students (total 700 subjects). Subjects were selected with the help of multistage random sampling technique. Details of final sample has been given in Table 5.1
Table 5.1

Table showing composition of final sample

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Institution</th>
<th>No. of students</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BCM School, Ludhiana.</td>
<td>26</td>
<td>24</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>D.A.V. Army School, Fazilka.</td>
<td>22</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>S.A.N.Jain High School, Hoshiarpur.</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Dev Samaj Model High School, Ferozepur.</td>
<td>11</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>5</td>
<td>Baba Farid Public School, Faridkot.</td>
<td>13</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Kirpal Sagar Academy, Raho.</td>
<td>26</td>
<td>12</td>
<td>38</td>
</tr>
<tr>
<td>7</td>
<td>Sawan Mal Aggarwal Adarsh High School, Zira.</td>
<td>19</td>
<td>19</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td>Dasmesh Model High School, Doraha.</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>St. Xavier School, Bathinda.</td>
<td>18</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>10</td>
<td>D.N. Model School, Moga.</td>
<td>24</td>
<td>22</td>
<td>46</td>
</tr>
<tr>
<td>11</td>
<td>C.T. Public School, Jalandhar.</td>
<td>50</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>12</td>
<td>Jeevan Mal Senior Secondary School, Zira.</td>
<td>22</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>13</td>
<td>Govt. High School, Mundian Kalan (Ludhiana)</td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>14</td>
<td>Govt. Sen. Sec. School, Bhikhi Vind (Amritsar).</td>
<td>38</td>
<td>45</td>
<td>83</td>
</tr>
<tr>
<td>15</td>
<td>Govt. Sen. Sec. School, Tarkhan Wala (Mukutsar).</td>
<td>18</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>16</td>
<td>Govt. Sen. Sec. School, Ghal Kala (Moga).</td>
<td>0</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>17</td>
<td>Channan Devi Govt. Girls School, Salem Tabri (Ludhiana)</td>
<td>0</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>337</strong></td>
<td><strong>363</strong></td>
<td><strong>700</strong></td>
</tr>
</tbody>
</table>
5.4 TOOLS USED FOR DATA COLLECTION

Following tools were used to collect the data for the present study.

1. Emotional Intelligence Scale (By Hyde, Pethe and Dhar, 2001)

2. Verbal Test of Creative Thinking (By Baqer Mehdi, 1985)

3. Inventory of Learning Styles (By Vermunt, Hindi version by Verma & Mishra, 1998)

4. Mathematical Aptitude Test (By Rajni, 2006)

5. Mathematics Achievement Test For 9th Class (This was developed by the investigator herself).

5.4.1 Emotional Intelligence Scale (Hyde, Pethe and Dhar, 2001)

The present scale was undertaken to develop a suitable self-report measure for Indian milieu. Before this 21 scales that best define EQ were available e.g. Cooper and Sawaf (1998), Goleman (1995). The author of this scale did not come across any scale developed for Indian conditions.

After consulting relevant literature, 106 items were developed. Each item was transferred on a card. A panel of 50 judges with postgraduate degree and more than 10 years of experience in their relevant fields was prepared. Definition of Emotional Intelligence was also written on a card along with necessary instructions for the selection of the items on the cards. The cards were placed before each judge who has contacted individually. The choice for categorization of each card was noted and the frequency of choice was calculated. The items, which were chosen 75% or more times, were spotted out. The 34 items thus
chosen were administered on 200 executives. The data was then tabulated and item-total correlations were calculated. Items having correlation less than the value of .25 ($p < .01$) were dropped. The value is taken from Fisher and Yates (1992) table of correlation coefficients and their levels of significance. The final form of the scale constituted 34 items. The Hindi Version of the final items was prepared in consultation with 10 judges who were well versed with both, English as well as Hindi. The inter-item correlations of the final items were also determined.

**Reliability of the scale**

The reliability of the scale was determined by calculating reliability coefficient on a sample of 200 subjects. The split-half reliability coefficient was found to be 0.88.

