CHAPTER - V
ANALYSIS, INTERPRETATION AND DISCUSSION
OF RESULTS

5.0 INTRODUCTION

Analysis of data means categorizing, ordering, manipulating and summarizing of data to obtain answers to the research questions. The purpose of analysis is to reduce data to intelligible and interpretable form so that the relation of research problem can be studied and tested. Variables under study in the experimental and control groups are compared and interpreted in an analytic manner to arrive at finding of the study in hand and to test the hypotheses to authenticate the outcomes.

5.1 THE DATA AND ITS DISTRIBUTION

The group of students taught through traditional method of teaching is denoted by C, i.e. Control group; the group of students taught through Student-Teams Achievement Divisions method of teaching is denoted by \( E_I \); and the group of students taught through Jigsaw method of cooperative learning is denoted by \( E_{II} \).

In order of find out the relative effectiveness of traditional method of teaching, Student-Teams Achievement Divisions (STAD) and Jigsaw method of cooperative learning, the scores of pupils on criterion measures were obtained both before commencement of the experiment and after the treatment. Pre-test scores were also obtained on General Mental Ability and Socio-Economic status of the sample students that were to be used as co-variates. This way pre-test scores were obtained on General Mental Ability, Socio-Economic Status, Self-Concept and Academic Achievement in Mathematics for all the three test groups Control Group (C), Experimental Group \( E_I \) (STAD) and Experimental Group \( E_{II} \) (Jigsaw), whereas, the post-test scores were obtained on Self-Concept and Academic Achievement in Mathematics for the same groups.

Bartlett’s test was used to measure the homogeneity of variance of the sample for each variance. The detailed description of the data is presented in the follows:
5.1.1 General Mental Ability

Pre-test scores obtained on General Mental Ability to be used as co-variate for the data of control, C, and experimental groups, E\textsubscript{I} and E\textsubscript{II} are displayed in Table 5.1.

Table 5.1
Table showing Mean, Median, Mode, Skewness, Kurtosis, Standard Deviation and Bartlett’s F-ratio of Pre-Test scores on General Mental Ability of C (control group), E\textsubscript{I} (STAD) and E\textsubscript{II} (Jigsaw)

<table>
<thead>
<tr>
<th>Group</th>
<th>C</th>
<th>E\textsubscript{I}</th>
<th>E\textsubscript{II}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>34.56</td>
<td>33.53</td>
<td>32.46</td>
</tr>
<tr>
<td>Median</td>
<td>35</td>
<td>32.5</td>
<td>32</td>
</tr>
<tr>
<td>Mode</td>
<td>35</td>
<td>33</td>
<td>32</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.025</td>
<td>-0.06</td>
<td>0.28</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.84</td>
<td>-0.66</td>
<td>-0.91</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>7.97</td>
<td>8.71</td>
<td>8.83</td>
</tr>
<tr>
<td>Bartlett’s F–ratio</td>
<td>0.346</td>
<td>Not Significant</td>
<td></td>
</tr>
</tbody>
</table>

Group C obtained a mean score of 34.56, group E\textsubscript{I} an average of 33.53 and group E\textsubscript{II} an average score of 32.46, with their standard deviations 7.97, 8.71 and 8.83, respectively.

These values indicate that the groups comprised of average students on General Mental Ability. The mode and median for Group C were 35 and 35 respectively, for group E\textsubscript{I} 33 and 32.5, while, for group E\textsubscript{II} these were 32 each. The skewness for group C was 0.025, group E\textsubscript{I} -0.06 and group E\textsubscript{II} 0.28, while the kurtosis values were -0.84, -0.66 and -0.91 for the groups C, E\textsubscript{I} and E\textsubscript{II} respectively.

The inter-comparison and intra-comparison of mean, mode and median of these three groups suggest these groups to be without any substantial difference. These findings indicate the three distributions to be normal and comparable. Thus, it can be said that group C, group E\textsubscript{I} and group E\textsubscript{II} did not differ on General Mental Ability.
Bartlett’s F-ratio (0.346) of the variations among groups C, E_I and E_{II} and within group variations was found to be not significant at 2/87 degrees of freedom, thereby re-inforcing that groups C, E_I and E_{II} did not differ significantly on General Mental Ability.

As the three groups did not differ significantly on pre-test in General Mental Ability, they could be compared directly using ANOVA on the related variables.

### 5.1.2 Socio-Economic Status

Pre-test score were obtained on Socio-Economic Status to be used as covariates for the data of Control group C and experimental groups E_I and E_{II} as shown in Table 5.2.

Group C obtained a mean score of 91.17; group E_I an average of 88.37; and group E_{II} an average score of 89.67, with their standard deviations 11.65, 11.52 and 12.08 respectively.

These values indicate that the groups comprised of an average, or a very near to average on the Socio-Economic Status. The mode and median for Group C were 92 each; for group E_I 88 each; while for group E_{II} these were 91 and 89 respectively. The skewness for group C was -0.04, group E_I -0.06 and group E_{II} 0.22, while the kurtosis values were -1.24, -0.52 and -0.28 for the groups C, E_I and E_{II} respectively.

The inter-comparison and intra-comparison of mean, mode and median of these three groups suggest these groups to be without any substantial difference. These findings indicate the three distributions to be normal and comparable. Thus, it can be said that group C, group E_I and group E_{II} did not differ on Socio-Economic Status.
Table 5.2
Table showing Mean, Median, Mode, Skewness, Kurtosis, Standard Deviation
and Bartlett’s F- ratio of Pre-Test scores on Socio-Economic Status of
C (control group), E_I (STAD) and E_II (Jigsaw)

<table>
<thead>
<tr>
<th>Group</th>
<th>C</th>
<th>E_I</th>
<th>E_II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>91.17</td>
<td>88.37</td>
<td>89.67</td>
</tr>
<tr>
<td>Median</td>
<td>92</td>
<td>88</td>
<td>89</td>
</tr>
<tr>
<td>Mode</td>
<td>92</td>
<td>88</td>
<td>91</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.04</td>
<td>-0.06</td>
<td>0.22</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.24</td>
<td>-0.52</td>
<td>-0.28</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>11.65</td>
<td>11.52</td>
<td>12.08</td>
</tr>
<tr>
<td>Bartlett’s F-ratio</td>
<td>0.138</td>
<td>Not Significant</td>
<td></td>
</tr>
</tbody>
</table>

Bartlett’s F-ratio (0.138) of the variations among group C, E_I and E_II and within group variations was found to be not significant at 2/87 degrees of freedom, thereby re-inforcing that groups C, E_I and E_II did not differ significantly on Socio-Economic Status.

As the three groups did not differ significantly on pre-test in Socio-Economic Status, they could be compared directly using ANOVA on the related variables.

5.1.3 Academic Achievement in Mathematics

Both pre-test as well as post-test scores were collected on Academic Achievement in Mathematics for Control group C and Experimental groups E_I and E_II as shown in Tables 5.3(a) and 5.3 (b).
(a) **PRE-TEST SCORES**

Table 5.3(a)

Table showing Mean, Median, Mode, Skewness, Kurtosis, Standard Deviation and Bartlett’s F-ratio of Pre-Test scores on Academic Achievement in Mathematics of C (control group) and Experimental Groups E₁ (STAD) and E₉II (Jigsaw)

<table>
<thead>
<tr>
<th>Group</th>
<th>C</th>
<th>E₁</th>
<th>E₉II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>20.26</td>
<td>21.4</td>
<td>21.67</td>
</tr>
<tr>
<td>Median</td>
<td>20.00</td>
<td>22.00</td>
<td>21.00</td>
</tr>
<tr>
<td>Mode</td>
<td>21.00</td>
<td>22.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.14</td>
<td>-0.12</td>
<td>0.06</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-1.00</td>
<td>-0.20</td>
<td>-0.62</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>7.09</td>
<td>5.24</td>
<td>5.76</td>
</tr>
<tr>
<td>Bartlett’s F-ratio</td>
<td>2.79</td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>

At pre-test stage control group C obtained a mean score of 20.26; experimental group E₁ an average of 21.4; and group E₉II an average score of 21.67, with their standard deviations 7.09, 5.24 and 5.76 respectively. These values indicate the groups to comprise of below average Academic Achievement in Mathematics.

The mode and median for group C were 21.0 and 20.0 respectively; for group E₁ 22.00 each; while for group E₉II these were 20.00 and 21.00 respectively. The skewness for group C was 0.14; group E₁ -0.12; and group E₉II 0.06, while the kurtosis value were -1.00, -0.20 and -0.62 for the groups C, E₁ and E₉II respectively.

The inter-comparison and intra-comparison of mean, mode and median of these three distributions also showed that they did not differ significantly, implying the three distributions to be normal and similar. Thus, it can be said that group C, group E₁, and group E₉II did not differ on achievement in Mathematics.

Bartlett’s F-ratio (2.79) of the variations among group C, E₁ and E₉II and within group variations was also found to be not significant at 2/87 degree of freedom,
thereby re-inforcing that groups C, E₁ and E₂ did not differ significantly in pre-test on academic achievement. This indicates that the population tended to be homogeneous in variance.

(b) POST-TEST SCORES

Table 5.3 (b)

Table showing Mean, Median, Mode, Skewness, Kurtosis, Standard Deviation and Bartlett’s F-ratio of Post-Test scores on Academic Achievement in Mathematics of C (control group) and Experimental Groups E₁ (STAD) And E₂ (Jigsaw)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>C</th>
<th>E₁</th>
<th>E₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>32.63</td>
<td>38.76</td>
<td>44.3</td>
</tr>
<tr>
<td>Median</td>
<td>33.0</td>
<td>37.0</td>
<td>44.0</td>
</tr>
<tr>
<td>Mode</td>
<td>35.0</td>
<td>37.0</td>
<td>44.0</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.21</td>
<td>0.64</td>
<td>0.39</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.25</td>
<td>0.25</td>
<td>0.22</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>8.73</td>
<td>7.57</td>
<td>10.74</td>
</tr>
<tr>
<td>Bartlett’s F-ratio</td>
<td>2.99</td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>

At post-test stage, control group C had a mean score of 32.63; experimental group E₁ had a mean score of 38.76; while the experimental group E₂ had an average score of 44.3 on this test, with standard deviations 8.73, 7.57 and 10.74 respectively, implying that they were above average on Academic Achievement in Mathematics as per norms of the test.

There has been a gain on Academic Achievement in Mathematics as a result of treatment, as is evident from the obtained data. The mode and median for group C were 35.0 and 33.0; for group E₁ were 37.0 each; while for group E₂ the values were 44.0 for each, respectively. The skewness for group C was 0.21; for group E₁ 0.64; and for group E₂ 0.22, while kurtois for groups C, E₁ and E₂ was found to be -0.25, 0.25 and 0.22 respectively.
The inter-comparison and intra-comparison of mean, mode and median of these three groups suggest to be without any substantial difference. These findings indicate the three distributions to be normal and comparable. F-value, found on Bartlett’s test as 2.99 was found to be not significant. This indicates that the population tended to be homogenous in variance.

5.1.4 Self-Concept

Both pre-test as well as post-test scores were collected on self-concept for control group C and experimental groups E\textsubscript{I} and E\textsubscript{II}, as shown in Tables 5.4(a) and 5.4(b).

(a) PRE-TEST SCORES

At pre-test stage the control group C had a mean score of 231.87; experimental group E\textsubscript{I} a mean score of 231.26; while, the other experimental group E\textsubscript{II} had an average score of 232.16 on this scale, with standard deviations of 20.88, 19.00 and 17.37 respectively. The mode and median for group C were 232 and 231.5 respectively; for experimental group E\textsubscript{I} these were 232 and 231.5; while for group E\textsubscript{II} these were 232 each respectively. The skewness for group C was 0.13; for group E\textsubscript{I} 0.62; and for group E\textsubscript{II} 0.50, while kurtosis values were -0.17, 0.40 and 0.85 for these three groups C, E\textsubscript{I} and E\textsubscript{II}, respectively.

The inter-comparison and intra-comparison of mean, mode and median of these three distributions also showed that they did not differ significantly, implying the three distributions to be normal and similar. Thus, it can be said that group C, Group E\textsubscript{I} and group E\textsubscript{II} did not differ on self-concept.
Table 5.4(a)

Table showing Mean, Median, Mode, Skewness, Kurtosis, Standard Deviation and Bartlett’s F-ratio of Pre-Test scores on Self-Concept of C (Control Group), E_I (STAD) and E_II (Jigsaw)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>C</th>
<th>E_I</th>
<th>E_II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>231.87</td>
<td>231.26</td>
<td>232.16</td>
</tr>
<tr>
<td>Median</td>
<td>231.5</td>
<td>231.5</td>
<td>232</td>
</tr>
<tr>
<td>Mode</td>
<td>232</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.13</td>
<td>0.62</td>
<td>0.50</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.17</td>
<td>0.40</td>
<td>0.85</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>20.88</td>
<td>19.00</td>
<td>17.37</td>
</tr>
<tr>
<td>Bartlett’s F-ratio</td>
<td>0.963</td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>

F-value, as found by Bartlett’s test, being 0.963, was found to be not significant, indicating that the population tended to be homogeneous in variance.

