CHAPTER – IV
ANALYSIS AND INTERPRETATION OF RESULTS

In this chapter the raw data collected were tabulated and analysed to test the hypotheses and draw conclusions therefrom. The data have been analysed using descriptive as well as inferential statistics.

4.1 Description of Data:

The data were obtained from 140 subjects, out of which it was incomplete due to various reasons in respect of 20 and hence dropped for these subjects. The results, therefore, are based on the responses of 120 subjects/students.

The data have been described in terms of Mean (M), Median (Md), Standard Deviation (SD), Skewness (Sk), Kurtosis (Ku) and graphical representations in the form of smoothed frequency polygons. The tables 4.1, 4.2, and 4.3 give computed values of Mean, Median, Mode, Skewness, Kurtosis and Smoothed frequency polygons of post-test scores of the achievement test for the total sample, Self-Learning Modules (SLM) group and Traditional Teaching (TT) group.
### Table 4.1: Frequency Distribution of the Total Sample Population (Post-test Achievement Scores)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Class Interval</th>
<th>Mid Point</th>
<th>Frequency</th>
<th>Smoothed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10-15</td>
<td>12.5</td>
<td>14</td>
<td>11.33</td>
</tr>
<tr>
<td>2</td>
<td>15-20</td>
<td>17.5</td>
<td>20</td>
<td>19.00</td>
</tr>
<tr>
<td>3</td>
<td>20-25</td>
<td>22.5</td>
<td>23</td>
<td>21.00</td>
</tr>
<tr>
<td>4</td>
<td>25-30</td>
<td>27.5</td>
<td>20</td>
<td>19.67</td>
</tr>
<tr>
<td>5</td>
<td>30-35</td>
<td>32.5</td>
<td>16</td>
<td>16.67</td>
</tr>
<tr>
<td>6</td>
<td>35-40</td>
<td>37.5</td>
<td>14</td>
<td>13.00</td>
</tr>
<tr>
<td>7</td>
<td>40-45</td>
<td>42.5</td>
<td>9</td>
<td>8.67</td>
</tr>
<tr>
<td>8</td>
<td>45-50</td>
<td>47.5</td>
<td>3</td>
<td>4.33</td>
</tr>
<tr>
<td>9</td>
<td>50-55</td>
<td>52.5</td>
<td>1</td>
<td>1.33</td>
</tr>
</tbody>
</table>

N = 120  
Mean = 27.24  
Median = 26.00  
Mode = 18.00  
SD = 9.75  
Sk = 0.38  
Ku = -0.77
Fig. 4.1: Smoothed Frequency Polygon of Post-test Achievement Scores of Total Sample Population.
Table 4.2: Frequency Distribution of the Self-Learning Modules Group
(Post-test Achievement Scores)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Class Interval</th>
<th>Mid Point</th>
<th>Frequency</th>
<th>Smoothed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10-15</td>
<td>12.5</td>
<td>1</td>
<td>0.67</td>
</tr>
<tr>
<td>2</td>
<td>15-20</td>
<td>17.5</td>
<td>1</td>
<td>2.33</td>
</tr>
<tr>
<td>3</td>
<td>20-25</td>
<td>22.5</td>
<td>5</td>
<td>5.67</td>
</tr>
<tr>
<td>4</td>
<td>25-30</td>
<td>27.5</td>
<td>11</td>
<td>10.33</td>
</tr>
<tr>
<td>5</td>
<td>30-35</td>
<td>32.5</td>
<td>15</td>
<td>13.33</td>
</tr>
<tr>
<td>6</td>
<td>35-40</td>
<td>37.5</td>
<td>14</td>
<td>12.67</td>
</tr>
<tr>
<td>7</td>
<td>40-45</td>
<td>42.5</td>
<td>9</td>
<td>8.67</td>
</tr>
<tr>
<td>8</td>
<td>45-50</td>
<td>47.5</td>
<td>3</td>
<td>4.33</td>
</tr>
<tr>
<td>9</td>
<td>50-55</td>
<td>52.5</td>
<td>1</td>
<td>1.33</td>
</tr>
</tbody>
</table>

