CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

5.1 Methodology in Brief

5.2 Comparison of Scores of Experimental and Control Groups based on Dependent Variables

5.3 Comparison of Gain Achievement Test Scores of Students having High, Average, and Low Levels of Creativity
ANALYSIS AND INTERPRETATION OF DATA

Analysis of data helps a researcher to categorise, code, edit and tabulate the raw information collected and provides a meaningful picture of the results. In this chapter, the investigator attempts to give a clear and precise picture of the data he has gathered, with the help of statistical techniques. The investigator also presents the methodology adopted for the study in brief.

Analysis is studying of organised materials to discover inherent facts and meanings. The process of interpretation is not a simple, routine, mechanical process; it is careful, logical and critical examination of the results of analysis, considering all the limitations of the study.

Data analysis has a key role to play in presenting a meaningful research report. Analysis is a systematic process of selecting, categorising, comparing, synthesising and interpreting to provide explanations of the single phenomenon of interest (McMillan & Schumacher, 1989).

5.1 METHODOLOGY IN BRIEF

The major objective of the present study was to determine the effectiveness of reflective thinking strategy of teaching over
conventional method of direct instruction. Six divisions of standard VIII students of three schools from two districts of Kerala were selected for the study. The present study took 212 students from all the three schools - 106 students in both control and experimental groups.

The study adopted pre test-post test design. The experimental group was taught through reflective thinking strategy of teaching and the control group was taught using the conventional method of direct instruction. Both the groups were subjected to pre tests and post tests based on the selected cognitive and affective variables before and after the treatment. In order to establish the effectiveness of reflective thinking strategy of teaching, the test scores obtained were analysed employing the following statistics.

a. Measures of Central Tendency and Variance.

b. Critical Ratio.

c. Analysis of Variance.

d. Analysis of Co-variance.

5.2 COMPARISON OF SCORES OF EXPERIMENTAL AND CONTROL GROUPS BASED ON DEPENDENT VARIABLES
In the present study the investigator administered pre tests such as ‘achievement test in chemistry’, ‘metacognitive awareness inventory’, ‘test on innovative attitude’ and ‘test on fear of success’ to both the groups before the experimental treatment. After the experiment, the same tests were administered as post tests. Meanwhile a test on creativity is also conducted by the investigator to stratify the students of the experimental group on the basis of their level of creativity. The scores obtained for each variable for the experimental and control groups in the pre tests and post tests were subjected to appropriate statistical procedures. The analysis of data is presented below.

5.2.1 Comparison of Scores of Experimental and Control Groups Based on Cognitive Variables.

The third major objective of the present study was to find out the effectiveness of reflective thinking strategy of teaching on the cognitive variables such as achievement in chemistry and metacognitive awareness. An achievement test in chemistry and metacognitive awareness inventory were administered as pre tests to both the experimental and control groups to assess the entry behaviour regarding these cognitive variables. The
descriptions of the analysis of data regarding the cognitive variables are given separately.

5.2.1.1 Comparison of Achievement in Chemistry among Pupils of Experimental and Control Groups

The first dependent variable (selected under cognitive dimension) in the present study, was achievement in chemistry. The analysis of data regarding the effectiveness of reflective thinking strategy on the achievement in chemistry of secondary school students is presented below.

A) Before Experiment

Before the experiment both the groups were subjected to an achievement test in chemistry as pre test and the scores for this test were collected. Achievement test used in the present study consisted of two sections with 21 items in each; the maximum score for each section is 25 marks, thus amounting to a maximum score of 50 marks and a minimum score zero. The data and results of the test of significance of difference in mean scores of the achievement test in chemistry are presented in Table 5.1.

Table 5.1

Data and Results of Test of Significance of the Difference between the Mean Pre Test Scores of Experimental and Control
Groups Regarding Achievement Test in Chemistry

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>4.71</td>
<td>2.34</td>
<td>0.41</td>
<td>p &gt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>4.57</td>
<td>2.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.1 it is seen that the mean achievement scores for experimental and control groups are 4.71 and 4.57 with standard deviations 2.34 and 2.58 respectively. The obtained value of critical ratio (CR = 0.41; p > .05) is not significant even at .05 level. It means that there is no significant difference between the means of the pre test scores of pupils in experimental and control groups. Since the mean of the pre test score of experimental group was comparable to that of control group, it was fairly assumed that the two groups are almost equal on their academic achievement in chemistry before the experiment. Further, the equivalence of both these groups regarding achievement in chemistry can be understood from the graph representing the mean pre test scores which is presented as Figure 5.1.

Figure 5.1
Comparison of Mean Achievement Test Scores of Experimental Group and Control Group before Experiment

Mean Achievement Test Scores:
- Experimental Group: 4.71
- Control Group: 4.57

The chart shows a comparison of mean achievement test scores between the experimental group and the control group before the experiment.
B) After Experiment

The experimental group was taught through reflective thinking strategy of teaching and the control group was taught through conventional method of direct instruction. The same topics of VIII standard chemistry were taught to both these groups with the same span of time. After the treatments, both the groups were subjected to the achievement test in chemistry which was used as pre test and the scores were collected. The data and results of the test of significance of difference between the mean scores of the achievement test in chemistry after the experiment are presented in Table 5.2.