(b) POST-TEST SCORES

At the post-test stage, control group C had a mean score of 234.67; experimental group E_I had a mean score of 249; while the experimental group E_II had an average score of 257.33 on the test, with standard deviations 21.65, 25.83 and 22.59 respectively.

There has been a gain on self-concept as a result of treatment, as is evident from the data. The mode and median for group C were 233 each; for group E_I values were 248 and 247.5 respectively; while for the other experimental group E_II the respective values were 258 each. The skewness for group C was 0.94; for group E_I 0.51; and for group E_II 0.26, while kurtosis for groups C, E_I and E_II were found to be 3.77, -0.44 and -0.70 respectively.
Table 5.4(b)

Table showing Mean, Median, Mode, Skweness, Kurtosis, Standard Deviation and Bartlett’s F-test of the post-test scores on self-concept of C (control group), E_I (STAD) and E_II (Jigsaw)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>C</th>
<th>E_I</th>
<th>E_II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>234.67</td>
<td>249</td>
<td>257.33</td>
</tr>
<tr>
<td>Median</td>
<td>233</td>
<td>247.5</td>
<td>258</td>
</tr>
<tr>
<td>Mode</td>
<td>233</td>
<td>248</td>
<td>258</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.94</td>
<td>0.51</td>
<td>0.26</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.77</td>
<td>-0.44</td>
<td>-0.70</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>21.65</td>
<td>25.83</td>
<td>22.59</td>
</tr>
<tr>
<td>Bartlett’s F-ratio</td>
<td>0.99</td>
<td>Not significant</td>
<td></td>
</tr>
</tbody>
</table>

The inter-comparison and intra-comparison of mean, mode and median of these three groups suggest these groups to be without substantial difference. These findings indicate the three distributions to be normal and comparable.

F-value, as found by Bartlett’s test being 0.99, was found to be not significant. This indicates that the population tended to be homogenous in variance.

5.2 ANALYSIS OF DATA

As stated in the preceding section, an attempt has been made to study the nature of distribution of data before applying statistics to ensure that it satisfies the underlying assumptions. For this purpose Mean, Median, Mode, Skewness and Kurtosis have been computed for all the variables under study.

The values of these measures indicated almost comparable distribution for all the variables under study, and that the data tested for homogeneity of variance through Bartlett’s test gave F-ratios to be not significant in either case at 0.05 levels. Hence, the assumptions for enabling necessary comparison and interpretation of statistical results were ensured.
Following the above assumptions, it was decided to employ analysis of variance (ANOVA) on pre-test and post-test scores of Academic Achievement and Self-Concept. F-ratios were computed for both the variables on pre-test and post-test scores. Gain scores as measures of outcome of the treatment have been analyzed to study relative effectiveness and ‘t’-test has also been applied on all the possible combination pairs of control group and experimental groups to assess their relative effectiveness (Traditional methods of teaching; Student-Teams Achievement Divisions; and Jigsaw method of cooperative learning).

### 5.3 EFFECT OF STUDENT-TEAMS ACHIEVEMENT DIVISIONS (STAD) AND JIGSAW METHOD OF CO-OPERATIVE LEARNING ON PUPILS’ ACADEMIC ACHIEVEMENT

This section deals with the effect of Student-Teams Achievement Divisions and Jigsaw methods of cooperative leaning on pupils’ Academic Achievement. For this purpose three groups were formed i.e., the group of students taught through traditional method of teaching denoted by C, i.e. Control Group; the group of students taught through Student-Teams Achievement Divisions method of teaching denoted by E\_I; and the group of students taught through Jigsaw method of cooperative learning denoted by E\_II. Analyses of variance for their mean academic achievement scores before and after the experimental treatment are as given in Tables 5.3.1, 5.3.2 and 5.3.4 respectively. Table 5.3.3 presents “t” values for post-test mean scores on academic achievement and Table 5.3.5 indicates the ‘t’- values for the post-test mean gain scores on Academic Achievement.

#### Table 5.3.1

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>33.16</td>
<td>16.58</td>
<td>0.448</td>
<td>Not significant</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>3217.73</td>
<td>36.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>3250.89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3.1 shows that the F-ratio 0.448 for degree of freedom 2/87 for the control group and experimental groups was found to be not significant at pre-test stage, indicating that all the three groups were similar on Academic Achievement scores at the pre-test stage.

Table 5.3.2
ANOVA for Post-Test Scores on Academic Achievement between Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>2043.47</td>
<td>1021.73</td>
<td>12.31</td>
<td>Significant</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>7222.63</td>
<td>83.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>9266.10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.3.2 shows that F-ratio 12.31 for degree of freedom 2/87 for the control group and experimental groups was significant at 0.01 level, indicating that there existed a significant difference between the mean scores on academic achievement of all the three groups at post-test stage.

Since F-value is significant, ‘t’-test was applied to test the significance of difference between the means scores on academic achievement of control group and experimental groups and the respective ‘t’ values were found to be as shown in Table 5.3.3.

Table 5.3.3
‘t’- values for difference in the Post-Test mean Scores on Academic Achievement of Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>‘t’- values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group (C)</td>
<td>30</td>
<td>32.63</td>
<td>8.74</td>
<td>(t_{C_{EI}} = 2.90)</td>
<td>Significant at 0.01</td>
</tr>
<tr>
<td>Experimental Group (E_I)</td>
<td>30</td>
<td>38.76</td>
<td>7.58</td>
<td>(t_{E_{I_{II}}} = 2.31)</td>
<td>Significant at 0.05</td>
</tr>
<tr>
<td>Experimental Group (E_{II})</td>
<td>30</td>
<td>44.30</td>
<td>10.74</td>
<td>(t_{C_{E_{II}}} = 4.62)</td>
<td>Significant at 0.01</td>
</tr>
</tbody>
</table>
Table 5.3.3 reveals that the experimental group E\textsubscript{II} achieved higher mean score (M = 44.30 ± 10.74) than the experimental group E\textsubscript{I} (38.76 ± 7.58) on Academic Achievement at post-test stage. The Table depicts that ‘t’-value 2.31 for the difference in the mean scores of academic achievement of students of experimental group E\textsubscript{I} and experimental group E\textsubscript{II} at post-test stage was found to be is significant at 0.05 level for 58 degree of freedom. Thus, the subjects exposed to Jigsaw methods of cooperative learning achieved significantly higher mean level of Academic Achievement in comparison to Student-Teams Achievement Divisions method of cooperative learning.

Similarly, ‘t’-value 2.90 for the difference in the mean scores of experimental group E\textsubscript{I} (M = 38.76 ± 7.58) was found to be higher than the mean score of control group C (M = 32.63 ± 8.74) at the post-test stage, indicating that subjects exposed to Students-Teams Achievement Divisions (STAD), a method of cooperative learning, were found higher on Academic Achievement in comparison to subjects exposed to traditional method of teaching. So, STAD is effective in raising the academic achievement of students.

In other words, the Jigsaw method was found to be more effective than the STAD method and the STAD method, in turn more effective than the traditional method of teaching in raising the academic achievement of students.

Table 5.3.3 also depicts that ‘t’-value 4.62 for the difference in the mean score on academic achievement of students of experimental group E\textsubscript{II} and control group C at the post-test stage was found to be significant at 0.01 level indicating that there existed a significant difference in the mean scores on academic achievement between these two groups.

Thus, it can be concluded that STAD and Jigsaw methods of co-operative learning were found to be more effective in enhancing the academic achievement of students in comparison to traditional method of teaching.

Thus, the hypothesis H\textsubscript{1}: “At the end of experimental treatment the group of Student-Teams Achievement Divisions (STAD) and Jigsaw methods under co-
operative learning will score significantly higher mean on the academic achievement test than the group of students taught through traditional methods” stands accepted.

As a corollary if further indicates:

- that both Jigsaw and STAD proved to be more significantly effective in raising the academic achievement of students than the traditional method;
- that Jigsaw proved to be more effective than the STAD in raising the academic achievement of students;
- that the Jigsaw proved to be more effective than the traditional method in raising the academic achievement of students; and
- that the STAD proved to be more effective than the traditional method in raising the academic achievement of students.

Table 5.3.4

ANOVA for Post-Test mean Gain Scores on Academic Achievement Between Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>1581.42</td>
<td>790.71</td>
<td>12.856</td>
<td>Sig. at 0.01</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>5350.90</td>
<td>61.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>6932.32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.3.4 shows that F-value 12.856 for the degree of freedom 2/87 for the control group and experimental groups was found to be significant at 0.01 level. It may be observed from the Table that there is a significant difference between mean gain in academic achievement test scores of all the three groups. Since F-value was found to be significant, ‘t’-test has also been applied to test the significance of difference between the mean gain scores on academic achievement test of control group and experimental groups.
Table : 5.3.5
‘t’ – values for difference in the Post-Test mean Gain Scores on Academic Achievement Test of Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>S.D.</th>
<th>‘t’-values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group (C)</td>
<td>30</td>
<td>12.37</td>
<td>5.84</td>
<td>t_{C, EI} = 2.75</td>
<td>Sig. at 0.01</td>
</tr>
<tr>
<td>Experimental group (E_I)</td>
<td>30</td>
<td>17.36</td>
<td>8.02</td>
<td>t_{EI, EII} = 2.35</td>
<td>Sig. at 0.05</td>
</tr>
<tr>
<td>Experimental group (E_{II})</td>
<td>30</td>
<td>22.63</td>
<td>9.27</td>
<td>t_{E_{II}, C} = 5.13</td>
<td>Sig. at 0.01</td>
</tr>
</tbody>
</table>

Table 5.3.5 reveals that experimental group E_{II} achieved higher mean gain score (M = 22.63 ± 9.27) than the experimental group E_I (17.36 ± 8.02) on academic achievement at post-test stage on mean gain score. It is evident from the Table that ‘t’-value 2.35 for the difference in the mean gain scores on academic achievement test of the experimental group E_{II} and experimental group E_I at post-test stage was found to be significant at 0.05 level of significance, indicating that subjects exposed to Jigsaw method of cooperative learning were found higher on academic achievement test in comparison to subjects exposed to Student-Teams Achievement Divisions (STAD) method under cooperative learning.

Similarly, ‘t’-value 2.75 for the difference in the mean gain scores of experimental group E_I (17.36 ± 8.02) was found to be higher than the mean gain scores of control group C (12.37 ± 5.84) at the post-test stage. This indicated that the subjects exposed to STAD method under cooperative learning were found higher on academic achievement test in comparison to subjects exposed to traditional method. In other words, STAD is effective in raising the academic achievement test scores of students. Table 5.3.5 also depicts that ‘t’-value 5.13 for the difference in the mean gain scores on academic achievement test of students of experimental group E_{II} and control group C at post-test stage was found to be significant at 0.01 level of significance, indicating that there existed significant difference in the mean gain scores on academic achievement test between these two groups.

Since the tests conducted pertained to the teaching of Mathematics, it implies that subjects exposed to Jigsaw method of cooperative leaning were found to be
higher on academic achievement test gain scores in mathematics in comparison to subject exposed to traditional method to teaching was found that STAD and Jigsaw methods under cooperative learning were reported to be more effective in raising the mean gain score on the academic achievement test than the traditional method of teaching in Mathematics.

Thus the hypothesis $H_2$: “At the end of experimental treatment the group of pupils taught mathematics through STAD and Jigsaw under the cooperative learning will show a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method” stands accepted.

It is further confirmed that the corollaries to the $H_2$ also hold good for academic achievement in Mathematics also as in case of $H_1$. To reiterate, the corollaries do show:

- that both Jigsaw and STAD proved to be more significantly effective in raising mean gain score on the academic achievement of students than the traditional method;
- that Jigsaw proved to be more effective than the STAD in raising mean gain score on the academic achievement of students;
- that the Jigsaw proved to the more effective than the traditional method in raising mean gain score on academic achievement of students; and
- that the STAD proved to be more effective than the traditional method in raising mean gain score on the academic achievement students.

These findings are further confirmed as per analysis indicated in Table 5.4.1.