**Validity of the scale**

Besides face validity, as all items were related to the variable under focus, the scale has high content validity. It is evident from the assessment of judges/experts that items of the scale are directly related to the concept of emotional intelligence. In order to find out the validity from the coefficient of reliability, the reliability index was calculated, which indicated high validity on account of being 0.93.

**Factors of Emotional Intelligence**

The scale was administered on 200 executives. The scores obtained were subjected to factor analysis and ten factors were identified. These are self-awareness, empathy, self-motivation, emotional stability, managing relations, integrity, self-development, value orientation, commitment and altruistic behaviour.
A. **Self-awareness** is being aware of oneself and is measured by items 6, 12, 18, 29. These items are “I can continue to do what I believe in even under severe criticism”, “I have my priorities clear”, “I believe in myself” and “I have built rapport and made and maintained personal friendships with work associates”. This factor is the strongest and explains 26.8 percentage variance and has a total factor load of 2.77. The correlation of this factor with total score is 0.66.

B. **Empathy** is feeling and understanding the other person and is measured by items 9, 10, 15, 20 and 25. These are “I pay attention to the worries and concerns of others”, “I can listen to someone without the urge to say something”, “I tried to see the other person’s point of view”, “I can stay focused under pressure”, “I am able to handle multiple demands”. This factor explains 7.3% variance with a total factor load of 3.11. The correlation of the factor with total score is 0.70.

C. **Self-motivation** is being motivated internally and is measured by 2, 4, 7, 8, 31 and 34. These items are “People tell me that I am inspiration for them”, “I am able to make intelligent decisions and a healthy balance of emotions and reasons”, “I am able to access the situation and then behave”, “I can concentrate on the task at hand in spite of disturbance”, “I think feelings should be managed” and “I believe that happiness is an attitude”. This factor accounts for 6.3% variance in total load of 3.28. Its correlation with total score is 0.77.

D. **Emotional stability** is measured by items 14, 19, 26 and 28. These are “I do not mix unnecessary emotions with issues at hand”, “I am able to stay composed in both good and bad situations”, “I am comfortable and open to novel ideas and new
information” and “I am persistent in pursuing goals despite obstacles and setbacks”. This factor explains 6.0% variance with a total factor load of 2.51. The correlation of this factor with total score is 0.75.

E. Managing relations are measured by 1, 5, 11 and 17. The statement that measure this factor are, “I can encourage others to work even when things are not favorable”, “I do not depend on others’ encouragement to do my work well”, “I am perceived as friendly and outgoing” and “I can see the brighter side of any situation”. This factor explains 5.3% variance with a total factor load of 2.38. The correlation of this factor with total score is 0.67.

F. Integrity is measured by items 16, 27 and 32. “I can stand up for my beliefs”, “I pursue goals beyond what is required of me” and “I am aware of my weaknesses” are the statements that measure this factor. This factor explains 4.6% variance with a total factor load of 1.88.

G. Self development is measured by items 30 and 33 which are “I am able to identify and separate my emotions” and “I feel that I must develop myself even when my job does not demand it” and explains 4.1% variance with a total load of 1.37.

H. Value orientation is measured by items 21 & 22. The statements are “I am able to maintain the standards of honesty and integrity” and “I am able to confront unethical actions in others” and explain 4.1% variance with a total factor load of 1.29.

I. Commitment is measured by the items 23 and 24. “I am able to meet commitments and keep promises” and “I am organized and careful in my work”. This factor accounts for 3.6 variance with a total load of 1.39.
J. Altruistic behaviour is measured by the items 3 and 13. The items are “I am able to encourage people to take initiative” and “I can handle conflicts around me”. It explains 3.0 percent variance with a total factor load of 1.3.

Uses of the scale: The scale can be used for research and survey purposes. It can also be used for individual assessment. It is self-administering and does not require the services of highly trained tester. It is eminently suitable for groups as well as individual testing.

Limitations of the Scale: In all the tests of this nature, the subject does manage to get some insight into what the purpose is. As such, there is always the factor of “Social desirability and faking”. The scale purposes to measure learned optimism of which the subject has some awareness. It should not be used as a tool for individual diagnosis unless supported by other evidences. Observations of other self-related perceptions are also required.