N = 60
Mean = 34.30
Median = 34.00
Mode = 40.00
SD = 7.96
Sk = -0.20
Ku = -0.24
Fig. 4.2: Smoothed Frequency Polygon of Post-test Achievement Scores of Self-Learning Modules Group
Table 4.3: Frequency Distribution of the Traditional Teaching Group
(Post-test Achievement Scores)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Class Interval</th>
<th>Mid Point</th>
<th>Frequency</th>
<th>Smoothed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10-15</td>
<td>12.5</td>
<td>13</td>
<td>10.67</td>
</tr>
<tr>
<td>2</td>
<td>15-20</td>
<td>17.5</td>
<td>19</td>
<td>16.67</td>
</tr>
<tr>
<td>3</td>
<td>20-25</td>
<td>22.5</td>
<td>18</td>
<td>15.33</td>
</tr>
<tr>
<td>4</td>
<td>25-30</td>
<td>27.5</td>
<td>9</td>
<td>9.33</td>
</tr>
<tr>
<td>5</td>
<td>30-35</td>
<td>32.5</td>
<td>1</td>
<td>3.33</td>
</tr>
<tr>
<td>6</td>
<td>35-40</td>
<td>37.5</td>
<td>0</td>
<td>0.33</td>
</tr>
</tbody>
</table>

N = 60
Mean = 20.18
Median = 20.00
Mode = 18.00
SD = 5.22
Sk = 0.36
Ku = -0.26
Fig. 4.3: Smoothed Frequency Polygon of Post-test Achievement Scores of Traditional Teaching Group
In order to have an overview of requisite statistical information regarding the self-learning modules and traditional teaching groups and the whole group (total sample), statistics of post-test achievement scores have been given in table 4.4.

Table 4.4: Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis of Post-test Achievement Scores

<table>
<thead>
<tr>
<th>Groups (N)</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Standard Deviation (SD)</th>
<th>Skewness (Sk)</th>
<th>Kurtosis (Ku)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Group (120)</td>
<td>27.24</td>
<td>26.00</td>
<td>18.00</td>
<td>9.75</td>
<td>0.38</td>
<td>-0.77</td>
</tr>
<tr>
<td>Group - I SLM (60)</td>
<td>34.30</td>
<td>34.00</td>
<td>40.00</td>
<td>7.96</td>
<td>-0.20</td>
<td>-0.24</td>
</tr>
<tr>
<td>Group - II TT (60)</td>
<td>20.18</td>
<td>20.00</td>
<td>18.00</td>
<td>5.22</td>
<td>0.36</td>
<td>-0.26</td>
</tr>
</tbody>
</table>

4.2 Interpretation and Discussion based on Descriptive Statistics:

From the frequency distributions obtained from raw scores – table 4.4 – it is evident that frequencies are evenly distributed in all the smoothed frequency polygons.

On the basis of post-test scores, the skewness of the whole group i.e. for the total sample (table 4.4) was 0.38 (positively skewed), which showed that scores were massed at the low (or left) end of the scale and were spread out gradually towards the high (or right) end as shown in figure 4.1. From fig. 4.1, it was found that the values of mean, median and mode were scattered and therefore, frequencies did not cluster at any one point. The value of the standard deviation 9.75 represented the scattering of scores from the mean position.

Further, the value of kurtosis -0.77 (table 4.4) is slightly less than that for normal distribution (Ku = 0), which indicates that the distribution was slightly platykurtic. Since the values of skewness and kurtosis in this case were near to the normal frequency distribution values, the post-test achievement scores distribution of the total sample population was nearly a normal distribution. The skewness (table 4.4) of the post-test achievement
scores of Self-Learning Modules group was -0.20 (negatively skewed), which showed that scores were massed at the high (or right) end and spread out more gradually towards the lower (or left) end as shown in figure 4.2. The values of mean, median and mode were scattered (fig. 4.2) and therefore, frequencies did not pile up at any one point. The value of standard deviation 7.96 represented the scattering of scores from the mean position. The value of kurtosis (table 4.4) was -0.24, which is slightly less than 0 (for normal distribution). Hence, the curve was slightly platykurtic. Since the values of skewness and kurtosis for this distribution were near to the normal distribution curve, the post-test achievement scores distribution of SLM group was almost a normal distribution.

From table 4.4, the skewness of the post-test achievement scores distribution of Traditional Teaching group was found to be 0.36 (positively skewed) and the value of kurtosis was found to be -0.26, which is slightly less than 0 (for normal distribution); hence the curve was slightly platykurtic. The values of mean, median and mode were scattered (fig. 4.3) and therefore the frequencies did not pile up at any one point. The value of standard deviation 5.22 represented the scattering of scores from the mean position. Since the values of skewness and kurtosis were near to those of the normal distribution (Sk = 0, KU = 0), the post-test achievement scores distribution of the traditional teaching group could be interpreted as being nearly normal. Further, the mean achievement scores (post-test) for self-learning modules group (Group - I) and traditional teaching group (Group - II), were observed to be 34.30 and 20.18 (table 4.4) respectively. The mean post-test achievement score of the self-learning modules group was higher than the mean score of the traditional teaching group.