5.4 INDIVIDUAL EFFECTIVENESS OF STAD AND JIGSAW METHODS ON ACADEMIC ACHIEVEMENT IN MATHEMATICS

‘$t$’-test was employed to study and compare the effectiveness of STAD and Jigsaw methods under cooperative learning on raising the academic achievement of students in Mathematics.
Table 5.4.1
Means, Standard Deviations and ‘t’ value of Post-Test Scores on Academic Achievement in Mathematics for STAD and JIGSAW

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>‘t’-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group E₁ (STAD)</td>
<td>30</td>
<td>38.77</td>
<td>7.58</td>
<td>2.31</td>
<td>Significant at 0.05 level</td>
</tr>
<tr>
<td>Experimental group E₁ (JIGSAW)</td>
<td>30</td>
<td>44.30</td>
<td>10.74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.4.1 reveals that experimental group E₁ achieved higher mean score (M = 44.30 ± 10.74) than the experimental group E₁ (M = 38.77 ± 7.58) on academic achievement in Mathematics at post-test stage. The table depicts that ‘t’-value 2.31 for the difference in the mean scores on academic achievement of students of experimental group E₁ (STAD) and experimental group E₁ (JIGSAW) at post-test stage was found to be significant at 0.05 level for 58 degree of freedom. Thus, the group of students taught through Jigsaw method of cooperative learning achieved significantly higher mean on academic achievement in mathematics in comparison to Students-Teams Achievement Divisions (STAD) method under cooperative learning.

Thus, the hypothesis H₃: “There exists significant difference between STAD and Jigsaw methods on Academic Achievement of students” stands accepted.

In other words, Jigsaw method was found to be more effective in raising the mean scores and academic achievement of students in Mathematics than the STAD method.

The overall status of the effectiveness of the CL methods of Jigsaw and STAD vis-à-vis the traditional method is also presented here graphically through Bar Graphs at Figure 5(a), which is self explanatory upholding the H₁ to H₃ and their respective corollaries.
Comparing the pre-test as well as post-test mean scores on academic achievement in Mathematics for control group taught through traditional method and experimental groups E_I and E_II taught through STAD and Jigsaw methods, respectively, as well as mean gain scores of all the three groups represented graphically in the form of histogram in Figure 5(a), the analysis indicates that at pre-test stage control group C (Traditional method) obtained a mean score of 20.26; experimental group E_I (STAD) an average of 21.4; and group E_II (Jigsaw) an average score of 21.67, whereas at the post-test stage, control group had a mean score of 32.63; experimental group E_I (STAD) an average of 38.76; while the experimental group E_II (Jigsaw) had an average score of 44.3 on an achievement test, as also statistical interpretation in the Table 5.3.3, all clearly showing a gain on academic achievement.
achievement in mathematics in terms of significant difference as a result of treatment in all the three groups with the two experimental groups scoring more than control group.

Thus, there exists a significant difference between pre-test and post-test mean scores on academic achievement in mathematics for all the three groups, i.e., traditional, STAD and Jigsaw: the experimental group E_{II} (Jigsaw) achieved higher mean score than experimental group E_{I} (STAD) and control group (Traditional) on academic achievement at post-test stage; the STAD achieved higher mean score than traditional method; the Jigsaw group had a mean gain score 22.63, which is higher than 17.36 and 12.37, the mean gain scores of STAD and traditional method group respectively on academic achievement; and the STAD higher mean gain score than traditional method as a result of treatment on achievement test but also has significant difference with Jigsaw group, statistically re-iterated in the Table 5.3.5. It was thus found that at the end of experimental treatment the group of pupils taught mathematics through STAD and Jigsaw under the cooperative learning showed a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method.

Discussion on Academic Achievement

Cooperative learning has an effect on achievement under essential two conditions: group and individual accountability. Group goals motivate students to help their group-mates learn. They develop positive interdependence between individuals in the group, giving them reason to cooperate in a meaningful fashion (Deutsch, 1949; Johnson & Johnson, 1989; Stevens, 1994). Individual accountability, a measure of each student’s learning, increases the probability that all students will learn and reduces the potential for a free rider effect, where a student does little and relies on others in the group to accomplish the goal (Johnson & Johnson 1989; Slavin, 1994; Stevens, 1994).

In the present study, the subjects exposed to STAD and Jigsaw method of cooperative learning were found higher on academic achievement in comparison to subjects exposed to traditional method of teaching. In other words, it supports that
STAD and Jigsaw are effective methods in raising the academic achievement of students because the experimental programme had many components, it is difficult to ascribe the programme’s outcomes to any single element. However, the results of this study support three hypotheses, that is, (1) at the end of experimental treatment the group of students taught mathematics through Student–Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning will score significantly higher mean on the academic achievement test than the group of students taught through traditional methods; (2) at the end of experimental treatment the group of pupils taught mathematics through STAD and Jigsaw under the cooperative learning will show a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method and (3) there exists significant difference between STAD and Jigsaw methods on achievement of students.

Thus, the results of the present study highlight and support the idea that cooperative learning strategies have a positive impact on the academic achievement. To discuss the results further it is a very clear advantage of cooperative learning that it provides a structure which allows students to help manage the classroom; which evolves from the positive interdependence created within the learning teams; and helps the students take more responsibility; and also that it gives teachers more instructional flexibility to accommodate the increased class-wide heterogeneity inherent in mainstreaming (Johnson & Johnson, 1989; Slavin, 1994).

The present study also compares the effectiveness of STAD and Jigsaw methods on academic achievement of students. The results reveal that the group of students taught through Jigsaw method achieved substantially higher on academic achievement in Mathematics in comparison to Student-Teams Achievement Divisions (STAD) method of cooperative learning. The study also retains the hypothesis that there exists significant difference between STAD and Jigsaw methods on academic achievement of students. The positive effect suggests the multifaceted cooperative learning methods like Student-Teams Achievement Divisions (STAD) and Jigsaw can exhibit their effectiveness on achievement in Mathematics.
Cooperative teaching creates an environment of positive interdependence within the teams, where students depend on one another and where all must succeed together for the group as well as that each member succeeds. This makes contact between the students having different levels of socio-economic status, intelligence, castes, religion, sex, race etc. on cooperative learning teams’ meaningful and more intimate status. In small group learning settings, students not only learn to work together by also learn to live together, the loftiest goal propounded by UNESCO (Sharma, Hemant Lata & Sharma, Savita, 2008).

In the Indian context, where caste, creed, religion etc. pose prominent obstacles in the inter-group relationship, cooperative learning methods seem to promote the feeling of positive interdependence along with the enhanced academic achievement and self-concept.

5.5 EFFECT OF STUDENT-TEAMS ACHIEVEMENT DIVISIONS (STAD) AND JIGSAW METHODS OF COOPERATIVE LEARNING ON PUPIL’S SELF-CONCEPT

This section deals with the effect of STAD and Jigsaw methods of cooperative learning on pupil’s self-concept. For this purpose, three groups were formed, i.e., the group of students taught through traditional method of teaching denoted by ‘C’, i.e., control group; the group of students taught through STAD denoted by E₁ (1st Experimental group); and the group of students taught through Jigsaw method of cooperative learning denoted by E₂ (2nd Experimental group). Data of variance for mean self-concept scores before and after the experimental treatment is as given in Tables 5.5.1, 5.5.2 and 5.5.4 respectively, while Tables 5.5.3 and 5.5.5 show ‘t’-values for the post-test mean scores on self-concept and ‘t’-value for post-test mean gain scores on self-concept.
Table 5.5.1
ANOVA for Pre-Test Scores of Self-Concept between Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>12.60</td>
<td>6.30</td>
<td>0.017</td>
<td>Not significant at 0.05 level</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>31869.5</td>
<td>366.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>31882.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.5.1 shows that F-value 0.017 for degree of freedom 2/87 for the control group and experimental groups, E₁ and E₂, is not significant at 0.05 level of significance at the pre-test stage, indicating that all the three groups were similar on self-concept scores at the pre-test stage.

Table 5.5.2
ANOVA for Post-Test Scores of Self-Concept between Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Sources of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-ratio</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>7886.67</td>
<td>3943.34</td>
<td>7.18</td>
<td>Significant at 0.01 level</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>47755.33</td>
<td>548.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>55642</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.5.2 shows that F-ratio 7.18 for degree of freedom 2/87 for the control group and experimental groups was found to be significant at 0.01 level, indicating a significant difference between mean self-concept scores of all the three groups at post-test stage.

Since, F-value is significant, ‘t’–test was applied to test the significance of difference between the mean self-concept scores of control group and experimental groups and the respective ‘t’ values were found to be as shown in Table 5.3.3.
Table 5.5.3
‘t’ – values for Difference in the Post-Test mean Scores on Self-Concept of Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>S.D.</th>
<th>'t'-Values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>30</td>
<td>234.67</td>
<td>21.65</td>
<td>t_{C,EI} = 2.33</td>
<td>Sig. at 0.05</td>
</tr>
<tr>
<td>Experimental group (E)</td>
<td>30</td>
<td>249</td>
<td>25.83</td>
<td>t_{E1,EII} = 1.33</td>
<td>Not sig. at 0.05</td>
</tr>
<tr>
<td>Experimental group (E)</td>
<td>30</td>
<td>257.33</td>
<td>22.59</td>
<td>t_{EII,C} = 3.97</td>
<td>Sig. at 0.01</td>
</tr>
</tbody>
</table>

Table 5.5.3 reveals that experimental groups E_I achieved higher mean score (M = 249 ± 25.83) than control group C (M = 234.67 ± 21.65) on self-concept at post-test stage. The Table depicts that ‘t’-value 2.33 for the difference in the mean scores of self-concept of students of experimental group E_I and control group ‘C’ at post-test stage is significant at 0.05 level for 58 degree of freedom. Thus, the subjects exposed to STAD achieved significantly higher mean level of self-concept in comparison to traditional method of teaching.

Similarly, ‘t’–value 3.97 for the difference in the mean self-concept scores of experimental group E_{II} (M = 257.33 ± 22.59) is higher than the mean score of control group (M = 234.67 ±21.65) at the post-test stage. This implies that there is a significant difference at 0.01 level of significance in the mean scores of self-concept between these two groups at the post-test stage. Thus, the subjects exposed to Jigsaw achieved significantly higher mean level of self-concept in comparison to traditional method of teaching.

Table 5.5.3 also shows that ‘t’–value 1.33 for the difference in the mean score of self-concept of students of experimental group E_{I} (249 ± 25.83) and the other experimental group E_{II} (257.33 ± 22.59) at the post-test stage was found to be not significant even at 0.05 level, indicating no significant difference in the mean scores of self-concept between these two groups. The small difference in the mean score that existed cannot, however, be attributed to different small group learning system and may be due to sampling fluctuations or otherwise. Thus, it can be said that Jigsaw is not more effective in comparison to STAD method under cooperative learning in
raising the self-concept of students along with the fact that both the methods of cooperative learning were found to be effective in comparison of traditional method in raising self-concept of students but at different levels of significance.

In other words, both Jigsaw and STAD method were found to be more effective in raising the self-concept of students in comparison to the traditional method of teaching.

Thus, the hypothesis $H_4$: “At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under co-operative learning method will attain a significantly higher mean score on the test of self-concept than the group of students taught through traditional method” is accepted at 0.05 level of significance.

As a corollary if further indicates:

- that both Jigsaw and STAD proved to be more significantly effective in raising the self-concept of students than the traditional method;
- that Jigsaw proved to be not more effective than the STAD in raising the self-concept of students;
- that the Jigsaw proved to the more effective than the traditional method in raising self-concept of students; and
- that the STAD proved to be more effective than the traditional method in raising the self-concept of students.

Table 5.5.4
ANOVA for Post Test Gain Scores on Self-Concept between Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Degree of Freedom (df)</th>
<th>Sum of Squares</th>
<th>Mean Square Variance</th>
<th>F-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between</td>
<td>2</td>
<td>7785.27</td>
<td>3892.63</td>
<td>9.217</td>
<td>Sig. at 0.01 level</td>
</tr>
<tr>
<td>Within</td>
<td>87</td>
<td>36744.83</td>
<td>422.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>44530.10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.5.4 shows that F-value 9.217 for the degree of freedom 2/87 for the control group and experimental groups is significant at 0.01 level. It may be observed from the Table that there is a significant difference between the mean gain self-concept scores of all the three groups.

Since F-value is significant, ‘t’-test has been applied to test the significance of difference between the mean gain self-concept scores of control group and experimental groups as shown in Table 5.5.5.

Table 5.5.5
‘t’ – Values for difference in the Post-Test mean Gain Self-Concept Scores of Control Group and Experimental Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>S.D.</th>
<th>‘t’-Values</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>30</td>
<td>2.8</td>
<td>19.70</td>
<td>$t_{C,E_1} = 2.81$</td>
<td>Sig. at 0.01</td>
</tr>
<tr>
<td>Experimental group (E_I)</td>
<td>30</td>
<td>17.73</td>
<td>21.43</td>
<td>$t_{E_I,E_{II}} = 1.37$</td>
<td>Not sig. at 0.05</td>
</tr>
<tr>
<td>Experimental group (E_{II})</td>
<td>30</td>
<td>25.17</td>
<td>20.49</td>
<td>$t_{E_{II},C} = 4.31$</td>
<td>Sig. at 0.01</td>
</tr>
</tbody>
</table>

Table 5.5.5 reveals that experimental groups E_{II} achieved higher mean gain score ($M = 25.17 \pm 20.49$) than the control group C ($M = 2.8 \pm 19.7$) on self-concept at post-test stage on mean gain score. It is evident from the Table that ‘t’-value 4.31 for the difference in the mean gain score of self-concept of students of experimental group E_{II} and control group C at post-test stage was found to be significant at 0.01 level of significance indicating that subjects exposed to Jigsaw method of cooperative learning were found higher on self-concept in comparison to subjects exposed to traditional method of teaching.