**Table 5.2**

Data and Results of Test of Significance of the Difference between the Mean Post Test Scores of Experimental and Control Groups Regarding Achievement Test in Chemistry

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>38.39</td>
<td>6.53</td>
<td>3.12</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>35.58</td>
<td>6.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
From the table 5.2 it is seen that the mean achievement scores for experimental and control groups are 38.39 and 35.58 with standard deviations 6.53 and 6.57 respectively. The obtained value of critical ratio (CR = 3.12; p < .01) is significant at .01 level. It means that there is significant difference between the means of the post test scores of pupils in experimental and control groups. Since the mean of the post test scores of experimental group (38.39) was greater than that of control group (35.58), it can be interpreted that reflective thinking strategy of teaching is superior to conventional method of direct instruction on academic achievement in chemistry among secondary school students. The superiority of experimental group concerning achievement in chemistry can be understood from the graph representing the mean post test scores which is presented as Figure 5.2.

Figure 5.2

Comparison of Mean Achievement Test Scores of Experimental Group and Control Group after Experiment
C) Gain in Performance

To further ascertain the effectiveness of reflective thinking strategy of teaching, the performance of pupils in experimental group was compared to that of the pupils in the control group by testing the significance of the difference between the mean gain scores of the two groups in achievement test. The data and result of test of significance are given in Table 5.3

Table 5.3
Data and Results of Test of Significance of the Difference between the Mean Gain Scores of Experimental and Control Groups Regarding Achievement Test in Chemistry

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
</table>
The table 5.3 shows that the obtained value of critical ratio (CR = 3.34; p < .01) is significant at .01 level. Therefore it can be inferred that there is significant difference between the mean gain scores of pupils in experimental and control groups. Since the mean gain scores of experimental group (33.68) is greater than that of control group (31.01), it can be interpreted that the reflective thinking strategy of teaching is more effective than conventional method of direct instruction on academic achievement in chemistry among secondary school students. Again the superiority of experimental group regarding achievement in chemistry is clear from the graph representing the mean gain scores which is presented as Figure 5.3.

**Figure 5.3**

Comparison of Mean Gain Scores of Achievement Test in Chemistry of Experimental Group and Control Group
D) Genuineness of the Difference in Performance of Experimental and Control Groups based on Achievement test in Chemistry

Here the investigator compares the effectiveness of reflective thinking strategy of teaching over conventional method of direct instruction on the cognitive variable ‘achievement in chemistry’. The pre test and post test scores on achievement test in chemistry of 212 students of two groups, with one learned through the reflective thinking strategy of teaching and the other in conventional method of direct instruction were subjected to ANCOVA to determine the effectiveness of the former method over the latter. Total sum of squares, mean squares variance and 

$F$ - ratios for the pre-test and post-test scores of the
experimental and control groups were computed. The details of
the analysis are shown in the table 5.4 to 5.6

**Table No. 5.4**

Summary of Analysis of Variance of ‘X’ (Pre Test) and ‘Y’
(Post Test) Scores of Pupils in Experimental and Control Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Df</th>
<th>SS$_X$</th>
<th>SS$_Y$</th>
<th>MS$_X$ (V$_X$)</th>
<th>MS$_Y$ (V$_Y$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among means</td>
<td>1.00</td>
<td>1.06</td>
<td>418.9</td>
<td>1.06</td>
<td>418.89</td>
</tr>
<tr>
<td>Within groups</td>
<td>210.00</td>
<td>1273.97</td>
<td>9007.0</td>
<td>6.07</td>
<td>42.89</td>
</tr>
<tr>
<td>Total</td>
<td>211.00</td>
<td>1275.03</td>
<td>9425.9</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

$F_X = \frac{1.06}{6.07} = 0.17$  
$F_Y = \frac{418.89}{42.89} = 9.77$

From table of F ratio, for df 1/105

$F$ at .05 level = 3.94

$F$ at .01 level = 6.90

The F ratios for the two sets of scores were tested for
significance. The table values of $F$ for df 1/105 are 3.94 at .05
level and 6.90 at .01 level. The obtained value of $F_X$ is 0.17 which
is not significant at .05 level. The non significant $F_X$ value shows
that there was no significant difference between pre-test scores
of pupils of experimental and control group. The obtained $F_y$ value 9.77 is significant at .01 level. The significant $F_y$ value indicates that the two groups differ significantly in the post test achievement.

The total sum of squares and adjusted mean squares variances for post test scores were computed and $F$ ratio was calculated.

**Table No. 5.5**

**Summary of Analysis of Co-Variance of ‘X’ (Pre test) and ‘Y’ (Post test) Scores of Pupils in Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>$SS_x$</th>
<th>$SS_y$</th>
<th>$SS_{xy}$</th>
<th>$SS_{yx}$</th>
<th>$MS_{yx}$</th>
<th>$SD_{yx}$</th>
<th>$F_{yx}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among Means</td>
<td>1.00</td>
<td>1.06</td>
<td>418.9</td>
<td>21.08</td>
<td>368.05</td>
<td>368.05</td>
<td>5.81</td>
<td>10.90</td>
</tr>
<tr>
<td>Within Groups</td>
<td>209.00</td>
<td>1273.97</td>
<td>9007.0</td>
<td>1575.46</td>
<td>7058.74</td>
<td>33.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>210.00</td>
<td>1275.03</td>
<td>9425.9</td>
<td>1596.55</td>
<td>7426.79</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
F_{yx} = \frac{368.05}{33.77} = 10.90
\]

From table $F$, for df 1/210

$F$ at .05 level = 3.89
The obtained value of F ratio is 10.90. It is significant at .01 level, since the value at .01 level from the table is 6.76. This significant F ratio for the adjusted post test scores shows that the two final scores viz the final mean score of pupils in experimental group and that of the control group differ significantly after they have been adjusted for difference in the pre test scores.

To find out which of the two methods is more significant, the investigator applied t test.