In order to draw statistically significant/nonsignificant inferences and to test the hypotheses, the investigator used inferential statistics viz. Analysis of Variance (ANOVA) and t test.

4.3 Inferential Statistics:
To evaluate the main effects and interaction effects among teaching
strategies, [Self-Learning Modules (SLM) and Traditional Teaching (TT)], altruism and emotional intelligence (EI), the data were analysed by using three-way analysis of variance (F-ratio) and t-test.

4.3.1 Analysis of variance:

In order to test hypotheses, analysis of variance (ANOVA) was employed. The following assumptions for applying analysis of variance of data were tested.

1. Observations within experimentally homogeneous sets should be from normally distributed population.
2. The sampling units within sets should be random and mutually exclusive.
3. Within groups, variance should be nearly equal.

The first assumption that observations within experimentally homogeneous sets should be from normally distributed population, was tested through descriptive statistics. The Mean, Median, Mode Standard Deviation, Skewness and Kurtosis for each sample have been presented in table 4.4. In order to test the first assumption of ANOVA, smoothed frequency polygons were drawn, which showed nearly normal distributions (vide figures 4.1 to 4.3). The values of skewness and kurtosis for the total sample, for Group - I (SLM) and Group - II (TT) can be considered near to the values of normal distributions.

The second assumption that the sampling units within the sets should be random and mutually exclusive was satisfied by randomly assigning students to different treatment groups.

Regarding the third assumption, i.e. the homogeneity of variance, within groups the condition was met, with the help of Bartlett’s test for homogeneity of variance (for ANOVA). The critical value (X^2 for 7 degrees of freedom) was 12.803, which is less than table value of 18.475. (X^2, for 7 degrees of freedom, .01 level of significance). So there was no significant difference in variance within groups. Therefore, the two groups were of equal variances. After having the main assumptions underlying the analysis of
variance satisfied, the calculations of 2 x 2 x 2 analysis of variance were computed on post-test achievement scores by varying the independent variables of teaching strategies (A) in two ways – Self-Learning Modules (A1), and Traditional Teaching (A2); Altruism (B) in two ways – low (B1) and high (B2); Emotional Intelligence (C) also in two ways – low (C1) and high (C2). The layout of 2 x 2 x 2 factorial design is given as under:
Figure 4.4: Layout of the factorial design
Figure 4.5: Number of Combinations in 2x2x2 Factorial Design
The summary of analysis of variance has been presented in table 4.5.

**Table 4.5: Summary of 2 x 2 x 2 Analysis of Variance in Respect of Achievement**

<table>
<thead>
<tr>
<th>No.</th>
<th>Source of Variation</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Sum of Squares</th>
<th>F-value</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strategies of Teaching (A)</td>
<td>1</td>
<td>5978.41</td>
<td>5978.41</td>
<td>161.50</td>
<td><strong>Significant</strong></td>
</tr>
<tr>
<td>2</td>
<td>Altruism (B)</td>
<td>1</td>
<td>232.41</td>
<td>232.41</td>
<td>6.28</td>
<td><em>Significant</em></td>
</tr>
<tr>
<td>3</td>
<td>Emotional Intelligence (C)</td>
<td>1</td>
<td>4.41</td>
<td>4.41</td>
<td>0.12</td>
<td>Nonsignificant</td>
</tr>
<tr>
<td>4</td>
<td>A x B</td>
<td>1</td>
<td>385.21</td>
<td>385.21</td>
<td>10.41</td>
<td><strong>significant</strong></td>
</tr>
<tr>
<td>5</td>
<td>A x C</td>
<td>1</td>
<td>130.21</td>
<td>130.21</td>
<td>3.52</td>
<td>Nonsignificant</td>
</tr>
<tr>
<td>6</td>
<td>A x B x C</td>
<td>1</td>
<td>114.06</td>
<td>114.06</td>
<td>3.08</td>
<td>Nonsignificant</td>
</tr>
<tr>
<td>7</td>
<td>Error in Groups or SSW</td>
<td>112</td>
<td>4145.87</td>
<td>37.01</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Total/SST</td>
<td>119</td>
<td>11333.99</td>
<td>95.24</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Significant at .05 level (table value for F = 3.93 for 1/112 degrees of freedom).

