CHAPTER IV

ANALYSIS, INTERPRETATION AND RESULTS

Cooperation isn't the absence of conflict but a means of managing conflict.

— Deborah Tannen —
CHAPTER IV

ANALYSIS, INTERPRETATION AND RESULTS

4.1 Introduction:

The research design used in the present study was the multi method research design to find out the effect of cooperative learning teaching strategy on the achievement of pre service teachers. The data collected in this study used three methods i.e. Survey, Product Development and Experimental Methods.

Mixed Methods Research has been followed in this study as both qualitative and quantitative data were collected and analysed. Qualitative Data was collected using the Survey and was analysed using qualitative method of data analysis following the grounded theory approach. Quantitative data was gathered through the survey and experimental method which was then statistically analysed for interpretation. The data obtained from the experiment was analysed using SPSS and has been presented in the forms of tables, figures and graphs. Chapter IV gives the details of the analysis and interpretation of both the qualitative and quantitative data leading to the results of the study.

4.2. Quantitative Analysis of Data for Objective 1

Objective 1: To explore the views of teacher educators regarding cooperative learning teaching strategies and find out if they use these strategies while teaching the subject ‘Psychology of Development and Learning’ to pre service teachers.

4.2.1. Method: Survey – Base line survey.
4.2.2. Population: All teacher educators teaching Paper II ‘Psychology of Development and Learning’ in Teacher Education colleges affiliated to Savitribai Phule Pune University formerly the University of Pune.

4.2.3. Sampling Method: Purposive Sampling

4.2.4. Sample Size: 53 Teacher Educators teaching Paper II ‘Psychology of Development and Learning’ in Teacher Education colleges affiliated to Savitribai Phule Pune University formerly the University of Pune in Pune City.

The Survey questionnaire contained a total of 14 items of which 6 items were close ended items. The remaining 8 items were open ended items (APPENDIX A). The quantitative data obtained from the close ended items were analysed using percentage. The quantitative analysis has been presented in table 4.1

**TABLE 4.1**

Analysis of the responses regarding the views of the Teacher educators about Cooperative Learning (close ended items)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Item</th>
<th>Yes (%)</th>
<th>No (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I am willing to use cooperative learning teaching techniques in my teaching.</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Cooperative learning teaching techniques will help me to keep students active in the class.</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Cooperative learning teaching techniques will improve the performance of students in exams.</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>4.</td>
<td>A Teacher’s Handbook will help me in using cooperative learning teaching techniques.</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>Cooperative learning teaching techniques will be useful to cater to students with diverse needs.</td>
<td>77</td>
<td>23</td>
</tr>
<tr>
<td>6.</td>
<td>I am confident and feel well equipped to use cooperative learning teaching techniques in my classroom.</td>
<td>28</td>
<td>72</td>
</tr>
</tbody>
</table>
Observation:

The above table shows that all the teacher educators were willing to use cooperative learning teaching techniques and were keen on a Teacher’s Handbook to help them out with it. 92% of the teacher educators or professors opined that cooperative learning teaching technique will help them keep the students active in the class. However a majority of 72% of them were not confident and showed their apprehension of using cooperative learning teaching strategy as they felt they were not equipped to conduct these techniques in the classroom.

Interpretation:

The teacher educators or professors have a favourable opinion about using cooperative learning teaching techniques, but are not confident in using them as they feel they are not well equipped to use the techniques in the classroom.

4.2.5. Qualitative Analysis of the Survey Questionnaire:

The survey consisted of 14 items of which 8 were open ended items. Items or Questions 12 and 14 were divided into two subparts each. Qualitative data was thus obtained from the open ended questions. The systematic procedure developed by Strauss and Corbin (1990, 1998) for the Grounded theory approach was used to analyse the qualitative data collected through the survey.

Grounded theory is best defined as a research strategy to generate theory from data (Punch, 1998). When grounded theory is used, it is mainly because the researcher goes to the research literature and finds that little knowledge about this research topic
exists (Grams, 2001; Corrine & Alan, 1992; Eisner, 1991). Grounded theory generates a theory when existing theories do not address the research problems. The researcher follows the three stages of grounded theory data analysis: open coding, axial coding and selective coding (Strauss & Corbin, 1990).

- **Open Coding** –
  
  This is the first stage in data analysis. Here the researcher identifies concepts and discovers the properties and dimensions of the data through line by line analysis (Strauss & Corbin, 1998). It is the process of labelling important words and phrases in the transcribed data. The researcher labels the data to generate conceptual categories for use in theory building and to expose theoretical possibilities in the data (Punch, 1998).