Instructions for Administration and Scoring:
1. The instructions printed on the response sheet are sufficient to take care of the questions that are asked.

2. No time limit should be given for completing the scale. However, most respondents should complete it in about 10 minutes.

3. Before administering the scale, it is advisable to emphasize orally that responses should be checked as quickly as possible and sincere co-operation is sought for the same. The responses should be kept confidential.

4. It should also be emphasized that there is no right or wrong answer to the statements. The statements are designed to
understand the differences in individual factors to various situations. The scale is meant to know the difference between individuals and not meant to rank them as good or bad.

5. It should be duly emphasized that all statements have to be responded and no statement should be left unanswered.

6. Though the scale is self-administering, it has been found useful to read out the instructions printed on the response sheets to the subjects.

7. Manual scoring is done conveniently. Hence no scoring key is provided.

8. Each item or statement should be scored 5 for strongly agree, 4 for agree, 3 for neutral, 2 for disagree and 1 for strongly disagree.

5.4.2 Verbal Test of Creative Thinking (Baqer Mehdi, 1985)

The battery is meant to identify creative talent at all stages of education, except pre-primary and primary.

The choice of this test was made due to its wide applicability and use. This test has already been used by Prasad (1979), Singh (1980) and Singh (2006) in Indian situation.

The theoretical framework for the preparation of the test battery was provided by empirical studies on the nature of creativity. Unlike convergent thinking, where information leads to one right answer or a recognized best or conventional answer, divergent production leads to novel responses to given stimuli. Guilford related divergent thinking to certain well-known ability factors, which seems to go with creative output.
For example in (i) consequence test some hypothetical situations (as ‘what would happen if man could fly like a bird?’) are given and the subject is required to think as many as consequences of these situations as he/she can. The time allowed for the three problems is 4 minutes each. In (ii) unusual uses test subject is presented with the names of three common object (as a piece of stone, a wooden stick and water) and he/she is required to write as many novel, interesting and unusual uses of these objects as he/she may think of. The time allowed for the three tasks is 5 minutes. In (iii) New Relationship Test, the subject is presented with three pairs of words apparently different- tree and house, chair and ladder, air and water. It is required from him/her to think and write as many novel relationships as possible between the two objects of each pair in the space provided. The time allowed for each pair of words is 5 minutes. In (iv) Product Improvement Test, the subject is asked to think of a simple wooden toy of a horse and suggest addition of new things to it to make it more interesting for the children to play. The time allowed is 6 minutes.

The total time required for administering the test is 48 minutes in addition to the time necessary for giving instructions, passing out test booklets to children and collecting them back.

**Reliability of the test**

The test-retest reliabilities of the factor scores and also the total scores were obtained on a small sample (N=31).
Table

Test-retest reliability of the factor scores and the total creativity scores (N=31)

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Flexibility</th>
<th>Originality</th>
<th>Total Creative Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>.945</td>
<td>.921</td>
<td>.896</td>
<td>.959</td>
</tr>
</tbody>
</table>

Both the factor scores and total creativity score reliabilities are considerably high ranging from .896 to .959. These values are highly satisfactory.

Validity of the test

The validity coefficients for teacher ratings for each factor are given below:

Table

Validity coefficient for factor scores and total creativity score against teacher rating (N=300)

<table>
<thead>
<tr>
<th>Fluency</th>
<th>Flexibility</th>
<th>Originality</th>
<th>Total Creativity Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>.40</td>
<td>.32</td>
<td>.34</td>
<td>.39</td>
</tr>
</tbody>
</table>

All correlation are significant beyond .01 level which place confidence in the use of the test.
5.4.3 Inventory of Learning Styles

Inventory of learning styles by Vermunt, Hindi version by Verma and Mishra (1998) consists of following three components:

1. Activities related to learning
2. Motivation for learning
3. Views regarding learning

1. Activities related to learning: This component has 55 statements. Each of these statements has five alternatives 1, 2, 3, 4 and 5 which have the following meanings:
   1 means I never do it.
   2 means I do it occasionally.
   3 means I do it regularly.
   4 means I often do it.
   5 means I always do it.