** Significant at .01 level (table value for F = 6.87 for 1/112 degrees of freedom).
Fig. 4.6: Indicating Significant Interaction Between Teaching Strategies and Altruism
Fig. 4.7: Indicating Interaction Between Teaching Strategies and Emotional Intelligence
4.3.1 Discussion based on Table 4.5

(1) Main effect of strategies of teaching:

(Discussion based on hypothesis 1)

The F-value 161.50 for the main effect of strategies of teaching namely Self-Learning Modules (SLM) and Traditional Teaching (TT) on achievement was found to be significant at .01 level. The result revealed that the difference between means of SLM an TT groups could not be attributed to chance factors or some kind of error variance. The difference is genuine, so the first hypothesis that there is no significant difference in the mean achievement scores in respect of groups taught through self-learning modules and conventional method of instruction in environmental education stands rejected. Therefore, there exists a significant difference between the students exposed to self-learning modules and the students exposed to traditional teaching on achievement in environmental education.

The difference between the post-test achievement scores of students was tested for significance between SLM and TT strategies. The results confirming a significant difference between the groups are given in table 4.6.

Table 4.6: t-Ratio Between Group - I (SLM) and Group - II (TT)

(Post-test Achievement Scores)

<table>
<thead>
<tr>
<th>Group</th>
<th>No.</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLM</td>
<td>60</td>
<td>34.30</td>
<td>7.96</td>
<td>11.48</td>
<td>** Significant</td>
</tr>
<tr>
<td>TT</td>
<td>60</td>
<td>20.18</td>
<td>5.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Significant at .01 level (t_{18} = 2.63)

Interpretation of results of table 4.6:

The t-ratio of 11.48 between SLM and TT strategies for post-test achievement scores in the subject of environmental education was found to be significant at .01 level. It was inferred that there was a statistically significant difference in the post-test achievement scores between the groups taught through SLM strategy and TT strategy. The SLM strategy group had
higher mean scores than TT strategy group. This result showed that the students taught through SLM strategy grasped more environmental education concepts than the students taught through the TT strategy.

Several recent studies, namely Curry (1994), Pant (1997), Narula (1999), Kohli (1999) and Sulaiman (2001) also observed SLM to be the superior strategy of teaching, as compared to the traditional method. On the other hand, studies by Misra (1994), Varlejs (1996), Umar (1999), and Haggerty (2000) were not consistent with the investigator's findings.

Misra (1994) and Umar (1999) found that no teaching strategy was better than the others. In another study it was observed that it was not essential that professional achievement might be influenced by self-directed learning (Varlejs, 1996). The traditional method of instruction was found to have an edge in most of the cases in a study conducted by Haggerty (2000).

Curry (1994) conducted a study on ‘Matching chemistry instructional methods with perceptual learning style preferences of eleventh grade women. It found that the knowledge of both an individual’s learning style and the perceptual preference and utilization of appropriate learning style instructional strategies by a science educator would enhance both attitudes and achievement in the classroom. Pant (1997) studied the effect of guided instruction through self-learning module (SLM) on the achievement of students in book-keeping and accountancy and found the former a superior teaching strategy as compared to the conventional model (TT). Narula (1999) studied the effectiveness of self-learning modules in applied physics on the achievement of students in relation to gender and personality of polytechnic students and found self-learning modules to be a superior strategy of teaching compared to the conventional one. Kohli (1999) on ‘Effectiveness of self-learning modules on achievement in geography in relation to mastery and non-mastery teaching strategies, intelligence and study habits’, showed that the students taught through SLM with mastery teaching strategy, acquired more concepts than the students taught through SLM with non-mastery teaching strategy. Further, the study by Sulaiman (2001) on ‘The effect of varied instructional text design strategies on the achievement of different
educational objectives’, reported that there were significant differences in student achievement when the self-instructional module was used.

Like all the studies described in the previous paragraph, the present study also clearly established the superiority of SLM over TT. A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study.