**Comparison of Adjusted Mean Scores**

The adjusted mean for the post test scores of the students in the experimental and control groups were computed. The data are given in the table below.
Table No. 5.6

Data for Adjusted ‘Y’ Means of the Post Test Scores of Pupils in Experimental and Control Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>M_x</th>
<th>M_y</th>
<th>M_yx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>106.00</td>
<td>4.71</td>
<td>38.40</td>
<td>38.30</td>
</tr>
<tr>
<td>Control</td>
<td>106.00</td>
<td>4.57</td>
<td>35.60</td>
<td>35.66</td>
</tr>
<tr>
<td>General Mean</td>
<td>212.00</td>
<td>4.64</td>
<td>36.98</td>
<td>-</td>
</tr>
</tbody>
</table>

Significance of difference among adjusted Y means

SD_{yx} = 5.81

SE_d between two adjusted means = 0.80

From Table of t, for df, 211

t at .01 level = 2.60

t at .05 level = 1.97

Difference of adjusted mean obtained (D) = 2.64

Calculated t value = \frac{\text{Difference between Y means}}{SE_d}

\[ t = \frac{2.64}{0.80} = 3.30 \]

Adjusted means for post test scores were tested for significance for df 1/211. The t value obtained, 3.30 exceeds the critical value of t (df = 1/211), 2.64 at .01 level.
The significant t value leads to the conclusion that the two means differ considerably. This implies that the experimental group and the control group differ significantly in their achievement. The adjusted mean of post test scores for the experimental group is greater than that of the control group. So it is obvious that the experimental group is better than the control group in achievement. It may therefore be inferred that the students who learned through reflective thinking strategy of teaching have better achievement than those who studied through the conventional method of direct instruction. In other words, reflective thinking strategy of teaching is more effective than conventional method of direct instruction on achievement in the cognitive variable, achievement in chemistry among secondary school students.

5.2.1.2 Comparison of Metacognitive Awareness among Experimental and Control Groups

The second dependent variable (selected under cognitive dimension) in the present study, was metacognitive awareness. The analysis of data regarding the effectiveness of reflective thinking strategy in developing the metacognitive awareness of secondary school students is presented below.

A) Before Experiment
Before the experiment the investigator administered a metacognitive awareness inventory to the students of both experimental and control groups in order to measure their metacognitive awareness. The maximum score that can be attained by an individual for metacognitive awareness inventory is 364 (52x7) and the minimum score is 52 (52 x 1). The data and results of the test of significance of difference in mean scores of metacognitive awareness are presented in Table 5.7.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>274.16</td>
<td>45.46</td>
<td>0.74</td>
<td>p &gt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>278.37</td>
<td>37.54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.7 it is seen that the mean metacognitive awareness scores for experimental and control groups are 274.16 and 278.37 with standard deviations 45.46 and 37.54 respectively. The obtained value of critical ratio (CR = 0.74; p > .05) is not significant even at .05 level. It indicates that there is no significant difference between the means of the pre test
scores of pupils in experimental and control groups. Since the mean of the pre test scores of experimental group was comparable to that of control group, it can be assumed that the two groups are almost equal on their metacognitive awareness before the experiment. Further, the equivalence of both these groups regarding metacognitive awareness can be understood from the graph representing the mean pre test scores which is presented as Figure 5.4.

**Figure 5.4**

Comparison of Mean Metacognitive Awareness Scores of Experimental Group and Control Group before Experiment

B) After Experiment
After the treatments, the investigator administered the metacognitive awareness inventory to both the groups and the scores were collected. Here the same tool, which was used as the pre test to measure the metacognitive awareness, was employed. The data and results of the test of significance of the difference in the mean scores of the metacognitive awareness inventory after the experiment are presented in Table 5.8.

Table 5.8

Data and Results of Test of Significance of the Difference between the Mean Post Test Scores of Experimental and Control Groups Regarding Metacognitive Awareness

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>291.68</td>
<td>39.48</td>
<td>2.14</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>279.82</td>
<td>41.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.8 it is seen that the mean metacognitive awareness scores for experimental and control groups are 291.68 and 279.82 with standard deviations 39.48 and 41.30 respectively. The obtained value of critical ratio (CR = 2.14; p < .05) is significant at .05 level. It means that there is significant difference between the mean of the post test scores of pupils in experimental and control groups. Since the mean of the post test scores of experimental group (291.68) was greater than that of
control group (279.82), it can be interpreted that reflective thinking strategy of teaching is superior to conventional method of direct instruction in developing the metacognitive awareness among secondary school students. The superiority of experimental group regarding metacognitive awareness is evident from the graph representing the mean post test scores which is presented as Figure 5.5.
C) Gain in Metacognitive Awareness

To further establish the effectiveness of reflective thinking strategy of teaching, in the improvement of metacognitive awareness, the metacognitive awareness scores of pupils in experimental group was compared with that of pupils in the control group by testing the significance of the difference between the mean gain scores of the two groups. The data and result of test of significance are given in Table 5.9
Table 5.9

Data and Results of Test of Significance of the Difference between the Mean Gain Scores of Experimental and Control Groups Regarding Metacognitive Awareness

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>46.91</td>
<td>17.52</td>
<td>3.29</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>18.01</td>
<td>1.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table 5.9 shows that the obtained value of critical ratio (CR = 3.29; p < .01) is significant at .01 level. Therefore, it can be inferred that there is significant difference between the mean gain scores of pupils in experimental and control groups. Since the mean gain scores of experimental group (46.91) is greater than that of control group (18.01), it can be interpreted that the reflective thinking strategy of teaching is superior to conventional method of direct instruction in developing the metacognitive awareness among secondary school students. Again, the superiority of experimental group regarding metacognitive awareness is obvious from the graph representing the mean gain scores which is presented as figure 5.6.
D) Genuineness of the Difference in Performance of Experimental and Control Groups based on Metacognitive Awareness Inventory