Similarly, ‘t’-value 2.81 for the difference in the mean gain scores of experimental group E_I ($M = 17.73 \pm 21.43$) was found to be higher than the mean gain scores of control group C ($M = 2.8 \pm 19.7$) at the post-test stage. This indicated that the subjects exposed to STAD method under cooperative learning were found higher on self-concept in comparison to subjects exposed to traditional method. In other words, STAD is effective in raising the self-concept of students.
Table 5.5.5 also depicts that ‘t’-value 1.37 for the difference in the mean gain scores of self-concept of students of experimental group E₁ and experimental group E₂ at post-test stage was found to be not significant even at 0.05 level of significance indicating that there existed no significant difference in the mean gain scores of self-concept between these two groups. The small difference in mean gain scores that existed cannot, however, be attributed to STAD or Jigsaw and may be attributed to sampling fluctuations or otherwise. Thus, it can be concluded that STAD and Jigsaw methods of cooperative learning were statistically indifferent in raising the self-concept of students in Mathematics.

Thus, the hypothesis $H_5$: “At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain a significantly higher mean gain scores on the test of self-concept than the group of students taught through traditional method” stands accepted.

It is further confirmed that the corollaries to the $H_5$ also hold good for self-concept among students also as in case of $H_4$. To reiterate, the corollaries do show:

- that both Jigsaw and STAD proved to be more significantly effective in raising mean gain scores of the self-concept of students than the traditional method;
- that Jigsaw proved to be not more effective than the STAD in raising mean gain score of the self-concept of students;
- that the Jigsaw proved to the more effective than the traditional method in raising mean gain score of self-concept of students; and
- that the STAD proved to be more effective than the traditional method in raising mean gain score of the self-concept students.

These findings are further confirmed as per analysis indicated in Table 5.6.1.
5.6 INDIVIDUAL EFFECTIVENESS OF STAD AND JIGSAW METHOD ON SELF-CONCEPT

't'-test was employed to study and compare the effectiveness of STAD and Jigsaw methods under cooperative learning in raising the self-concept of students. Table 5.6.1 depicts an account of different computations in this regard.

**Table 5.6.1**

Means, Standard Deviations and ‘t’-value of Post-Test Scores on Self-concept for STAD and JIGSAW

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>M</th>
<th>S.D.</th>
<th>‘t’-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(E_I) (STAD)</td>
<td>30</td>
<td>249</td>
<td>25.83</td>
<td>1.33</td>
<td>Not significant at 0.05 level</td>
</tr>
<tr>
<td>Experimental group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(E_{II}) (JIGSAW)</td>
<td>30</td>
<td>257.33</td>
<td>22.59</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.6.1 reveals that ‘t’-value 1.33 for the difference in the mean scores self-concept of students of experimental group \(E_I\) and the other experimental group \(E_{II}\) at the post-test stage was found to be not significant even at 0.05 level of significance. This indicated that there existed no significant difference in the mean gain scores of self-concept between these two groups. The small difference in the mean scores that exists cannot, however, be attributed to different small group learning systems, and may be attributed to sampling fluctuations or otherwise. Thus, it can be concluded that Jigsaw was found not to be more effective in raising self-concept of students in comparison to STAD method under cooperative learning. In other words, subjects exposed to Jigsaw method were not found higher in the mean gain scores of self-concept in comparison to subjects exposed to STAD method.

Thus, the hypothesis \(H_6\): “There would be significant difference between STAD and Jigsaw methods in developing Self-Concept of students” stands rejected.
Histogram for Mean and Mean Gain Scores on Self-Concept Scores of Control Group and Experimental Groups

E_I AND E_II

<table>
<thead>
<tr>
<th></th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Mean Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRADITIONAL</td>
<td>231.87</td>
<td>234.67</td>
<td>2.8</td>
</tr>
<tr>
<td>STAD</td>
<td>231.27</td>
<td>249</td>
<td>17.73</td>
</tr>
<tr>
<td>JIGSAW TRADITIONAL</td>
<td>232.17</td>
<td>257.33</td>
<td>25.17</td>
</tr>
<tr>
<td>STAD</td>
<td>234.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JIGSAW</td>
<td>249</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure: 5(b)

Overview

To compare pre-test as well as post-test mean scores on self-concept for control group taught through traditional method and experimental groups E_I and E_II taught through STAD and Jigsaw methods, respectively, the available data is represented graphically in the form of histogram as given in Figure 5(b). It includes pre-test, post-test mean scores and also represents mean gain scores on self-concept of all the three groups.

At pre-test stage control group C (Traditional method) obtained a mean score of 231.87; experimental group E_I (STAD) an average of 231.27; and group E_II (Jigsaw) has an average score of 232.17, whereas at the post-test stage, control group has a mean score as 234.67; experimental group E_I (STAD) an average of 249; while
the experimental group $E_{II}$ (Jigsaw) has an average score of 257.33 on self-concept. It is quite clear from histogram that initially pre-test mean scores appear similar, thereafter it shows a gain on self-concept scores as a result of treatment in all the three groups but the two experimental groups score more than control group.

It indicates that there exists a significant difference between the mean scores on self-concept of all the three groups at post-test stage as it is statistically interpreted in the Table 5.5.3. It also depicts in the figure that there exists a significant difference between pre-test and post-test mean scores on self-concept for all the three groups, i.e., traditional, STAD and Jigsaw.

Figure shows that experimental group $E_{II}$ (Jigsaw) achieved higher mean score than experimental group $E_{I}$ (STAD) and control group (Traditional) on self-concept at post-test stage. STAD achieved higher mean score than traditional method. Further it also depicts that Jigsaw group has a mean gain score 25.17, which is higher than 17.73 and 2.8, the mean gain scores on self-concept of STAD and traditional method group, respectively. STAD had higher mean gain score than traditional method as a result of treatment on self-concept but in comparison to Jigsaw the difference was not much significant. Statistically it is mentioned in the Table 5.5.5. It concludes that at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method attained a significantly higher mean gain scores on the test of self-concept than the group of students taught through traditional method.

**Discussion on Self-Concept**

Block (1971) observed a relationship between students academic performance and progress with his self-concept, indicating that if a student is provided with a history of successful and rewarded experiences in a given type of task, his confidence in his ability to perform similar and related tasks will increase his aspiration to learn with the result that his actual performance will improve.

The shortage of literature which specifically addresses self-concept in relation to STAD and Jigsaw methods under cooperative learning is enriched by the research pertaining to the attributional theory of motivation. Attribution theory (Weiner, 1979,
1986) indicates that students’ perceptions of success and failure determine their future behaviours. Successful outcomes are likely to influence students’ perceptions of their ability thereby, developing self-concept. It is imperative and logical to assume that it enhances self-concept and self confidence also.

Self-concept is an important attribute of understanding and predicting behaviour. Self-concept may be thought of as an organized configuration of perceptions of the self, which are admissible to awareness. Berk (1996) has described self-concept as a set of beliefs about one’s own characteristics. Ram Kumar (1972) reported positive and significant relationship between self-concept and academic achievement. Sharma (1979) reported that self-concept affects academic achievement. Rangappa (1992) had also found that self-concept affected the achievement of students in mathematics.

These previous research studies support the results of the present study on the area of self-concept. The study retained the hypotheses $H_4$ and $H_5$ and rejected $H_6$ partially in relation to self-concept.

The results of various other studies revealed some important factors strongly related with academic achievement including ‘self-concept’ as one of them, e.g., the perception of oneself about strength, weakness, value, belief, and attitude from environment or social interaction (Longres, 1995; Marsh & Craven, 1997; Slavin, 2003; Huitt, 2004; Jordan & Porath, 2006; Suldo, Riley & Shaffer, 2006; Fraine, Damme & Onghena, 2007). Bonaparte, E.P.C. (1989) also indicated that the act of combining cooperative learning strategy with mastery learning teaching in classroom organization results in enhancing mathematical performance and self-concept of students. So did Fan, Minte (1990) indicate that cooperative learning and tutoring have a strong positive effect upon academic achievement and development of self-concept, while Fyans, Salili, Maehr and Desai (1983) maintained that achievement motivation inspires to acquire new knowledge and skills and increases the self’s competence as well as an urge to improve or, as a psychological factor, provides internal impetus to excellence. It is highly valued in all human societies.
Shrivastava (1974), Christian (1977), Contractor (1977), Gandhi (1982), Singh (1986), Ramhariya (2003) and Vamdevappa (2003) also found that achievement motivation is significantly and positively related to academic achievement and self-concept. Such studies do show that and both affect each other as well as achievement perse and that student with positive self-concept and achievement motivation do achieve better.

Sharma et. al. (2006) too stressed, in their gender comparative study, that self-concept, achievement motivation and achievement are correlated to one another in mathematics.

The study in hand supports the hypothesis that at the end of experimental treatment, the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain significantly high mean and mean gain scores on the test of self-concept than the group of students taught through traditional method. It shows that subjects exposed to STAD and Jigsaw method were found higher on self-concept in comparison to subjects exposed to traditional method of teaching. In other words, STAD and Jigsaw methods are quite effective in raising the self-concept of students. Similar results were also given by Krishanaj & Kalaiyarasan (2004) who found that STAD with reward approach proved more effective than the traditional approach in enhancing self-esteem of learners.

But comparing the effectiveness of STAD and Jigsaw methods in developing self-concept of students, the current study results depict that difference in the mean scores and mean gain scores on self-concept of students taught through STAD and Jigsaw methods at the post-test stage were found not significant even at 0.05 level. This shows that there exists no significant difference in the mean scores and mean gain scores of self-concept between these two groups. Thus, it may be concluded that Jigsaw is not more effective in raising self-concept of students in comparison to STAD method but with the statistical fact that STAD and Jigsaw were found higher mean scores of self-concept in comparison to traditional method at different levels of significance. The subjects exposed to STAD and Jigsaw achieved significantly higher mean level of self-concept in comparison to traditional method of teaching at 0.05
and 0.01 level of significance, respectively. Thus, analysis of data partially supports that Jigsaw seems better than STAD in this respect, too, as in case of academic achievement.
CHAPTER – VI
FINDINGS, CONCLUSIONS, IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

6.0 SIGNIFICANCE OF THE STUDY

In every area of research, the findings have certain implications of practical value and in the field of education they have special meaning for all stakeholders from pupils to parents, teachers to teacher educators, guidance workers to policy framers and administrators to innovators and inventors. They enable the people to share and utilize the experience and knowledge of research as guidelines for educational planning and implementation to cause quality improvement in the process of schooling. Thus, based on the analysis of data and interpretation of results, a set of findings and conclusions can be drawn and on the basis of their discussion, a wide range of implications and suggestions need also to be focused on for further research in the field related to a study.

Some of the significant possibilities and provisions in terms of findings of this piece of research may be accepted as follows. They could be divided under different heads and subheads like principal features and merits of cooperative learning methods and traditional learning methods; variables of the study; objectives and hypotheses under study; and variable-wise outcomes.

6.1.1 Pedagogy tried

In order to find out the relative effectiveness of co-operative learning methods and also to compare with the traditional method of teaching, somewhat selected pedagogical methodologies were used by researcher. Initially objectives of the study identified and by keeping them in view, researcher selected the appropriate content in mathematics and prepared herself for the experiment. Three different methods of teaching-learning were used along with appropriate teaching-learning materials. The study contributes to make comparison between two cooperative learning methods which are Student-Teams Achievement Divisions (STAD) and Jigsaw. Simultaneously, it compares the effectiveness of cooperative learning methods and
traditional method of teaching. Effectiveness for the present study is measured in terms of scholastic achievement and enhancement of self-concept of students. At the end of experiment data collected was analyzed and interpreted in relation to the objectives fixed previously. Each and every phase of the experiment conducted was evaluated to identify the scope for further research.