Firstly, in SLM the language used was lucid and the terms used were self-explanatory. Also, the whole subject matter content was divided into small units such that each unit was covered/learned by an average student in a specified interval of time required for a normal rate of learning. Since the subject matter content was more effectively presented when it was broken up into conveniently structured units called modules, this feature of the SLM confers a substantial advantage on the students taught under this system. Secondly, each student was allowed to learn a given Teaching-Learning Unit (TLU) at his own rate of learning and came to terms with concepts and absorbed them at a pace that was suited to his own individual abilities and capacities. Since there was a wide variation in intellectual abilities in this regard, this feature of SLM offered a crucial advantage over the other method. Thirdly, another area where SLM scored over TT was the provision for a continuous feedback. Learning takes place in small steps with feedback (immediate knowledge of the result) accelerating the process of learning. The student learned the subject of his on-going unit thoroughly before he advanced to the next one. The student’s grasp of the unit was also strengthened when he took a test at the end of each unit. The lack of this opportunity in the case of TT rendered it a more passive procedure.

(2) Main effect of altruism:

(Discussion based on hypothesis 2)

The F-value 6.28 for the main effect of altruism on achievement was found to be significant at 0.5 level. This showed that the variable of altruism affected achievement in environmental education concepts significantly. The result revealed that the difference between the means of the two groups namely low altruism (B₁) and high altruism (B₂) could not be attributed to
chance factors or some kind of error variance. The difference is genuine, hence refuting the second null hypothesis that there is no significant difference between mean scores of students having different levels of altruism.

The difference in the mean post-test achievement scores of high (B2) and low (B1) altruism was found by computing the t-ratio (table 4.7).

<table>
<thead>
<tr>
<th>Group</th>
<th>No.</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>High altruism</td>
<td>60</td>
<td>28.63</td>
<td>8.18</td>
<td>2.02</td>
<td>* Significant</td>
</tr>
<tr>
<td>Low altruism</td>
<td>60</td>
<td>25.85</td>
<td>11.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .05 level $t_{118} = 1.98$

The t-ratio of 2.02 between high altruism and low altruism groups was found to be significant at .05 level in respect of post-test achievement scores.

The result of this study is supported by Winniford, Carpenter and Grinder (1995), Downie (1996) and Kang (1999), whereas a study by Cahill (1996) was inconsistent with the findings of the present study.

Altruistic motivation was found to be important by Winniford, Carpenter and Grinder (1995) while exploring traits and motivations in a sample of 443 college students involved in service organizations. Downie (1996) in a study on 'A comparison of values among counselling psychologists characterised as scientist-practitioners, practitioners or scientists', found that both scientist-practitioners and practitioners placed a higher value on social interaction and altruism. In another study on 'Motivational factor of Asian/Pacific Islanders in entering a helping profession', Kang (1999) discovered that educational achievement, hard-work, perseverance, a desire to repay the debt to one's community, fulfilment in helping others, viewing the helping process as important and the belief in individual equality were all important factors.
On the other hand, Cahill (1996) in ‘A study on the nature of police values before and after recruitment training and their subsequent experience as police officers’, revealed that altruism decreased not only as a result of training, but also on account of the officers’ two and a half years working experience.

Altruism is concerned with an intention aimed at helping others, motivated by a regard for the well being of others and placing the interests of others ahead of those of oneself. It is the principle or practice of unselfish concern for the welfare of others, which includes all life. Accordingly, the right action is that which produces the greatest benefits to others. Altruistic behaviour, therefore, is conducive to betterment of environment and makes environmental solutions possible. As environmental education is the subject content of the achievement test and it has been found that altruistic motives do influence the improvement of environment (Holmes, 1995), it is very much likely that significant differences have been obtained in this study between mean scores of students having different levels of altruism.

(3) Main effect of emotional intelligence (El):

(Discussion based on hypothesis 3)

The F-value 0.12 for the main effect of emotional intelligence (EI) on achievement in environmental education was found to be non-significant. This showed that the variable of EI did not have a significant effect on achievement in environmental education concepts. Thus, the third null hypothesis that emotional intelligence does not significantly account for differential achievement in environmental education stands validated.

The result of the present work is supported by the study conducted earlier by Tapia (1998). Tapia conducted a study on the relationship of emotional intelligence inventory and achievement. He found that there existed a lack of relationship between emotional intelligence and academic achievement.

The following factors could possibly account for the result that achievement in environmental education is not significantly affected by EI.

Achievement in the subject of environmental education is a part of a
much broader concept of achievement, which is academic achievement. 
Academic achievement is also sometimes expressed in terms of academic intelligence (Goleman, 1995).