Here the investigator compares the effectiveness of reflective thinking strategy of teaching over conventional method of direct instruction on the cognitive variable metacognitive awareness. The scores on metacognitive awareness inventory of 212 students of two groups, with one learned through the reflective thinking strategy of teaching and the other in conventional method of direct instruction were subjected to
ANCOVA to determine the effectiveness of the former method over the latter. Total sum of squares, mean squares variance and F ratios for the pre test and post test scores of the experimental and control group were computed. The details of the analysis are shown in the table 5.10 to 5.12

**Table No. 5.10**

**Summary of Analysis of Variance of ‘X’ (Pre-Test) and ‘Y’ (Post-Test) Scores of Pupils in Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>SSₓ</th>
<th>SSᵧ</th>
<th>MSₓ(Vₓ)</th>
<th>MSᵧ(Vᵧ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among means</td>
<td>1.00</td>
<td>938.28</td>
<td>7453.1</td>
<td>938.28</td>
<td>7453.06</td>
</tr>
<tr>
<td>Within groups</td>
<td>210.00</td>
<td>364900.92</td>
<td>342776.7</td>
<td>1737.62</td>
<td>1632.27</td>
</tr>
<tr>
<td>Total</td>
<td>211.00</td>
<td>365839.21</td>
<td>350229.8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

\[
Fₓ = \frac{938.28}{1737.62} = 0.54 \quad Fᵧ = \frac{7453.06}{1632.27} = 4.57
\]

From table of F ratio, for df 1/105

F at .05 level = 3.94

F at .01 level = 6.90

The F ratios for the two sets of scores were tested for significance. The table values of F for df 1/105 are 3.94 at .05
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level and 6.90 at .01 level. The obtained value of $F_x$ is 0.54 which is not significant at .05 level. The non significant $F_x$ value shows that there was no significant difference between pre test scores of the pupils of experimental and control groups. The obtained $F_y$ value 4.57 is significant at .05 level. The significant $F_y$ value indicates that the two groups differ significantly in the post test achievement.

The total sum of squares and adjusted mean squares variances for post test scores were computed and F ratio was calculated.

**Table No. 5.11**

Summary of Analysis of Co-Variance of ‘X’ (Pre test) and ‘Y’ (Post test) Scores of Pupils in Experimental and Control Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>$SS_x$</th>
<th>$SS_y$</th>
<th>$SS_{xy}$</th>
<th>$SS_{yx}$</th>
<th>$MS_{yx}$</th>
<th>$SD_{yx}$</th>
<th>$F_{yx}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among Means</td>
<td>1.00</td>
<td>938.28</td>
<td>7453.1</td>
<td>-2644.44</td>
<td>10977.12</td>
<td>10977.12</td>
<td>31.59</td>
<td>11.00</td>
</tr>
<tr>
<td>Within Groups</td>
<td>209.00</td>
<td>364900.92</td>
<td>342776.7</td>
<td>221280.44</td>
<td>208589.49</td>
<td>998.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>210.00</td>
<td>365839.21</td>
<td>350229.8</td>
<td>218636.00</td>
<td>219566.61</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$$F_{yx} = \frac{10977.12}{998.04} = 11.00$$
From table F, for df 1/210

F at .05 level = 3.89

F at .01 level = 6.76

The obtained value of F ratio is 11.00. It is significant at .01 level, since the value at .01 level from the table is 6.76. This significant F ratio for the adjusted post test scores shows that the two final scores viz the final mean score of pupils in experimental group and that of the control group differ significantly after they have been adjusted for difference in the pre test scores.

To find out which of the two methods is more significant, the investigator applied t test.

**Comparison of Adjusted Mean Scores**

The adjusted mean for the post test scores of the students in the experimental and control groups were computed. The data are given in the table below.

**Table No. 5.12**

*Data for Adjusted ‘Y’ Means of the Post Test Scores of Pupils in Experimental and Control Groups*
### Analysis and Interpretation of Data

#### Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>$M_x$</th>
<th>$M_Y$</th>
<th>$M_{YX}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment</strong></td>
<td>106.00</td>
<td>274.16</td>
<td>291.7</td>
<td>292.95</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>106.00</td>
<td>278.37</td>
<td>279.8</td>
<td>278.55</td>
</tr>
<tr>
<td><strong>General Mean</strong></td>
<td>212.00</td>
<td>276.26</td>
<td>285.75</td>
<td>-</td>
</tr>
</tbody>
</table>

**Significance of difference among adjusted Y means**

$SD_{yx} = 31.59$

$SE_D$ between two adjusted means = 4.34

From Table of t, for df, 211

$t$ at .01 level = 2.60

$t$ at .05 level = 1.97

Difference of adjusted mean obtained (D) = 14.40

Calculated ‘$t$’ value = \( \frac{\text{Difference between Y means}}{SE_D} \)

\[
t = \frac{14.40}{4.34} = 3.32
\]

Adjusted means for post test scores were tested for significance for df 1/211. The $t$ value obtained, 3.32 exceeds the critical value of $t$, 2.64 (df, 1/211) at .01 level.
The significant t value indicates that the two means differ considerably. This implies that the experimental group and the control group differ significantly in their achievement. The adjusted mean of post test scores for the experimental group is greater than that of the control group. So it is apparent that the experimental group is better than the control group in metacognitive awareness. It may therefore be interpreted that the students who learned through reflective thinking strategy of teaching have improved their metacognitive awareness than those who studied through the conventional method of direct instruction. In other words, reflective thinking strategy of teaching is more effective than conventional method of direct instruction on achievement in the cognitive variable metacognitive awareness among secondary school students.