6.1.1.1 Salient Features of the Cooperative Learning Methodology and It’s Pedagogical Bases

1. An activity involving a small group of learners, who work together as a team to solve a problem, complete a task or to accomplish a common goal.
2. Small group cooperative learning provides alternative to both traditional whole-class expository instruction and individual instruction systems.
3. It is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject.
4. Fast learners can assist the slower pupils to achieve and do well. They can learn as well from the slow learner, in return, too.
5. Learners may motivate and challenge each other in a committee setting and yet efforts are harmonized to attain togetherness in an educational endeavour.
6. Group cohesion is necessary so that the goals of cooperative learning are consistently attained. All need to participate actively and achieve maximally.
7. Cooperative learning instructional approaches provide opportunities for a learner to interact with other learners in the class, and thus the approaches maximize the learner’s intrinsic interest in learning.
8. The cooperative learning approaches cater to the needs of students having different mental abilities in organizing students to work together in small group.
9. Cooperative learning is an arrangement in which students work in mixed ability groups and are rewarded on the basis of the success of the group.
10. Each member of a team is responsible not only for learning what is taught but also for helping team mates learn, thus, creating an atmosphere of achievement.
11. Cooperative learning is a relationship in a group of students that requires the following five elements: positive interdependence; individual accountability; interpersonal skills; face-to-face promotive interaction; and group processing.

12. A criteria-referenced assessment and evaluation system is used, the focus is usually on the learning and academic progress of the individual student but may also include the group as whole, the class and the school.

6.1.1.2 Merits of the Cooperative Learning Methods Used

1. Cooperative learning is easy to implement and is not expensive.

2. Cooperative learning improves children’s behaviour, their attendance and increases their liking of school.

3. It encourages group processes, fosters social and academic interaction among students and rewards successful group participation in the learning of school subjects.

4. It produces higher achievement, more positive relationships among students and healthier psychological adjustment than do competitive or individualistic experiences.

5. It improves relationships among students from different ethnic backgrounds.

6. Cooperative learning also increases students’ motivation by providing peer support.

7. It encourages learning the material in a greater depth than they might otherwise have done, and makes them able to think of creative ways to convince the teacher that they have mastered the required material.

8. In cooperative learning teams, low-achieving students can make contributions to a group and experience success, and all students can increase their understanding of ideas by explaining them to others.

9. Cooperative learning successfully fosters and masters interpersonal skills among students that are also needed for the group to accomplish its tasks.

10. It helps to increase students’ retention and enhance students’ satisfaction with their learning experience.

11. It also helps students’ to develop skills in oral communication and students' social skills.
12. It promotes tolerance for individual differences.

6.1.1.3 Traditional Pedagogy Used - Its Salient Features and Merits

Traditional method of teaching encourages one-way communication; therefore, the teacher must make a conscious effort to become aware of student problems and student understanding of content without verbal feedback. It places students in a passive rather than an active role, which hinders learning. This method requires the instructor to have or to learn effective writing and speaking skills and also requires a considerable amount of unguided student time outside of the classroom to enable understanding and long-term retention of content. Alongwith all these features it also reflects some kind of merits that this pedagogical setting gives the instructor the chance to expose students to unpublished or not readily available material and allows the instructor to precisely determine the aims, content, organization, pace and direction of a presentation. Traditional pedagogy can be used to arouse interest in a subject and can complement and clarify text material. It complements certain individual learning preferences. Some students depend upon the structure provided by highly teacher-centered methods. In crowded classroom circumstances it equally facilitates large-class communication. Traditional teaching is concerned with the teacher being the controller of the learning environment. Power and responsibility are held by the teachers and they play the role of instructor (in the form of lectures) and decision maker (in regard to curriculum content and specific outcomes). They regard students as having 'knowledge holes' that need to be filled with information. In short, the traditional teacher views that it is the teacher that causes learning to occur (Novak, 1998).

6.1.1.4 Comparative/Interactive Mingling of Cooperative Learning and Traditional Techniques

Our on-going traditional classroom teaching is totally teacher dominated and content centered. Here, the teachers are regarded as repositories of subject knowledge and their role is simply to pour into the open, empty and willing minds of students their vast reservoir of knowledge. They do not trust that their students would learn on their own. They think that they must tell them what to learn and provide all the
structure for the learning to take place. This learning structure is highly individualistic. It encourages individual and competitive learning in place of group and co-operative learning. Here, the students are tempted to learn more and more in order to gain good grade, divisions, certificates and appreciations by excelling their own peers. Cooperative learning says no to such practices. It is a learner-centered strategy in which the students get opportunities to learn by themselves in a small group in a co-operative or a non-cooperative environment by forming a number of teams, each consisting of a small number of students of different levels of ability for the understanding of a subject. They share all information among themselves and help one another for having the required knowledge, understanding and application of one or the other aspects of the content material, or course units included in their syllabus. It seems quite contrary to the practice of traditional teaching-learning in our current educational system.

This approach emphasizes a variety of different types of methods that shifts the role of the instructors from givers of information to facilitating student learning. Traditionally instructors focused on what they did, and not on what the students are learning. This emphasis on what instructors do often leads to students who are passive learners and who do not take responsibility for their own learning. Educators call this traditional method or “instructor-centered teaching.” In contrast, cooperative learning method, “learner-centered teaching” occurs when instructors focus on student learning. Learner-centered teaching places the emphasis on the person who is doing the learning (Weimer, 2002).

The Indian classrooms are highly heterogeneous in nature. In the classroom, the students have different abilities. Some can master the subject quickly and some take more time to attain mastery. But the teacher tailors his instruction to the whole group without taking note of the heterogeneity of the group. Cooperative learning may best be defined as small heterogeneously mixed working groups of learners learning collaborative/social skills while working towards a common academic goal or task. The teacher's role in cooperative learning changes from being in front of the learners doing most of the talking (and most of the work) to becoming a facilitator who guides the learner learning both in academic as well as the social realms. In some
of the cooperative learning strategies like STAD and Jigsaw II, content is to be shared with students with the use of traditional techniques and later on, teaching-learning process put forward in small group settings in an instructional session to make the complex things easier.

6.1.1.5 Superiority Parameters of CL and Traditional Approach

When the focus becomes student learning, school attain higher rates of student retention and have better prepared civilized individuals with social skills than those students who are more traditionally trained. The functions of the content in cooperative learning include building a strong knowledge foundation and to develop learning skills and learner self-awareness. The roles of the instructor are facilitative rather than didactic. The responsibility for learning shifts from the instructor to the students in cooperative learning setting where instructor creates learning environments that motivate students to accept responsibility for learning. The processes and purposes of assessment shift from only assigning grades to include constructive feedback and to assist with improvement. Cooperative learning uses assessment as a part of the learning process. The balance of power shifts so that the instructor shares some decisions about the course with the students such that the instructor and the students collaborate on course policies and procedures. Students promote each other’s success in teams rather than individual success. Equal opportunity for success, a feature of cooperative learning, ensures that high, average and low achievers are equally challenged to do their best and that the contributions of all team members are equally valued but it is not possible in traditional approach.

6.1.2 Variables Tested

Different variables were tested in recent research studies such as achievement, attitude, self-esteem, cognitive skills, behaviour modifications, self-concept etc. in different subjects like Languages and Humanities, Social Sciences, Sciences and technology, Physical and environmental sciences, Mathematics etc. In the present comparative study of the cooperative learning vis-à-vis traditional approach, the methods of instruction or teaching in the form of cooperative learning strategies involving Student-Teams Achievement Divisions (STAD) and Jigsaw methods were
used as independent variables to see their effect on the achievement of students in Mathematics, and their self-concepts.

6.1.3 Objectives/Hypotheses Tested

The results drawn during this study support that:

6.1.3.1 At the end of experimental treatment, the group of students taught mathematics through Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning scored significantly higher mean on the academic achievement test than the group of students taught through traditional methods. It suggested that Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning contribute towards raising the academic achievement of students in Mathematics in comparison to traditional methods.

6.1.3.2 The group of students taught Mathematics through STAD and Jigsaw methods under the cooperative learning shows a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method at the end of experimental treatment.

6.1.3.3 At the end of experimental treatment, there existed a significant difference between STAD and Jigsaw methods on the Academic Achievement of students. Jigsaw showed a significant higher on achievement than the Students-Teams Achievement Divisions (STAD) method under cooperative learning.

6.1.3.4 At the end of experimental treatment the group of students taught Mathematics through STAD and Jigsaw under cooperative learning method attained a significantly higher mean score on the test of self-concept than the group of students taught through traditional methods. It suggests that STAD and Jigsaw methods under cooperative learning contribute towards raising the self-concept of students in Mathematics.

6.1.3.5 The mean gain scores of both the experimental groups, the group of students taught mathematics through STAD and Jigsaw under cooperative learning
method were also found to have attained significantly higher on the test of self-concept than the group of students taught through traditional method called as control group.

6.1.3.6 At the post-experimental stage, there existed no significant difference between Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning in developing self-concept of students. It suggested that STAD and Jigsaw are equally effective in developing self-concept among students, even though Jigsaw appeared to be much too higher in mean scores than the mean score of STAD which may be due to an error of minor consequence.

6.2 CONCLUSION

The popular cooperative learning approaches cater to the needs of students having different mental abilities in organizing students to work together in small group which has been “an ancient practice in education throughout the world” (Slavin, 1995). Cooperative learning instructional approaches provide opportunities for a learner to interact with other learners in the class, and thus the approaches maximize the learner’s intrinsic interest in learning. Children improved behaviour and attendance and increased liking of school are some of the benefits of co-operative learning (Slavin, 1987). Although much of the research on cooperative learning has been done with older students, cooperative learning strategies are effective with younger children in pre-school centres and primary classrooms as well, in addition, cooperative learning promotes students’ motivation, encourages group processes, fosters social and academic interaction among students and rewards successful group participation in the learning of school subjects.

Finally, if we are to accept the proposition that Cooperative Learning has a far broader intention than simply a set of strategies to use in a classroom, there is a need to examine the public purpose of education and to congregate research and argument as to how this needs to be articulated in future.

In this context, the observations made by the UNESCO International Commission on Education for the twentyfirst century (1996) are quite relevant. It
“discussed the need to advance towards a ‘Learning Society’. The Truth is that every aspect of life, at both the individual and social level, offer opportunities for both learning and doing….Better still, school should impart both the desire for, and pleasure in, learning, the ability to learn how to learn, and intellectual curiosity. One might even imagine a society in which each individual would be in turn both teacher and learner” (UNESCO, 1996).

“Not only must it adapt to changes in the nature of work but it must also constitute a continuous process of forming whole human beings – their knowledge and aptitudes, as well as their critical faculty and ability to act. It should enable people to develop awareness to them and encourage them to play their social role at work and in the community” (ibid). Education is a deeper, more profound, undertaking than the hope, in the political entities that are schools serving a purpose in a democratic society.

In order to address the present educational practices, it is important to examine latest UNESCO document (1996) titled ‘Learning- The Treasure Within’ which spells out education along Four Fundamental Pillars of Education– Learning to Know, Learning to Do, Learning to Be, Learning to Live Together. The investigator thought it well to develop new dimension of the study in the light of four fundamental pillars of learning suggested by UNESCO. If cooperative learning could be used well in the educational system then it addresses each of these four elements.

The Commission further observes, “Formal education systems tend to emphasize the acquisition of knowledge to the detriment of other types of learning; but it is vital now to conceive education in a more encompassing fashion. Such a vision should inform and guide further educational reforms and policy, in relation both to contents and to methods’ (ibid). It, therefore recommend, Four pillars of learning as the principal focus of schooling which is achieved best though cooperative learning.

It may be safely concluded from the above findings that Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning improves the scores of students of the respective experimental groups in their Academic
Achievement and Self-Concept. It can be drawn that the methods of cooperative learning like STAD and Jigsaw prove more meaningful and effective than the conventional methods of teaching and learning. At the end of experimental treatment the effects may be relatively small, and even then it reflects significant differences on the measure of academic achievement and self-concept which indicated that students in cooperative learning strategies like Student-Teams Achievement Division and Jigsaw outperformed those in the traditional methods of teaching.

This study is focused on the use of cooperative learning methods in the area of academic achievement and self-concept at the elementary school stage and is delimited to the seventh grade level; further, the major emphasis is given to compare the effectiveness of the STAD and Jigsaw methods themselves, and with the traditional teaching methods. Thus, the fundamental variables of this study includes:

(a) Learning method especially cooperative learning methods such as Student-Teams Achievement Divisions (STAD) and Jigsaw;
(b) Learning outcomes in terms of Academic Achievement; and
(c) Self-Concept stands for awareness of oneself as a human being and the importance or significance of oneself’s role in life.

The present study retained five hypotheses out of the six namely:

- **H1**, at the end of experimental treatment the group of students taught mathematics through Student-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning scores significantly higher mean on the academic achievement test than the group of students taught through traditional methods;
- **H2**, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under the cooperative learning shows a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method;
- **H3**, there exists significant difference between STAD and Jigsaw methods on academic achievement of students;
• $H_4$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method attains a significantly higher mean score on the test of Self-Concept than the group of students taught through traditional method; and

• $H_5$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning methods shows a significantly higher mean gain scores on the test of Self-Concept than the group of students taught through traditional method, which proves effectiveness of cooperative learning methods like STAD and Jigsaw over the traditional classroom teaching methods and processes.