Firstly, this nonsignificance may be attributed to the fact that academic intelligence has little to do with emotional life. Unlike IQ, emotional intelligence (EI) can be cultivated and it continues to develop as one goes through life. In comparison to the old concept of IQ which revolves around a narrow band of linguistic and mathematical skills, the relatively new concept of EI is valued for its practical applications and revolves around self-awareness, self-regulation, motivation, empathy and social skills.

Gardener’s influential (1983) book ‘Frames of Mind’, was a manifesto refuting the I.Q. view, it proposed that there was not just one monolithic kind of intelligence that was crucial for success in life but rather a wide spectrum of intelligences with seven key categories. His list includes the two standard academic kinds, verbal and mathematical. Rounding out the list are two faces of what Gardener calls “interpersonal” and “interapersonal” intelligence. The former is the ability to understand other people - what motivates them, how they work and how to work co-operatively with them. “Interapersonal intelligence” is a correlative ability, turned inward. It is a capacity to form an accurate, veridical model of oneself and to be able to use that model to operate effectively in life.

This multifaceted view of intelligence offers a richer picture of a child’s ability and potential for success than the standard I.Q. When spectrum students were evaluated on the Stanford-Binet Intelligence Scale - once the gold standard of IQ tests - and again by a battery designed to measure Grandner’s spectrum of intelligences, there was no significant relationship between the children’s scores on the two tests. The five children with the highest IQs (from 125 to 133) showed a variety of profiles on the ten strengths measured by the Spectrum test. For example, of the five "smartest" children according to the IQ tests, one was strong in three areas, three had strengths in two areas, and one "smart" child had just one Spectrum strength. Those strengths were scattered: four of these childrens’ strengths were in music, two
in the visual arts, one in social understanding, one in logic, two in language. None of the five high IQ children were strong in movement, numbers or mechanics; movement and numbers were actually the weak spots for two of these five.

Gardener’s conclusion was that “The Stanford-Binet Intelligence Scale did not predict successful performance across or on a consistent subset of Spectrum activities”. On the other hand, the Spectrum scores give parents and teachers clear guidance about the fields that these children will take a spontaneous interest in, and where they will do well enough to develop the passions that could one day lead beyond proficiency to mastery.

However, there is another notion of EI which says that a person who is liberally endowed with the traits that define and distinguish EI; such as being able to manage feelings within oneself - and read and deal other peoples’ feelings, is an emotionally stable person (Goleman, 1995). This, in turn, leads to high achievement in various fields of life, including academics. This is supported by empathy’s influence on academic achievement. In testing with a version of the PONS (Profile of Non-verbal Sensitivity) designed for children, it was found that those who showed an aptitude for reading feelings non-verbally were the most emotionally stable. They also did better in school, even though, on average, their IQs were not higher than those children who were less skilled at reading non-verbal messages.

Another study revealed that significant relationship exists between scores on the measure of empathic acuity and SAT (Scholastic Aptitude Test) or IQ scores or school achievement tests.

(4) Interaction between teaching strategies and altruism:

(Discussion based on hypothesis 4)

The F-value for the first order interaction between teaching strategies and altruism was found to be significant at .01 level (F = 10.41). Thus, it can be said that in this study, the result revealed that there was significant interaction between strategies of teaching and altruism (A x B) on achievement in environmental education. It was found that there was a statistically significant difference in the post-test achievement scores between
the groups taught through SLM strategy and TT strategy (table 4.6). The significant nature of A x B interaction is also obvious from the two non-parallel, intersecting lines (B₁ and B₂) in fig. 4.6. This suggests that the difference between the means of achievement scores in environmental education of SLM group and TT group is also dependent upon high (B₂) and low (B₁) and altruism. Thus, the effect of the two teaching strategies (A) - namely SLM (A₁) and TT (A₂) on achievement in environmental education is not the same for different levels of altruism.

It can be observed from fig. 4.6 that the SLM group students with high (B₂) altruism have higher mean post-achievement scores than those with low (B₁) altruism and the difference is significant at .05 level (t = 2.72).