5.2.2 Comparison of Scores of Experimental and Control Groups Based on Affective Variables.

The fourth major objective of the present study was to find out the effectiveness of reflective thinking strategy of teaching on the affective variables such as innovative attitude and fear of success. A test on innovative attitude and a test on fear of success were administered as pre tests to both the experimental and control groups to assess the entry behaviour regarding these
variables. The descriptions of the analysis of data regarding the affective variables are presented separately.

5.2.2.1 Comparison of Innovative Attitude among Experimental and Control Groups

The third dependent variable (selected under affective dimension) in the present study, was innovative attitude. The analysis of data regarding the effectiveness of reflective thinking strategy on innovative attitude of secondary school students is given below.
A) Before Experiment

Before the experiment both the groups were subjected to test on innovative attitude as pre test and the scores for this test were collected. The maximum score one can obtain in this test on innovative attitude is fifty (5x10) and minimum score is ten (1x10). The data and results of the test of significance of means score of test on innovative attitude are presented in Table 5.13.

**Table 5.13**

Data and Results of Test of Significance of the Difference between the Mean Pre Test Scores of Experimental and Control Groups Regarding Innovative Attitude

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>35.23</td>
<td>5.89</td>
<td>1.41</td>
<td>p &gt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>36.27</td>
<td>4.82</td>
<td>1.41</td>
<td>p &gt; .05</td>
</tr>
</tbody>
</table>

From the table 5.13 it is seen that the mean innovative attitude scores for experimental and control groups are 35.23 and 36.27 with standard deviations 5.89 and 4.82 respectively. The obtained value of critical ratio (CR = 1.41; p > .05) is not significant even at .05 level. It means that there is no significant difference between the means of the pre test scores of pupils in
experimental and control groups. Since the mean of the pre test score of experimental group was comparable to that of control group, it was assumed that the two groups are almost equal on their innovative attitude before the experiment. Further, the equivalence of both these groups regarding innovative attitude can be understood from the graph representing the mean pre test scores which is presented as Figure 5.7.

Figure 5.7
Comparison of Mean Innovative Attitude Scores of Experimental Group and Control Group before Experiment

B) After Experiment

The experimental group was taught through reflective thinking strategy of teaching and the control group was taught
through conventional method of direct instruction. The same topics were taught to both these groups with the same span of time. After the treatments, both the groups were subjected to a test on innovative attitude and the scores were collected. The same test used as pre test was employed here also. The data and results of the test of significance of difference of mean scores of the test on innovative attitude after the experiment are presented in Table 5.14.

Table 5.14

Data and Results of Test of Significance of the Difference between the Mean Post Test Scores of Experimental and Control Groups Regarding Innovative Attitude

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>37.94</td>
<td>5.41</td>
<td>2.19</td>
<td>( p &lt; .05 )</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>36.34</td>
<td>5.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.14 it is seen that the mean innovative attitude scores for experimental and control groups are 37.94 and 36.34 with standard deviations 5.41 and 5.20 respectively. The obtained value of critical ratio (CR = 2.19; \( p < .05 \)) is
significant at .05 level. It means that there is significant difference between the means of the post test scores of pupils in experimental and control groups. Since the mean of the post test scores of experimental group (37.94) was greater than that of control group (36.34), it can be interpreted that reflective thinking strategy of teaching is superior to conventional method of direct instruction in developing innovative attitude among secondary school students. The superiority of experimental group regarding innovative attitude can be understood from the graph representing the mean post test scores which is presented as Figure 5.8.

**Figure 5.8**

Comparison of Mean Innovative Attitude Scores of Experimental Group and Control Group after Experiment
C) Gain in Innovative Attitude

To ascertain the effectiveness of reflective thinking strategy of teaching, the innovative attitude gain scores of pupils in experimental group was compared with that of the pupils in the control group. The significance of the difference between these mean gain scores of the two groups was tested. The data and result of test of significance are given in Table 5.15

Table 5.15

Data and Results of Test of Significance of the Difference between the Mean Gain Scores of Experimental and Control Groups Regarding Innovative Attitude

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>5.25</td>
<td>2.72</td>
<td>3.80</td>
<td>p &lt; .01</td>
</tr>
</tbody>
</table>
The table 5.15 shows that the obtained value of critical ratio (CR = 3.80; \( p < .01 \)) is significant at .01 level. Therefore, it can be inferred that there is significant difference between the mean gain scores of pupils in experimental and control groups. Since the mean gain scores of experimental group (5.25) is greater than that of control group (4.91), it can be interpreted that the reflective thinking strategy of teaching is superior to conventional method of direct instruction in developing innovative attitude among secondary school students. Again, the superiority of experimental group regarding innovative attitude is apparent from the graph representing the mean gain scores which is presented as Figure 5.9.

**Figure 5.9**

*Comparison of Mean Gain Scores of Innovative Attitude of Experimental Group and Control Group*
D) Genuineness of the Difference in Performance of Experimental and Control Groups based on Innovative Attitude

Here the investigator compares the effectiveness of reflective thinking strategy of teaching over conventional method of direct instruction on the affective variable innovative attitude. The scores on test on innovative attitude of 212 students of two classes with one learning through the reflective thinking strategy of teaching and the other in conventional method of direct instruction were subjected to ANCOVA to determine the effectiveness of the former method over the latter. Total sum of squares, mean squares variance and F ratios for the pre test and post test scores of the experimental and control group were
Analysis and Interpretation of Data

computed. The details of the analysis are shown in the table 5.16 to 5.18

Table No. 5.16

Summary of Analysis of Variance of ‘X’ (Pre Test) and ‘Y’ (Post Test) Scores of Pupils in Experimental and Control Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>SS&lt;sub&gt;X&lt;/sub&gt;</th>
<th>SS&lt;sub&gt;Y&lt;/sub&gt;</th>
<th>MS&lt;sub&gt;X&lt;/sub&gt;(V&lt;sub&gt;X&lt;/sub&gt;)</th>
<th>MS&lt;sub&gt;Y&lt;/sub&gt;(V&lt;sub&gt;Y&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among means</td>
<td>1.00</td>
<td>58.12</td>
<td>136.3</td>
<td>58.12</td>
<td>136.32</td>
</tr>
<tr>
<td>Within groups</td>
<td>210.00</td>
<td>6073.63</td>
<td>5911.4</td>
<td>28.92</td>
<td>28.15</td>
</tr>
<tr>
<td>Total</td>
<td>211.00</td>
<td>6131.75</td>
<td>6047.8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

\[ F_X = \frac{58.12}{28.92} = 2.01 \quad F_Y = \frac{136.32}{28.15} = 4.84 \]