It further shows that ($H_3$) Jigsaw was found better than STAD to improve academic achievement in mathematics. It also revealed a few corollaries of $H_2$ which are as follows:

- that both Jigsaw and STAD proved to be more significantly effective in raising the academic achievement of students than the traditional method;
- that Jigsaw proved to be more effective than the STAD in raising the academic achievement of students;
- that the Jigsaw proved to the more effective than the traditional method in raising the academic achievement of students; and
- that the STAD proved to be more effective than the traditional method in raising the academic achievement of students.

The rejection of the hypothesis $H_6$, shows that there existed no significant difference between STAD and Jigsaw methods in developing Self-Concept of students. $H_6$ stands partially retained on the basis of better mean scores in favour of Jigsaw over STAD and partially rejected on ‘t’ scores. It does not show however, any controversy in the above results. It clearly indicates, on the other hand, similar significant effectiveness of STAD and Jigsaw in raising the Self-Concept of students. The results of the study do not, in any way, discard or undermine these techniques, nor was it the objective of the study, but it only shows that methods of cooperative learning as STAD and Jigsaw are quite crucial to the inculcation of values like living
together, mutual sharing and understanding, and healthy cooperation rather than stark competition that narrows down the process of education to self-directed individualized learning. Quite significantly, both healthy cooperation as well as healthy competition complement and supplement each other in making the learning process tangible to sustainable human development. Therefore, both of them are obligatory in their own right to an effective schooling. They favourably compare in their effectiveness with different methods of cooperative learning vis-à-vis the conventional teaching methods and programmes.

Indeed it has been the growing demand of the fast changing educational scenario today, making schooling a playful endeavour for all practical and methodological purposes of sustainable development and joyful learning, especially at the elementary school level.

6.3 EDUCATIONAL IMPLICATIONS

The present research offers many an implication for parents, teachers, guidance workers and all educational stakeholders and even administrators. Parents need to identify the latent talents and potentialities of their wards being their first mentors of the child in her most impressionable period of development as an infant and early childhood before putting the child in the four walls of the formal schools; and also to actively participate and cooperate with school teachers for wholesome and sustainable development of the child as a joint and shared responsibility of the parents and school authorities. They should inspire the children to develop self-confidence and self-concept better which, in turn, would lead to better academic achievement. Teachers in the classroom confront with different potentialities, attitudes, aptitudes, propensities and academic abilities of the students coming from the different areas, class, caste and economic status. It is responsibility of teachers and the school system especially to provide congenial environment for meaningful development of every child in terms of various life skills like building self-confidence, self-respect, interpersonal skills and social relationships etc. as part of the schooling process, besides imparting the knowledge and skills of learning the academic context as well as the incumbent practices.
The present study clearly shows that changing from a traditional competitive classroom to cooperative settings does not diminish student’s achievement; in fact, it significantly improves their academic achievement in mathematics as also their self-concept in a cooperative learning environment. In that way, cooperative learning improves student perception about learning and decrease the feeling of alienation also that groups of students taught through STAD, Jigsaw methods of cooperative learning and shows higher gain scores on academic achievement and self-concept in comparison to traditional method of teaching, which conveys that cooperative learning reduced individual differences, enhances self-concepts and enables all type of students to perform better. It highlights the comparative merits of the cooperative learning methods vis-à-vis traditional classroom teaching, on the one hand and their intra-merits on the other. It does not counter any method but only seeks an ambitious amalgam of all methods and techniques of teaching in the school to promote educational excellence all round development of children put to their charge. Teachers, Teachers educators and indeed the system as such need to be fully awake about their role models and duties per se. An insight into pedagogy both traditional as well as the emergent, developed over a period of time- goes a long way in boosting the spectrum of schooling in a wholesome and holistic way. Hence, the need for innovative pedagogies all the while.

In the present study, groups were intimately rewarded based on their members’ learning and also students were expected and made individually accountable for their academic performance. Thus, a positive effect on students’ self-concept and academic achievement in Mathematics was found to be there to suggest the usefulness and effectiveness of cooperative learning for improving their academic achievement and also their self-concept. Any study of multifaceted programme leaves many questions unanswered and this one seems to be no exception. Perhaps the most evident question revolved around the relative impact of each of the methods, that is, STAD and Jigsaw under cooperative learning in producing the various effects on achievement and students’ self-concepts. It was found that cooperative learning methods like STAD and Jigsaw proved to be more tangible in its effectiveness on achievement and self-concepts between students and peers as also with teachers than
the traditional classroom approach which has remained by and large teacher-oriented than students-initiated, in any way, since its inception in the hoary past in human history. Despite its being too old and on its last legs, as some people do believe under the heavy weight of imminent ICT, the fact still remains that the sinews of the traditional pedagogy are so strong that no new pedagogical technology whatsoever can overthrow or ignore it to be successful in itself. No pedagogy can ever exist sans teacher-taught interaction and close-knit relationship between them. Cooperative learning proves to be practical and widely acceptable to students. When students are not able to understand teacher’s explanation, group members including peers are able to explain and communicate in simpler words that are more easily understood.

The merits of a few other sundry cooperative learning inputs and their implications for educational purposes could be gauged on the basis of observations like the following.

- Cooperative learning methods like STAD and Jigsaw have shown different ways of instructional arrangement which can be used to foster active student learning, which shows an important dimension of mathematics learning. Students can be given tasks to discuss, solve problem and accomplish quizzes, riddles and puzzles.

- Cooperative learning teachers/facilitators, instead of dealing with so many students simultaneously in the class; deal with small groups of students and group facilitators; that saves a lot of time and energy to devote to planning and initiating cooperative learning projects and programmer.

- Cooperative learning suggests a new role for the teacher. A teacher, accustomed to being the sole source of information for teaching the passive learners in the classroom has to change to be a facilitator in the learning process to actively encourage the student to:
  - Help each other and learn from each other.
  - Participate in discussions.
  - Facilitate each others’ learning.
  - Engage in problem solving in a free democratic way.
• Structure the lessons and curriculum cooperatively.

- The study suggests that teachers can use cooperative learning activities to provide students with opportunities to practice newly introduced or to review skills and concepts.

- Sometimes students explain things to each other better than a teacher can do to an entire class of students. This usually results in better retention of the learnt material.

- The study shows that students make connections between the concrete and abstract level of instruction through peer integration and carefully designed activities.

- The study has important implications for teacher education. Given the current wide-spread use of cooperative learning at various levels, it is imperative that pre-service teachers understand how to structure and monitor meaningful learning experiences for students.

- The present study suggests that mathematics is conceptually dense having its own language. Cooperative learning can be used to promote classroom discourse and oral language development of concepts, connotations and symbols. In cooperative learning activity, mathematics vocabulary and symbolic understanding can be facilitated with peer interactions.

- The study shows that students today seem to have a much shorter attention span than they did years ago. With cooperative learning used on regular basis, they are less likely to become restless or misbehave during a teacher-directed part of a lesson since they know they will have time in groups.

- The study tells that teacher should design activities to promote mathematics understanding by having students practice, manipulate reason and solve problem. For example, learn algebraic formulae and apply them to solve equation together helping each other in mathematical constructions, solve word problems related to daily life etc.

- The study shows that shy students are more likely to ask and answer question in a group setting. The same is true for low-skills students.
The study interprets that today’s job market is looking for people with good interpersonal skills, high self-concepts and problem solving skills. Regular participation in cooperative learning activities can help them develop these skills. Important skills such as critical thinking, creative problem solving and the synthesis of knowledge can easily be accomplished through cooperative group activities an inclusive cooperative learning classroom.

Meaningful content in cooperative lessons is critical for the success of all students. For students to succeed within their groups, careful consideration regarding group heterogeneity must be in conjunction with roles that ensure active and equal participation.

Students in heterogeneous classroom team try to solve complex cognitive tasks and the progress of the lower achieving students does not occur at the expense of the higher achievers or vice versa. So, cooperative learning is recommended for fostering students’ reasoning and communication.

6.4 SUGGESTIONS FOR FURTHER RESEARCH

No research can say any final word on a problem because it is very difficult for a researcher to touch all the complex aspects of a problem that demands probing. In light of findings and conclusions of the study, the following few suggestions for further research in this area of study may not be out of place. Some of these can be enumerated as:

- The present study examined only the academic achievement and self-concept of students in Mathematics. Further studies may be conducted to investigate the effectiveness of cooperative learning for other dependent variables, such as attitude towards subjects, self-esteem, peer relation, social skills and academic motivation for different subjects.
- The studies can also be conducted to compare the different cooperative learning methods with other methods of instructions at different grade levels.
- Similar studies can also be conducted in other subjects like languages, Social Science, etc.
- There is a need to explore the relation of cooperative learning with other emotional and motivational variables.
A study can also be conducted to compare and explore how cooperative learning methods affect the students of various abilities on cognitive, emotional and motivational dimensions; as well as on cognitive and non-cognitive dimensions of the high achievers, average and low achievers.

The study can be repeated to compare the effectiveness of various strategies under cooperative learning in different situations like – rural, urban, male, female students and mixed genders at different levels, which may be elementary, secondary, higher secondary or university level of education.

A study needs to undertaken on a larger sample, and for a longer durations to examine the effects so that results can be confirmed better on non-cognitive variable like social skills or some other personality variable which take more time to bring about a change.

A comparative study is needed to analyze the effect of different cooperative learning methods on special groups of children such as the gifted, the learning disabled and other handicapped students in cognitive and non-cognitive domains.
CHAPTER - VII
SUMMARY

7.0 INTRODUCTION

One of the important goals of education is to improve both scholastic as well as non-scholastic achievement in school, offering them better social relations in a properly articulated school environment. There is an urgent need to practice alternative education programmes new instructional strategies or methods to solve the problem of students’ poor achievement as well as to provide congenial school climate and curriculum that meet the needs of students. Cooperative Learning seems to be one such strategy to bank upon for better quality schooling.

Cooperation in simple terms means working or acting together for a common purpose. Cooperative learning is a teaching-learning strategy in which the students of a class engage themselves in a variety of useful learning tasks, in a cooperative and non-competitive embracing environment by forming a number of small group teams, each consisting of a small number of students of different levels of ability to learn together in a homely atmosphere.

7.1 EMERGENCE OF THE PROBLEM AND ITS RATIONALE

Research on students’ thought processes is based on the belief that teaching is mediated by the students’ thinking skills and that teachers influence students’ achievement, not directly, but by causing students to think and behave in certain ways (Wittrock, 1986). It is evident that everyone has one’s own individual learning style. Our interests and genetic make-up determine what we can learn, how well we may learn and how well we can apply what has been learnt. Consequently, all methods of instruction do not align with the learning capabilities of each individual learner. Either we must devote time to each learner individually or rely on other means to assist each learner to progress which may not be possible as it requires more human resources than are available to schools. There is a need of a team of individuals to pull together to get tasks accomplished (Flowers and Ritz, 1994).

Cooperative learning is one of the teaching-learning strategies which is not expensive, makes learning easier and more enjoyable for the students. It is an easy
technique to implement in the classroom, particularly in a block or a scheduled time table. The rationale for using cooperative learning techniques is that the cooperative learning principles are important not only for helping people to work better together but also for recognition of every one’s gifts and strengths. Experimental studies (enhanced academic achievement, improved self-concept, greater motivation and better interpersonal relations) question continues to surface about students’ performance in small group settings and that not all students receive the same benefits from participation in heterogeneous cooperative groups.

Throughout the world, Mathematics is taught as one of the schools subjects, but a majority of the students feel that mathematics is a difficult subject which leads to high failure rate because of: (a) lack of interest in mathematics; and (b) ineffective teaching methods. Majority of the Mathematics teachers follow the traditional methods of instruction and at times also feel like creating their own learning strategies (settings) in the classroom that enable the learners to actively participate in the instructional process rather than being simply passive listeners.

Co-operative learning is one strategy that can enable all learners in the classroom to learn or work together in smaller groups. This can contribute to intellectual, social and psychological development of learners unlike other methods of instruction. Cooperative learning also focuses on preventing and treating a wide variety of instructional and of society problems too, such as addressing diversity (racism, sexism, inclusion of handicapped, anti-social behaviour, delinquency, drug abuse, bullying, violence and incivility), lack of pre-social values and egocentrism psychological pathology, low self-esteem, etc.

In cooperative learning settings, groups of students of mixed abilities help each other to learn by actively participating and discussing the issues involved through cooperation, self-effort and understanding. The research indicates that high achievers gain from cooperative learning (relative to high achievers in the traditional classes) just as much as do low and average achievers (Slavin, 1995).