The difference between the mean post-achievement scores of high (B₂) and low (B₁) altruism in TT group is nonsignificant (t = 1.94, table 4.8). Further, the mean post-achievement scores of SLM group are higher than that of TT group at high (B₂) as well as at low (B₁) altruism. Thus, the fourth null hypothesis that there is no first order significant interaction between strategies of teaching and altruism cannot be retained. Hence, a significant interaction between teaching and altruism was observed in this study. The different t-values for significant F-value in relation to interaction between strategies of teaching and altruism were also computed and are given in table 4.8.
Table 4.8: t-Ratios for Interaction Between Teaching Strategies and Altruism

<table>
<thead>
<tr>
<th>No.</th>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A1 B1</td>
<td>15</td>
<td>30.90</td>
<td>7.12</td>
<td>2.72</td>
<td>** Significant</td>
</tr>
<tr>
<td></td>
<td>A1 B2</td>
<td>15</td>
<td>34.70</td>
<td>8.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>A1 B1</td>
<td>15</td>
<td>33.90</td>
<td>7.12</td>
<td>6.50</td>
<td>** Significant</td>
</tr>
<tr>
<td></td>
<td>A2 B1</td>
<td>15</td>
<td>20.37</td>
<td>6.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>A1 B1</td>
<td>15</td>
<td>33.90</td>
<td>7.12</td>
<td>8.39</td>
<td>** Significant</td>
</tr>
<tr>
<td></td>
<td>A2 B2</td>
<td>15</td>
<td>17.00</td>
<td>3.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>A1 B2</td>
<td>15</td>
<td>34.70</td>
<td>8.40</td>
<td>8.82</td>
<td>** Significant</td>
</tr>
<tr>
<td></td>
<td>A2 B1</td>
<td>15</td>
<td>20.37</td>
<td>6.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>A1 B2</td>
<td>15</td>
<td>34.70</td>
<td>8.40</td>
<td>10.53</td>
<td>** Significant</td>
</tr>
<tr>
<td></td>
<td>A2 B2</td>
<td>15</td>
<td>17.00</td>
<td>3.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>A2 B1</td>
<td>15</td>
<td>20.37</td>
<td>6.54</td>
<td>1.94</td>
<td>Nonsignificant</td>
</tr>
<tr>
<td></td>
<td>A2 B2</td>
<td>15</td>
<td>17.00</td>
<td>3.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A1: SLM    B1: Low Altruism
A2: TT     B2: High Altruism
*
** Significant at .05 level (t_{58} = 2.00)
** Significant at .01 level (t_{58} = 2.66)

**Interpretation of results based on table 4.8:**

I. The t-ratio between low and high altruism was found to be significant at .01 level in respect of SLM strategy. Students with high altruism gained higher scores than with low altruism under SLM strategy as the mean for high altruism group was higher than that for low altruism group under SLM strategy.

II. The t-ratio between SLM low altruism and TT low altruism was found to be significant at .01 level. The result indicates that students with low altruism gained higher scores in SLM group than those in TT group as the mean for SLM low altruism group was higher than that for TT low altruism group.
III. The t-ratio between SLM low altruism and TT high altruism groups was found to be significant at .01 level in favour of SLM group. This implies that SLM low altruism group attained higher scores than the TT high altruism group as the mean for SLM low altruism group was higher than that for TT high altruism group. The result may be attributed to SLM strategy of teaching.

IV. The t-ratio between SLM high altruism and TT low altruism was found to be significant at .01 level in favour of SLM group. This means that SLM high altruism group gained higher scores than the TT low altruism group as the mean for SLM high altruism group was higher than the mean for TT low altruism group.

V. The t-ratio between SLM high altruism and TT high altruism groups was found to be significant at .01 level in favour of SLM strategy. The result revealed that students with high altruism gained higher scores in SLM group than those in TT group as the mean for high altruism group was higher under SLM strategy than that under TT strategy.

VI. The t-ratio between low and high altruism was found to be nonsignificant in respect of TT strategy.

The possible reasons which could contribute for the above result may be summarised as:

Altruism by definition denotes benevolence as contrasted with the selfish propensities (Comte, 1851). Though used primarily in a psychological sense, to designate emotions of a reflective kind, the immediate consequences of which are beneficial to others, its important significance is ethical. As such it defines a theory of conduct by which only actions having for their object the happiness of others possess a moral value. It is the attitude of caring about the good of others, leading to acts that help them although one does not gain anything by doing them. It is an action intentionally aimed at helping others, motivated by a regard for the well being of others for its own sake. As the subject content of the two strategies of teaching - namely SLM and TT strategies is environmental education, and as it has been found that altruistic behaviour is conducive to betterment of environment and makes
environmental solutions possible [discussed under (2)], it is very much possible that altruism has affected the difference between the achievement scores of the two strategies of teaching.