From table of F ratio, for df 1/105

F at .05 level = 3.94

F at .01 level = 6.90

The F ratios for the two sets of scores were tested for significance. The table values of F for df 1/105 are 3.94 at .05 level and 6.90 at .01 level. The obtained value of F<sub>X</sub> is 2.01 which is not significant even at .05 level. The non significant F<sub>X</sub> value shows that there was no significant difference between pre test scores of experimental and control group pupils. The
obtained $F_y$ value 4.84 is significant at .05 level. The significant $F_y$ value indicates that the two groups differ significantly in the post test achievement.

The total sum of squares and adjusted mean squares variances for post test scores were computed and $F$ ratio was calculated.

**Table No. 5.17**

**Summary of Analysis of Co-Variance of ‘X’ (Pre test) and ‘Y’ (Post test) Scores of Pupils in Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>$SS_x$</th>
<th>$SS_y$</th>
<th>$SS_{xy}$</th>
<th>$SS_{yx}$</th>
<th>$MS_{yx}$</th>
<th>$SD_{yx}$</th>
<th>$F_{yx}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among Means</td>
<td>1.00</td>
<td>58.12</td>
<td>136.3</td>
<td>-89.01</td>
<td>247.18</td>
<td>247.18</td>
<td>4.45</td>
<td></td>
</tr>
<tr>
<td>Within Groups</td>
<td>209.00</td>
<td>6073.63</td>
<td>5911.4</td>
<td>3283.51</td>
<td>4136.31</td>
<td>19.79</td>
<td></td>
<td>12.49</td>
</tr>
<tr>
<td>Total</td>
<td>210.00</td>
<td>6131.75</td>
<td>6047.8</td>
<td>3194.50</td>
<td>4383.49</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$F_{yx} = \frac{145.56}{22.74} = 12.49$

From table D, for df 1/210

$F$ at .05 level = 3.89

$F$ at .01 level = 6.76
The obtained value of F ratio is 12.49. It is significant at .01 level, since the value at .01 level from the table is 6.76. This significant F ratio for the adjusted post test scores shows that the two final scores viz the final mean score of pupils in experimental group and that of the control group differ significantly after they have been adjusted for difference in the pre test scores.

To find out which of the two methods is more significant, the investigator applied t test.

Comparison of Adjusted Mean Scores

The adjusted mean for the post test scores of the students in the experimental and control groups were computed. The data are given in the table below.

### Table No. 5.18

Data for Adjusted ‘Y’ Means of the Post Test Scores of Pupils in Experimental and Control Groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mₓ</th>
<th>Mᵧ</th>
<th>Mᵧₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>106.00</td>
<td>35.23</td>
<td>37.9</td>
<td>38.23</td>
</tr>
<tr>
<td>Control</td>
<td>106.00</td>
<td>36.27</td>
<td>36.3</td>
<td>36.06</td>
</tr>
<tr>
<td>General Mean</td>
<td>212.00</td>
<td>35.75</td>
<td>37.14</td>
<td>-</td>
</tr>
</tbody>
</table>
Significance of difference among adjusted Y means

SD_{yx} = 4.45

SE_D between two adjusted means = 0.61

From Table of $t$, for df, 211

t at .01 level = 2.60

t at .05 level = 1.97

Difference of adjusted mean obtained (D) = 2.17

Calculated ‘t’ value = \[
\frac{\text{Difference between Y means}}{SE_D}
\] = 3.55

Adjusted means for post test scores were tested for significance for df 1/211. The t value obtained was 3.55 which exceeds the critical value of t (df, 1/211) 2.60 at .01 level.

The significant t value leads to the conclusion that the two means differ considerably. This implies that the experimental group and the control group differ significantly in their innovative attitude. The adjusted mean of post test scores for the experimental group is greater than that of the control group. Therefore, it is obvious that the experimental group is better than the control group in innovative attitude. It may therefore
be interpreted that the students who learned through reflective thinking strategy of teaching have bettered their innovative attitude than those who studied through the conventional method of direct instruction. In other words, reflective thinking strategy of teaching is more effective than conventional method of direct instruction on achievement in the affective variable innovative attitude among secondary school students.

5.2.2.2 Comparison of Fear of Success among Experimental and Control Groups

The fourth dependent variable (selected under affective dimension) in the present study, was fear of success. The analysis of data regarding the effectiveness of reflective thinking strategy in reducing the fear of success of secondary school students is presented below.