Cooperative interdependence in classroom settings is the basis of many interventions designed to improve both academic achievement and self-concept of
students in schools and as such it has been a primary focus in educational, social and psychological literature for quite a long while over the decades, which poses an obvious problem for an intensive study. Hence, the choice of the topic and the statement of the problem:

7.2 **STATEMENT OF THE PROBLEM**

A Comparative Study of the Effectiveness of Student-Teams Achievement Divisions (STAD) and Jigsaw Methods of Cooperative Learning

7.3 **OPERATIONAL DEFINITIONS**

The operational definitions of some of these frequently used terms having specific meaning for the present investigation are as given below:

i) **Cooperative Learning:** Cooperative Learning is the strategy that can enable all the learners in the classroom to learn or work together to contribute in turn to intellectual, social and psychological development of the learner.

ii) **Effectiveness:** Effectiveness for the present study will be measured in terms of scholastic achievement and enhancement of self-concept of students.

iii) **Academic Achievement:** Academic achievement referred as the degree or level of performance, success or proficiency attained in academic work.

iv) **Self-Concept:** Self-Concept stands for awareness of oneself as a human being and the importance or significance of oneself in the role of life (James, 1902)

7.4 **OBJECTIVES OF THE STUDY**

The main objective of the present study is to compare the effectiveness of Student-Team Achievement Divisions (STAD) and Jigsaw method of cooperative learning on the students’ learning outcomes or achievement and self-concept in a Mathematics classroom of seventh graders. Its specific objectives would be:

1. To compare the mean academic achievement scores of three groups of students taught mathematics with and without use of cooperative learning methods (Student–Teams Achievement Divisions (STAD) and Jigsaw) before the experimental treatment.
2. To compare the mean Academic achievement scores of three groups of students taught mathematics with and without use of Co-operative learning methods (Student–Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

3. To compare the mean gain academic achievement scores of three groups of students taught mathematics with and without use of cooperative learning methods (Student-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

4. To compare the mean self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) before the experimental treatment.

5. To compare the mean self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

6. To compare the mean gain self-concept scores of three groups of students taught mathematics with and without use of cooperative learning methods (Students-Teams Achievement Divisions (STAD) and Jigsaw) after the experimental treatment.

7. To compare the effectiveness of STAD and Jigsaw methods on achievement of students.

8. To compare the effectiveness of STAD and Jigsaw method in developing self-concept of students.

7.5 HYPOTHESES

Converting the objectives in terms of hypotheses of following six would emerge as probable to be tested for their statistical significance:

H₁ At the end of experimental treatment the group of students taught mathematics through Student–Teams Achievement Divisions (STAD) and Jigsaw methods
under cooperative learning will score significantly higher mean on the academic achievement test than the group of students taught through traditional methods.

H₂ At the end of experimental treatment the group of pupils taught mathematics through STAD and Jigsaw under the cooperative learning will show a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method.

H₃ There exists significant difference between STAD and Jigsaw methods on achievement of students.

H₄ At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain a significantly higher mean score on the test of self-concept than the group of students taught through traditional method.

H₅ At the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method will attain a significantly higher mean gain scores on the test of self-concept than the group of students taught through traditional method.

H₆ There exists significant difference between STAD and Jigsaw methods in developing self-concept of students.

7.6 TEACHING METHODS USED

In the present study, two such methods of cooperative learning, that is, Student-Teams Achievement Divisions (STAD) and Jigsaw has been used to test their merit over traditional teaching methods.

7.7 DELIMITATIONS OF THE STUDY

Keeping in view obvious limitations and resources, the study has been delimited as under:-

1. The study is conducted on class VII students in Mathematics only.
2. The study is confined to two methods of cooperative learning, those are, STAD and Jigsaw.
3. The study is restricted to learning inside the classroom.
4. The study is conducted in one school at Karnal city only.
5. Study is delimited to only one subject, that is, Mathematics only and to five topics of Mathematics selected from the prescribed syllabus.
6. The experiment is delimited to 60 working days of the academic session.

7.8 DESIGN OF THE STUDY

In the present study pre-test, post-test group control quasi-experimental design was employed with a purposive sample in the form of intact sections of class VII of the same school. It involved three groups of students’, i.e., experimental groups (EI and EII) and control group (C). Experimental groups were taught in cooperative learning setting involving STAD and Jigsaw methods and the control group was taught through traditional approach.

The intact sections were equated on intelligence and socio-economic status. Quasi-experimental design of the study, as given in Table 7.1., comprising three stages. The first stage involved pre-testing of all the students of three groups on academic achievement in Mathematics, socio-economic status, intelligence and self-concept. The second stage involved the experimental treatment, which consisted of teaching five units of VII grade Mathematics through cooperative learning methods, i.e., STAD and JIGSAW approach to two experimental groups, EI and EII, respectively; and through traditional method to control group C.

Table 7.1
Design of the Study

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre-Test</th>
<th>Independent Variables</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group (EI)</td>
<td>T1</td>
<td>Teaching through cooperative learning i.e. STAD</td>
<td>T2</td>
</tr>
<tr>
<td>Experimental Group(EII)</td>
<td>T1</td>
<td>Teaching through cooperative learning i.e. JIGSAW</td>
<td>T2</td>
</tr>
<tr>
<td>Control Group (C)</td>
<td>T1</td>
<td>No intervention</td>
<td>T2</td>
</tr>
</tbody>
</table>
In the third stage, students were post-tested on academic achievement in Mathematics and self-concept. A schematic view of the phases of the experiment is presented in the table 7.2

### Table 7.2
**Phases of the Study**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-testing</td>
<td><strong>Control Group (C)</strong> Measurement of students 1. Intelligence of students 2. S.E.S of students 3. Achievement in Mathematics 4. Self-Concept of students</td>
</tr>
<tr>
<td></td>
<td><strong>Experimental Group EI</strong> Measurement of students 1. Intelligence of students 2. S.E.S. of students 3. Achievement in Mathematics 4. Self-Concept of students</td>
</tr>
<tr>
<td></td>
<td><strong>Experimental Group EII</strong> Measurement of students 1. Intelligence of students 2. S.E.S. of students 3. Achievement in Mathematics 4. Self-Concept of students</td>
</tr>
<tr>
<td>Treatment</td>
<td>Teaching Mathematics through traditional method Teaching Mathematics through STAD under Cooperative Learning method Teaching Mathematics through Jigsaw under Cooperative Learning method</td>
</tr>
<tr>
<td>Post-testing</td>
<td>Measurement of students 1. Achievement in Mathematics 2. Self-Concept of students</td>
</tr>
<tr>
<td></td>
<td>Measurement of students 1. Achievement in Mathematics 2. Self-Concept of students</td>
</tr>
<tr>
<td></td>
<td>Measurement of students 1. Achievement in Mathematics 2. Self-Concept of students</td>
</tr>
</tbody>
</table>

### 7.9 SAMPLE

In the present study, all the students studying at VII grade in Karnal is the population. Since the population, being usually too large, a smaller is chosen as representative of the population which is known as sample.

In the present study, the sample comprised 90 students studying in three sections of the VII class of S.B.S. Senior Secondary School, Karnal. Each of the three
sections/groups contained 30 students. One section formed the control group and the other two sections formed the experimental groups.

### Table 3.4
#### Sample of the Study

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Groups</th>
<th>Total no. of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Experimental group (EI)</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>Experimental group (EII)</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>Control group (C)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
</tr>
</tbody>
</table>

#### 7.10 TOOLS USED

For the present investigation, the following tools were used.

**A. Standardized Tests**

1. Raven’s Standard Progressive Matrices, J.C. Raven, 1977

**B. Self-Developed Tools**

4. Achievement Test (developed by investigator)
5. Cooperative learning Lesson Plans (developed by the investigator)
6. Worksheets (developed by the investigator)
7. Formative Tests (developed by the investigator)

#### 7.11 PROCEDURE FOLLOWED

Procedure of the experiment went through the following stages:

**Stage I : Selection of the Sample**

The sample of the study was comprised of 90 students of class VII (30 in control group, 30 each in two experimental groups (E_I and E_{II}) studying in S.B.S. Senior Secondary School, Railway Road, Karnal.
Stage II : Conducting the Experiment

The experiment included three phases as given below:

Phase I : Administration of pre-test

Phase II : Conducting the instructional programme.

Phase III : Administration of the post-test

Phase I : Administration of the Pre-test

Raven’s Standard Progressive Matrices, Socio-Economic Status Scale, Achievement Tests and Self-Concept Inventory were administered on the control group and experimental groups respectively.

Phase II : Conducting the Instructional Programme

Same content was taught to all the three groups. The instructional treatment was given for about 60 days here control group was taught by traditional method and experimental group (EI and EII) were taught by cooperative learning methods (Student-Teams Achievement Divisions or STAD and Jigsaw) respectively.

Phase III : Administration of the Post-Test

Immediately after the instructional treatment was over, the students were assessed on criterion measure to know the effects of the treatment. Achievement Test in mathematics and Self-concept inventory were administered to the control and experimental groups.

7.12 STATISTICAL TECHNIQUES USED

The data collected was statistically analyzed to test objectives of the study by using the following techniques or statistical tools:

1. Descriptive statistics such as means and SD’s were worked out on the score of achievement, and self-concept.

2. Bartlett’s test and analysis of variance (ANOVA) were used in order to adjust pupils’ intelligence and socio-economic status.
The Bartlett test statistic is designed to test for equality of variances across groups against the alternative that variances are unequal for at least two groups.

\[ T = \frac{(N - k) \ln(S_p^2) - \sum_{i=1}^{k} (n_i - 1) \ln(S_i^2)}{1 + \frac{1}{3(k-1)} \left[ \sum_{i=1}^{k} \left( \frac{1}{n_i - 1} \right) - \frac{1}{N - k} \right]} \]

Where \( N = \sum_{i=1}^{k} (n_i) \) & \( S_p^2 = \frac{1}{N - k} \sum_{i=1}^{k} (n_i - 1)S_i^2 \)

In the above equation, \( S_i^2 \) is the variance of the \( i \)th group, \( N \) is the total sample size, \( n_i \) is the sample size of the \( i \)th group, \( k \) is the number of groups, and \( S_p^2 \) is the pooled variance. The pooled variance is a weighted average of the group variances.

3. ‘t’-test was employed for testing the significance of difference between the means of pupils’ achievement in mathematics, their self-concept on pre-test, post-test and gain scores. The value of ‘t’ was computed with the help of the following formula:

\[ t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1^2}{N_1} - \frac{\sigma_2^2}{N_2}}} \]

Where

- \( M_1 \rightarrow \) mean of first group;
- \( M_2 \rightarrow \) mean of second group;
- \( \sigma_1 \rightarrow \) variance of first group;
- \( \sigma_2 \rightarrow \) variance of second group;
- \( N_1 \rightarrow \) number of cases in first group;
- \( N_2 \rightarrow \) number of cases in second group.
7.13 FINDINGS

The results drawn during this study support that:

(i) At the end of experimental treatment the group of students taught mathematics through Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning scored significantly higher mean on the academic achievement test than the group of students taught through traditional methods. It suggests that Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning contribute towards raising the academic achievement of students in Mathematics in contrast to traditional methods.

(ii) The group of students taught Mathematics through STAD and Jigsaw methods under the cooperative learning showed a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method at the end of experimental treatment.

(iii) At the end of experimental treatment, there existed a significant difference between STAD and Jigsaw methods on the Academic Achievement of students. Jigsaw showing a significant higher on achievement than the Students-Teams Achievement Divisions (STAD) method under cooperative learning.

(iv) At the end of experimental treatment the group of students taught Mathematics through STAD and Jigsaw under cooperative learning method attained a significantly higher mean score on the test of self-concept than the group of students taught through traditional methods. It suggests that STAD and Jigsaw methods under cooperative learning contribute towards raising the self-concept of students in Mathematics.

(v) The mean gain scores of both the experimental groups, the group of students taught mathematics through STAD and Jigsaw under cooperative learning method were also found to have attained
significantly higher on the test of self-concept than the group of students taught through traditional method called as control group.

(vi) At the post experimental stage, there existed no significant difference between Students-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning in developing self-concept of students. It suggests that STAD and Jigsaw are equally effective in developing self-concept among students even though Jigsaw appeared to be much too higher in mean scores than the mean score of STAD which may be due to an error of minor consequence.

7.14 CONCLUSION

The popular cooperative learning approach caters to the needs of students having different mental abilities in organizing students to work together in small group which has been “an ancient practice in education throughout the world” (Slavin, 1995). Cooperative learning instructional approaches provide opportunities for a learner to interact with other learners in the class, and thus the approaches maximize the learner’s intrinsic interest in learning. Children’s improved behaviour and attendance and increased liking of school are some of the benefits of co-operative learning (Slavin, 1987). Although much of the research on cooperative learning has been done with older students, cooperative learning strategies are effective with younger children in pre-school centres and primary classrooms as well, in addition, cooperative learning promotes students’ motivation, encourages group processes, fosters social and academic interaction among students and rewards successful group participation in the learning of school subjects.

Finally, if we are to accept the proposition that Cooperative Learning has a far broader intention than simply a set of strategies to use in a classroom, there is a need to examine the public purpose of education and to congregate research and argument as to how this needs to be articulated in future.