From above II to V it can be observed that irrespective of (high or low) altruism the mean post-achievement scores of SLM group are higher than that of TT group. The significant difference between the mean post-achievement scores of SLM group and TT group may be attributed to the SLM strategy of teaching, irrespective of altruism (the significance of difference between SLM and TT being very high).

(5) Interaction between teaching strategies and emotional intelligence (EI):

(Discussion based on hypothesis 5)

The F-value was found to be non significant (F = 3.52) between strategies of teaching and emotional intelligence. Thus, it can be inferred that in this study, the result disclosed that there was no significant interaction between strategies of teaching and emotional intelligence (A x C) on achievement in environmental education. The nonsignificant nature of A x C interaction can also be seen in fig. 2 in which two parallel lines form C1 (low EI) and C2 (high EI). This suggests that the difference between the means of achievement scores in environmental education of SLM group and TT group is independent of EI. This implies that the SLM students had higher mean post-achievement scores in environmental education than the TT students irrespective of low (C1) or high (C2) EI. So, the fifth null hypothesis that there is no first order significant interaction between strategies of teaching and emotional intelligence is retained.

A closer investigation suggests the following factors which might have contributed to the outcome of the present result:

At first, typically EI is defined in terms of empathy, attention to, and discrimination of one’s emotions, and accurate recognition of one’s own and others’ moods. It also includes mood management or control over emotions, response with appropriate (adaptive) emotions and behaviour in various life situations, especially to stress and difficult situations. It involves balancing of
honest expression of emotions against courtesy, consideration and respect for others.

The Sevenfold Emotional Intelligence Scale (SFEIS) consisting sixty-three items has been used in this study and includes the following seven dimensions which are further divided into two categories;

- **A**: Self-awareness and appraisal
- **B**: Self-regulation and responsibility
- **C**: Self-motivation
- **D**: Self-esteem and confidence
- **E**: empathy and acceptance of others.
- **F**: interpersonal relations.
- **G**: social skills.

The subject matter for the two teaching strategies namely SLM and TT was environmental education. Further, environmental education encompasses the concern for entire life. The environmental problems can be solved effectively only if the human beings start developing responsibility for the effect of their actions on all life. For this, the only dimension in the SFEIS (described above) which is vital/conducive to some extent towards solving environmental problems is ‘empathy and acceptance of others’, which means ‘sensing what others are feeling, being able to take their perspective, and accepting their point of view’. Thus, out of the total/entire SFEIS, “empathy” is the only factor in favour of environmental education, which constitutes one of the seven dimensions of SFEIS.

Secondly, even though emotional intelligence consists of “empathy” which accounts for sensitivity of others’ feelings/concerns and taking their perspective, yet it lacks the practice of unselfish concern for the welfare of others. It is devoid of placing the higher value on all but oneself, which is an essential characteristic of altruism. Also, EI does not go beyond the sphere of human beings, where feelings and compassion for other life forms are
concerned. As discussed earlier in this section that the contents of the two teaching strategies viz. SLM and TT consist of environmental education, the key factor for which is the selfless concern for the entire cosmos. Hence, EI might not be very important in influencing the achievement in environmental education with respect to the teaching strategies as did altruism.

(6) Interaction among teaching strategies, altruism and emotional intelligence:

(Discussion based on hypothesis 6)

The interactional effect of teaching strategies (A) x levels of altruism (B) x levels of emotional intelligence (C) had the F-value 3.08. The F-value was found to be nonsignificant. This revealed that teaching strategies, levels of altruism and emotional intelligence do not have significant interactional effect on the learning of environmental education concepts. The null hypothesis that there is no significant interaction among strategies of teaching, altruism and emotional intelligence holds good.
4.3.2 Conclusions:

The conclusions of the present study are as follows:

1. There exists a significant difference between the students exposed to self-learning modules strategy and the students exposed to traditional teaching strategy. Students exposed to self-learning modules performed significantly better on achievement in environmental education than those exposed to traditional teaching.

2. There is a significant difference between the mean scores of the students at different levels of altruism. Students with high altruism performed significantly better on achievement in environmental education than the students with low altruism.

3. Emotional intelligence does not significantly account for differential achievement in environmental education.

4. There exists a significant interaction between strategies of teaching and altruism.

5. There is no first order significant interaction between strategies of teaching and emotional intelligence.

6. Strategies of teaching, altruism and emotional intelligence do not account for total variance.