A) Before Experiment

The investigator administered a test on fear of success to the students of both experimental and control groups in order to measure their fear of success before the experimental treatment. The maximum score for the test on fear of success that one can secure is 15 and the minimum score is -11. A higher score corresponds to low fear of success. The scores of pupils for the test on fear of success were computed and subjected to
statistical analysis. The data and results of the test of significance of difference in mean scores of test on fear of success are presented in Table 5.19.
Table 5.19

Data and Results of Test of Significance of the Difference between the Mean Pre Test Scores of Experimental and Control Groups on Fear of Success

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>1.05</td>
<td>3.32</td>
<td>0.1</td>
<td>p &gt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>1.09</td>
<td>2.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.19 it is seen that the mean fear of success scores for experimental and control groups are 1.05 and 1.09 with standard deviations 3.32 and 2.47 respectively. The obtained value of critical ratio (CR = 0.1; p > .05) is not significant even at .05 level. It indicates there is no significant difference between the means of the pre test scores of pupils in experimental and control groups. Since the mean of the pre test score of experimental group was comparable to that of control group, it can be assumed that the two groups are almost equal on their level of fear of success before the experiment. Further, the equivalence of both these groups regarding fear of success can be understood from the graph representing the mean pre test scores which is presented as Figure 5.10.
B) After Experiment

During the study the experimental group was taught through reflective thinking strategy of teaching and the control group was taught through conventional method of direct instruction. After the treatments, the investigator administered the test on fear of success to both the groups and the scores were collected. Here the same tool, which was used as the pre test to measure the fear of success, was employed. The data and results of the test of significance of mean scores of the test on fear of success after the experiment are presented in Table 5.20.
Table 5.20

Data and Results of Test of Significance of the Difference between the Mean Post Test Scores of Experimental and Control Groups on Fear of Success

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>2.50</td>
<td>2.32</td>
<td>3.13</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>1.44</td>
<td>2.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the table 5.20 it is seen that the mean fear of success scores for experimental and control groups are 2.50 and 1.44 with standard deviations 2.32 and 2.60 respectively. The obtained value of critical ratio (CR = 3.13; p < .01) is significant at .01 level. It means that there is significant difference between the mean of the post test scores of pupils in experimental and control groups. Since the mean of the post test scores of experimental group (2.50) was greater than that of control group (1.44), it can be interpreted that reflective thinking strategy of teaching is superior to conventional method of direct instruction in reducing the fear of success among secondary school students. The superiority of experimental group regarding fear of success can be understood from the graph representing the mean post test scores which is presented as Figure 5.11.
C) Gain in Fear of Success Scores

To further establish the effectiveness of reflective thinking strategy of teaching, in reducing the fear of success, the fear of success scores of pupils in experimental group was compared with that of pupils in the control group by testing the significance of the difference between the mean gain scores of the two groups. The data and result of test of significance are given in Table 5.21
Table 5.21

Data and Results of Test of Significance of the Difference between the Mean Gain Scores of Experimental and Control Groups on Fear of Success

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Pupils</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Critical Ratio</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>106</td>
<td>3.47</td>
<td>1.45</td>
<td>2.46</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>Control</td>
<td>106</td>
<td>3.02</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The table 5.21 shows that the obtained value of critical ratio (CR = 2.46; p < .05) is significant at .05 level. Therefore, it can be inferred that there is significant difference between the mean gain scores of pupils in experimental and control groups. Since the mean gain scores of experimental group (3.47) is greater than that of control group (3.02), it can be interpreted that the reflective thinking strategy of teaching is superior to conventional method of direct instruction in reducing the fear of success among secondary school students. Again, the superiority of experimental group regarding fear of success is obvious from the graph representing the mean gain scores which is presented as Figure 5.12.
D) Genuineness of the Difference in Performance of Experimental and Control Groups based on Fear of Success

Here the investigator compares the effectiveness of reflective thinking strategy of teaching over conventional method of direct instruction on the affective variable fear of success. The scores on test on fear of success of 212 students of two classes, with one learning through the reflective thinking strategy of teaching and the other through conventional method of direct instruction were subjected to ANCOVA to determine the effectiveness of the former method over the later. Total sum of squares, mean squares variance and F ratios for the pre test
and post test scores of the experimental and control group were computed. The details of the analysis are shown in the table 5.22 to 5.24

### Table No. 5.22

**Summary of Analysis of Variance of ‘X’ (Pre Test) and ‘Y’ (Post Test) Scores of Pupils in Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>$SS_X$</th>
<th>$SS_Y$</th>
<th>$MS_X (V_X)$</th>
<th>$MS_Y (V_Y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among means</td>
<td>1.00</td>
<td>0.12</td>
<td>59.2</td>
<td>0.12</td>
<td>59.17</td>
</tr>
<tr>
<td>Within groups</td>
<td>210.00</td>
<td>1797.82</td>
<td>1276.7</td>
<td>8.56</td>
<td>6.08</td>
</tr>
<tr>
<td>Total</td>
<td>211.00</td>
<td>1797.94</td>
<td>1335.8</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

\[
F_X = \frac{0.12}{8.56} = 0.01 \quad F_Y = \frac{59.17}{6.08} = 9.73
\]

From table of F ratio, for df 1/105

F at .05 level = 3.94

F at .01 level = 6.90

The F ratios for the two sets of scores were tested for significance. The table values of F for df 1/105 are 3.94 at .05 level and 6.90 at .01 level. The obtained value of $F_X$ is 0.01 which is not significant at .05 level. The non significant $F_X$ value
shows that there was no significant difference between pre test scores of experimental and control group pupils. The obtained $F_y$ value 9.73 is significant at 0.01 level. The significant $F_y$ value indicates that the two groups differ significantly in the post test achievement.

The total sum of squares and adjusted mean squares variances for post test scores were computed and $F$ ratio was calculated.