2. Motivation for learning: This component has 25 statements. Each of these statements has five alternatives i.e. 1, 2, 3, 4 and 5.
   1 means fully not agreed
   2 means not agreed
   3 means undecided
   4 means agreed
   5 means fully agreed

3. Views regarding learning: This component has 40 statements. Each statement has five alternatives:
1 means fully not agreed
2 means not agreed
3 means undecided
4 means agreed
5 means fully agreed

Students are supposed to circle any one alternative out of these five alternatives against each statement.

This inventory has positive and negative statements. Each positive statement was given marks 0,1,2,3,4 for 1,2,3,4,5 alternatives where as for negative statements marking was reversed.

**Reliability of the test:**

Reliability of the inventory was found with the test-retest method which was found to be 0.83.

**Validity of the test:**

Validity of the test was found with the help of content validity. Judges agreed among themselves as per as the content of the inventory was concerned which speaks about the soundness of the inventory.

**5.4.4 Mathematical Aptitude Test (Rajni,2006)**

The present test framed to measure the mathematical aptitude of the students. A total number of 62 items concerning mathematical aptitude test were originally constructed. On the basis of judgment of 13 panel of experts, 17 items were deleted from all the components of mathematical aptitude test.
Then the test containing 45 items were given to 40 students for preliminary try out of mathematical aptitude test. The number of items remained after try out of mathematical aptitude test on a small group of students was 35. On the basis of item analysis, 5 items were rejected on the ground of difficulty value and discriminative power. Hence mathematical aptitude test in its final form comprised of 30 items.

**Reliability of the test:**

As the test being heterogeneous and items have been arranged logically, the two halves could not have been identical. Therefore, in the light of the above discussion on reliability, test-retest reliability was found to be the most suitable for this test. The reliability study of the test was conducted on a sample of 30 students. The second administration of the test was given after a month. The product moment coefficient of correlation for the two scores was computed. The coefficient of correlation between two scores was found to be 0.72. This coefficient of correlation is high enough, which testifies the soundness of the test (*Koul, 2001*).  

**Validity of the test:**

The purpose of the present investigation and the nature of the items restricted the use of very exhaustive statistical techniques to validate the test. Factorial validity could not be ascertained as in general each concept was represented by only few items.

Mathematical Aptitude Test was validated against criterion of “Content Validity”. The content validity is concerned with the adequacy of sampling of a specified universe of content. To determine the content validity, the test items and a list of outcomes
was given to the panel consisting of 4 experts in the subject of mathematics and 2 experts in test construction. The panel was asked to identify which test items corresponded to which component. The experts agreed 90% with the investigator on the assignment of test items. This concurrence was taken as evidence of content validity (Koul, 2001).

5.4.5 Mathematics Achievement Test (Constructed by Investigator herself)

The description of this test has been given in chapter IV.

5.5 COLLECTION OF DATA

Collection of data was completed in two stages. In the first stage, data was collected for the construction and standardization of achievement test in mathematics. Description of data collection for the purpose of construction and standardization of achievement test in mathematics is given in chapter IV.

After having finalized the other research tools, schools were selected on the basis of multi-stage random sampling technique. Survey of different schools was conducted and the permission of the head of the institution was taken beforehand for the collection of data from the concerned school. Different research tools were administered on after the other in two sittings, spread over a period of 1-2 days. As the tests were lengthy; therefore, these were administered one after the other with some recurrent break, in two sessions spread over a period of two days for each institution.

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 questions carefully. All efforts were
made to get maximum cooperation from the students. They were
assured that their results would be kept strictly confidential.

5.6 STATISTICAL TECHNIQUES USED

Following statistical techniques were used in the present
study:

1. Pearson’s Product Moment Method of Correlation was used to
find out relationship of each variable with academic
achievement of students in mathematics.

2. t-ratio technique was used to know differences in the
achievement of students in mathematics due to low and high
level of emotional intelligence, creativity, mathematical
aptitude, government and private schools, male and female
difference.