In this context, the observations made by the UNESCO International Commission on Education for the twentyfirst century (1996) are quite relevant. It “discussed the need to advance towards a ‘Learning Society’. The Truth is that every
aspect of life, both at the individual and social level, offer opportunities for both learning and doing. Better still, school should impart both the desire for, and pleasure in, learning, the ability to learn how to learn, and intellectual curiosity. One might even imagine a society in which each individual would in turn be both teacher and learner” (UNESCO, 1996). “Not only must it adapt to changes in the nature of work but it must also constitute a continuous process of forming whole human beings — their knowledge and aptitudes, as well as the critical faculty and ability to act. It should enable people to develop awareness to them and encourage them to play their social role at work and in the community” (ibid). Education is a deeper, more profound, undertaking than the hope, in the political entities that are schools serving a purpose in a democratic society. The UNESCO document (1996) spells out education along Four Fundamental Pillars of Education— Learning to Know, Learning to Do, Learning to Be, and Learning to Live Together. The investigator thought it well to develop new dimension of the study in the light of four fundamentals pillars of learning suggested by UNESCO. If cooperative learning could be used well in the educational system then it addresses each of these four elements.

The Commission further observed, ‘Formal education systems tend to emphasize the acquisition of knowledge to the detriment of other types of learning; but it is vital now to conceive education in a more encompassing fashion. Such a vision should inform and guide further educational reforms and policy, in relation both to contents and to methods’. It, therefore recommend Four pillars of learning as the principal focus of schooling which may be achieved best through cooperative learning.

Student-Teams Achievement Divisions and Jigsaw methods under cooperative learning improve the scores of students of the respective experimental groups in their Academic Achievement and Self-Concept and as such prove more meaningful and effective than the conventional methods of teaching and learning. At the end of experimental treatment the effects may be relatively small, even then it reflected significant differences on the measure of academic achievement and self-concept indicating that students in cooperative learning strategies out-performed those in the traditional methods of teaching.
This study is focused on the use of cooperative learning methods in the area of academic achievement and self-concept of seventh grade students at the elementary school stage to compare the effectiveness of the STAD and Jigsaw methods in teaching of mathematics vis-à-vis the traditional teaching methods. Thus, the fundamental variables of this study included:

(a) Learning method as specially cooperative learning methods such as Student-Teams Achievement Divisions (STAD) and Jigsaw
(b) The learning outcomes in terms of Academic Achievement
(c) Self-Concept, as stands for awareness of oneself as a human being and the important or significance of oneself in the role of life.

The present study retained five hypotheses out of the six namely:

- $H_1$, at the end of experimental treatment the group of students taught mathematics through Student-Teams Achievement Divisions (STAD) and Jigsaw methods under cooperative learning scores significantly higher mean on the academic achievement test than the group of students taught through traditional methods;
- $H_2$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under the cooperative learning shows a significantly higher mean gain score on the academic achievement test than the group of students taught through traditional method;
- $H_3$, there exists significant difference between STAD and Jigsaw methods on academic achievement of students;
- $H_4$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning method attains a significantly higher mean score on the test of Self-Concept than the group of students taught through traditional method; and
- $H_5$, at the end of experimental treatment the group of students taught mathematics through STAD and Jigsaw under cooperative learning methods shows a significantly higher mean gain scores on the test of Self-Concept than the group of students taught through traditional method, which proves
effectiveness of cooperative learning methods like STAD and Jigsaw over the traditional classroom teaching methods and processes.

It further shows that (H3) Jigsaw was found better than STAD to improve academic achievement in mathematics. It also revealed a few corollaries of H2 which are as follows:

- that both Jigsaw and STAD proved to be more significantly effective in raising the academic achievement of students than the traditional method;
- that Jigsaw proved to be more effective than the STAD in raising the academic achievement of students;
- that the Jigsaw proved to be the more effective than the traditional method in raising the academic achievement of students; and
- that the STAD proved to be more effective than the traditional method in raising the academic achievement of students.

The rejection of the hypothesis H6, shows that there existed no significant difference between STAD and Jigsaw methods in developing Self-Concept of students. H6 stands partially retained on the basis of better mean scores in favour of Jigsaw over STAD and partially rejected on ‘t’ scores. It does not show however, any controversy in the above results. It clearly indicates, on the other hand, similar significant effectiveness of STAD and Jigsaw in raising the Self-Concept of students. The results of the study do not, in any way, discard or undermine these techniques, nor was it the objective of the study, but it only shows that methods of cooperative learning as STAD and Jigsaw are quite crucial to the inculcation of values like living together, mutual sharing and understanding, and healthy cooperation rather than stark competition that narrows down the process of education to self-directed individualized learning. Quite significantly, both healthy cooperation as well as healthy competition complement and supplement each other in making the learning process tangible to sustainable human development. Therefore, both of them are obligatory in their own right to an effective schooling. They favourably compare in their effectiveness with different methods of cooperative learning vis-à-vis the conventional teaching methods and programmes.
Indeed it has been the growing demand of the fast changing educational scenario today, making schooling a playful endeavour for all practical and methodological purposes of sustainable development and joyful learning, especially at the elementary school level.

7.15 **EDUCATIONAL IMPLICATIONS**

The present research offers many an implication for parents, teachers, guidance workers and all educational stakeholders and even administrators. Parents need to identify the latent talents and potentialities of their wards being their first mentors of the child in her most impressionable period of development as an infant and early childhood before putting the child in the four walls of the formal schools; and also to actively participate and cooperate with school teachers for wholesome and sustainable development of the child as a joint and shared responsibility of the parents and school authorities. They should inspire the children to develop self-confidence and self-concept better which, in turn, would lead to better academic achievement.

Teachers in the classroom confront with different potentialities, attitudes, aptitudes, propensities and academic abilities of the students coming from the different areas, class, caste and economic status. It is responsibility of teachers and the school system especially to provide congenial environment for meaningful development of every child in terms of various life skills like building self-confidence, self-respect, interpersonal skills and social relationships etc. as part of the schooling process, besides imparting the knowledge and skills of learning the academic context as well as the incumbent practices.

The present study clearly shows that changing from a traditional competitive classroom to cooperative settings does not diminish student’s achievement; in fact, it significantly improves their academic achievement in mathematics as also their self-concept in a cooperative learning environment. In that way, cooperative learning improves student perception about learning and decrease the feeling of alienation also that groups of students taught through STAD, Jigsaw methods of cooperative learning and shows higher gain scores on academic achievement and self-concept in comparison to traditional method of teaching, which conveys that cooperative
learning reduced individual differences, enhances self-concepts and enables all type of students to perform better. It highlights the comparative merits of the cooperative learning methods vis-à-vis traditional classroom teaching, on the one hand and their intra-merits on the other. It does not counter any method but only seeks an ambitious amalgam of all methods and techniques of teaching in the school to promote educational excellence all round development of children put to their charge. Teachers, Teachers educators and indeed the system as such need to be fully awake about their role models and duties per se. An insight into pedagogy both traditional as well as the emergent, developed over a period of time- goes a long way in boosting the spectrum of schooling in a wholesome and holistic way. Hence, the need for innovative pedagogies all the while.

In the present study, groups were intimately rewarded based on their members’ learning and also students were expected and made individually accountable for their academic performance. Thus, a positive effect on students’ self-concept and academic achievement in Mathematics was found to be there to suggest the usefulness and effectiveness of cooperative learning for improving their academic achievement and also their self-concept. Any study of multifaceted programme leaves many questions unanswered and this one seems to be no exception. Perhaps the most evident question revolved around the relative impact of each of the methods, that is, STAD and Jigsaw under cooperative learning in producing the various effects on achievement and students’ self-concepts. It was found that cooperative learning methods like STAD and Jigsaw proved to be more tangible in its effectiveness on achievement and self-concepts between students and peers as also with teachers than the traditional classroom approach which has remained by and large teacher-oriented than students-initiated, in any way, since its inception in the hoary past in human history. Despite its being too old and on its last legs, as some people do believe under the heavy weight of imminent ICT, the fact still remains that the sinews of the traditional pedagogy are so strong that no new pedagogical technology whatsoever can overthrow or ignore it to be successful in itself. No pedagogy can ever exist sans teacher-taught interaction and close-knit relationship between them. Cooperative learning proves to be practical and widely acceptable to students. When students are
not able to understand teacher’s explanation, group members including peers are able to explain and communicate in simpler words that are more easily understood.

The merits of a few other sundry cooperative learning inputs and their implications for educational purposes could be gauged on the basis of observations like the following.

- Cooperative learning methods like STAD and Jigsaw have shown different ways of instructional arrangement which can be used to foster active student learning, which shows an important dimension of mathematics learning. Students can be given tasks to discuss, solve problem and accomplish quizzes, riddles and puzzles.

- Cooperative learning teachers/facilitators, instead of dealing with so many students simultaneously in the class; deal with small groups of students and group facilitators; that saves a lot of time and energy to devote to planning and initiating cooperative learning projects and programmer.

- Cooperative learning suggests a new role for the teacher. A teacher, accustomed to being the sole source of information for teaching the passive learners in the classroom has to change to be a facilitator in the learning process to actively encourage the student to:
  - Help each other and learn from each other.
  - Participate in discussions.
  - Facilitate each others’ learning.
  - Engage in problem solving in a free democratic way.
  - Structure the lessons and curriculum cooperatively.

- The study suggests that teachers can use cooperative learning activities to provide students with opportunities to practice newly introduced or to review skills and concepts.

- Sometimes students explain things to each other better than a teacher can do to an entire class of students. This usually results in better retention of the learnt material.
The study shows that students make connections between the concrete and abstract level of instruction through peer integration and carefully designed activities.

The study has important implications for teacher education. Given the current wide-spread use of cooperative learning at various levels, it is imperative that pre-service teachers understand how to structure and monitor meaningful learning experiences for students.

The present study suggests that mathematics is conceptually dense having its own language. Cooperative learning can be used to promote classroom discourse and oral language development of concepts, connotations and symbols. In cooperative learning activity, mathematics vocabulary and symbolic understanding can be facilitated with peer interactions.

The study shows that students today seem to have a much shorter attention span than they did years ago. With cooperative learning used on regular basis, they are less likely to become restless or misbehave during a teacher-directed part of a lesson since they know they will have time in groups.

The study tells that teacher should design activities to promote mathematics understanding by having students practice, manipulate reason and solve problem. For example, learn algebraic formulae and apply them to solve equation together helping each other in mathematical constructions, solve word problems related to daily life etc.

The study shows that shy students are more likely to ask and answer question in a group setting. The same is true for low-skills students.

The study interprets that today’s job market is looking for people with good interpersonal skills, high self-concepts and problem solving skills. Regular participation in cooperative learning activities can help them develop these skills. Important skills such as critical thinking, creative problem solving and the synthesis of knowledge can easily be accomplished through cooperative group activities an inclusive cooperative learning classroom.

Meaningful content in cooperative lessons is critical for the success of all students. For students to succeed within their groups, careful consideration
regarding group heterogeneity must be in conjunction with roles that ensure active and equal participation.

- Students in heterogeneous classroom team try to solve complex cognitive tasks and the progress of the lower achieving students does not occur at the expense of the higher achievers or vice versa. So, cooperative learning is recommended for fostering students’ reasoning and communication.

### 7.16 SUGGESTIONS FOR FURTHER RESEARCH

No research can say any final word on a problem because it is very difficult for a researcher to touch all the complex aspects of a problem that demands probing. In light of findings and conclusions of the study, the following few suggestions for further research in this area of study may not be out of place. Some of these can be enumerated as:

- The present study examined only the academic achievement and self-concept of students in Mathematics. Further studies may be conducted to investigate the effectiveness of cooperative learning for other dependent variables, such as attitude towards subjects, self-esteem, peer relation, social skills and academic motivation for different subjects.

- The studies can also be conducted to compare the different cooperative learning methods with other methods of instructions at different grade levels.

- Similar studies can also be conducted in other subjects like languages, Social Science, etc.

- There is a need to explore the relation of cooperative learning with other emotional and motivational variables.

- A study can also be conducted to compare and explore how cooperative learning methods affect the students of various abilities on cognitive, emotional and motivational dimensions; as well as on cognitive and non-cognitive dimensions of the high achievers, average and low achievers.

- The study can be repeated to compare the effectiveness of various strategies under cooperative learning in different situations like – rural, urban, male, female students and mixed genders at different levels, which may be elementary, secondary, higher secondary or university level of education.
A study needs to undertaken on a larger sample, and for a longer durations to examine the effects so that results can be confirmed better on non-cognitive variable like social skills or some other personality variable which take more time to bring about a change.

A comparative study is needed to analyze the effect of different cooperative learning methods on special groups of children such as the gifted, the learning disabled and other handicapped students in cognitive and non-cognitive domains.