**Table No. 5.23**

**Summary of Analysis of Co-Variance of ‘X’ (Pre test) and ‘Y’ (Post test) Scores of Pupils in Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>df</th>
<th>$SS_x$</th>
<th>$SS_y$</th>
<th>$SS_{xy}$</th>
<th>$SS_{yx}$</th>
<th>$MS_{yx}$</th>
<th>$SD_{yx}$</th>
<th>$F_{yx}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Among Means</td>
<td>1.00</td>
<td>0.12</td>
<td>59.2</td>
<td>-2.64</td>
<td>60.43</td>
<td>60.43</td>
<td>2.37</td>
<td>10.75</td>
</tr>
<tr>
<td>Within Groups</td>
<td>209.00</td>
<td>1797.82</td>
<td>1276.7</td>
<td>428.07</td>
<td>1174.74</td>
<td>5.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>210.00</td>
<td>1797.94</td>
<td>1335.8</td>
<td>425.42</td>
<td>1235.17</td>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

$$F_{yx} = \frac{60.43}{5.62} = 10.75$$

From table D, for df 1/210
F at .05 level = 3.89

F at .01 level = 6.76

The obtained value of F ratio is 10.75. It is significant at .01 level, since the table value is 6.76 at .01 level. This significant F ratio for the adjusted post test scores shows that the two final scores viz the final mean score of pupils in experimental group and that of the control group differ significantly after they have been adjusted for difference in the pre test scores.

To find out which of the two methods is more significant, the investigator applied t test.

Comparison of Adjusted Mean Scores

The adjusted mean for the post test scores of the students in the experimental and control groups were computed. The data are given in the table below.

Table No. 5.24

Data for Adjusted ‘Y’ Means of the Post Test Scores of Pupils in Experimental and Control Groups

<p>| Groups | N | Mₓ | Mᵧ | Mᵧₓ |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment</strong></td>
<td>106.00</td>
<td>1.05</td>
<td>2.5</td>
<td>2.51</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>106.00</td>
<td>1.09</td>
<td>1.4</td>
<td>1.44</td>
</tr>
<tr>
<td><strong>General Mean</strong></td>
<td>212.00</td>
<td>1.07</td>
<td>1.97</td>
<td>-</td>
</tr>
</tbody>
</table>
Significance of difference among adjusted Y means

SDyx = 2.37

SE\(_D\) between two adjusted means = 0.33

From Table of t, for df, 211

t at .01 level = 2.60

t at .05 level = 1.97

Difference of adjusted mean obtained (D) = 1.07

Calculated t value = Difference between Y means / SE\(_D\)

\[
t = \frac{1.07}{0.33} = 3.24
\]

Adjusted means for post test scores were tested for significance for df 1/211. The t value obtained 3.24 exceeds the critical value of t \((df, 1/211)\) 2.60 at .01 level.

The significant t value reveals that the two means differ considerably. This implies that the experimental group and the control group differ significantly in their fear of success. The adjusted mean of post test scores for the experimental group is greater than that of the control group. Therefore, it is obvious
that the experimental group is better than the control group in fear of success scores and it is interpreted that the students who learned through reflective thinking strategy of teaching have reduced their fear of success than those who studied through the conventional method of direct instruction. In other words, reflective thinking strategy of teaching is more effective than conventional method of direct instruction on eliminating the fear of success among secondary school students.

5.3 COMPARISON OF GAIN ACHIEVEMENT TEST SCORES OF STUDENTS HAVING HIGH, AVERAGE, AND LOW LEVELS OF CREATIVITY

The fifth objective of the present study is to verify the effectiveness of reflective thinking strategy of teaching on the performance of secondary school students with different levels of creativity. To establish the universal effectiveness of reflective thinking strategy of teaching, the gain scores in achievement of three groups of students with high, average and low levels of creativity were compared. A test on creativity was administered by the investigator to the experimental groups during the course of study and the scores were collected and tabulated. Based on the distribution of creativity scores, the students in the experimental group were classified into three – high, average,
and low. The arithmetic mean and standard deviation of creativity scores were considered for the classification of students.

The classification of students based on creativity of the sample of students in experimental group shows that 55.66% possesses average creativity, 23.58% of the total possesses low creativity, and 20.76% possesses high creativity (based on mean score and standard deviation). The classification of students in the experimental group based on creativity is detailed in table 5.25.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low creativity group (with score below: mean - $\sigma$)</td>
<td>25</td>
<td>23.58</td>
</tr>
<tr>
<td>Average creativity group (with score between: mean - $\sigma$ and mean + $\sigma$)</td>
<td>59</td>
<td>55.66</td>
</tr>
<tr>
<td>High creativity group (with score above: mean + $\sigma$)</td>
<td>22</td>
<td>20.76</td>
</tr>
<tr>
<td>Total</td>
<td>106</td>
<td>100</td>
</tr>
</tbody>
</table>
The classification of students into groups having different levels of creativity is presented in Figure 5.13.
For ascertaining whether there exist any significant differences in the mean gain scores in achievement of the three groups of students with different levels of creativity, the one way classification technique analysis of variance (ANOVA), was found adequate and was employed by the investigator. The details of this statistical procedure are given in Table 5.26.
Table 5.26
Summary of Analysis of Variance for the Gain Scores of Students against their Levels of Creativity

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2.34</td>
<td>2</td>
<td>1.17</td>
<td>0.036</td>
</tr>
<tr>
<td>Within Groups</td>
<td>3380.15</td>
<td>103</td>
<td>32.81</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3382.49</td>
<td>-</td>
<td>-</td>
<td>0.036</td>
</tr>
</tbody>
</table>

From the table 5.26 it is found that the calculated ‘F’ value 0.036 at 2 and 103 degrees of freedom is less than the F critical value 2.35 (as given in statistical tables) at .10 level of significance. Therefore it can be interpreted that there is no significant difference in the mean gain scores of students having high, average and low levels of creativity. Thus it is evident that the reflective thinking strategy of teaching is equally effective for students having different levels of creativity.