- **Axial Coding** –
  
  After open coding the researcher moves towards axial coding. In this second stage the researcher develops the concepts into categories (slightly more abstract concepts) and organises the categories to see what kind of things (themes) the particular participants mentioned many times across the responses. It is the part of analytical process in which the researcher puts the parts of the data identified and separated in open coding back together to make connections between categories (Mertens, 1998; Glaser, 1978).

- **Selective Coding** –
  
  Selective coding is the third stage in grounded theory analysis. Punch (1998) states that “selective coding is aimed at developing the abstract, condensed, integrated and grounded picture of the data” (p. 217). It involves the process of selecting one,
main core category (story line) and relating the other categories to it. The researcher integrates and refines the theory by organizing categories around a central explanatory concept (Strauss & Corbin as cited by Qui, 2010)

The analysis of the responses by the teacher educators obtained from the researcher made questionnaire has been analysed using the three stages of the Grounded Theory Approach. The responses were first subjected to ‘Open Coding’ where the data was organised into broad ‘categories’ using colour coding (APPENDIX E). These categories were then connected to form ‘themes’ using ‘Axial Coding’ for each item given in the questionnaire. Finally all the themes were integrated to form a ‘theory’ using ‘Selective Coding’. The open ended questions consisted of items starting from no. 7 to item no. 14. The qualitative analysis has been presented in the form of figures as follows according to the items given in the questionnaire:
7. Teaching strategies followed by the teacher educators while teaching Educational Psychology:

**FIGURE 4.1 Responses about the teaching strategies followed while teaching Educational psychology**

**Observation:**

All the responses were put into three categories: ‘Traditional teaching’, ‘Constructive teaching’ and ‘Technology based teaching’. Figure 4.1 shows that majority of the teacher educators mentioned that they used constructive strategies along with traditional teaching strategies while teaching Educational Psychology. Some of them also made use of Micro Soft Power Point Presentations while teaching. The theme that emerged through Axial Coding was ‘The teacher educators use constructive teaching strategies along with traditional teaching strategies while teaching Educational Psychology.’
8. Teacher educators’ know-how about cooperative learning strategies:

![Diagram showing theoretical aspects, teacher's role, and student's role in cooperative learning strategies.]

**Observation:**

The categories used to label the responses were the knowledge about the teacher educators regarding the ‘Theoretical aspects’, ‘Teacher’s role’ and the ‘Student’s role’ in cooperative learning teaching strategies. Categorisation of the responses shown in figure 4.2 clearly indicates the theme (using Axial Coding) that majority of the ‘teacher educators knew more about the theoretical aspect of cooperative learning’.

**FIGURE 4.2 Responses to what the professors know about cooperative learning**
9. Cooperative learning strategy used by the teacher educators in educational psychology class:

![Diagram showing cooperative learning strategies]

**FIGURE 4.3 Responses regarding the cooperative learning teaching strategies used**

**Observation:**

The responses given were the teaching strategies used in class by the respondents while teaching Educational Psychology. These responses were categorised into three categories namely ‘Not used’, ‘Pair work’ and ‘Group Work’. As seen from figure 4.3 the theme that emerges (using Axial Coding) is that the teacher educators mainly used group work than pair work during their classroom teaching. Furthermore it is seen that they were not much aware of the different types of pair work (Think-Pair-Share mentioned by most of them) and group work activities which are a part of cooperative learning teaching strategies.
10. Teaching strategies used by the teacher educators to teach the subunit on Cooperative and Collaborative Learning:

**FIGURE 4.4 Responses regarding the teaching strategies used to teach the subunit on cooperative and collaborative learning.**

**Observation:**

The respondents provided a number of teaching strategies that they used to teach the subunit on cooperative and collaborative learning. These strategies have been categorized into ‘Cooperative Learning strategies’ and ‘Other Techniques or Strategies’. The figure 4.4 shows the theme (using Axial Coding) that the teacher educators used a variety of other teaching strategies as compared to using cooperative learning teaching strategy for teaching the subunit on cooperative and collaborative learning. It can also be noted that Think-Pair-Share was the only pair work strategy used by the respondents although there are many types of pair work as cooperative learning techniques.
11. Different experience the teacher educators have while using Cooperative Learning as compared to traditional lecture:

**FIGURE 4.5** Responses regarding the experience of the teacher educators while using cooperative learning as compared to traditional lecture.

**Observation:**

The experience of the respondents using cooperative learning as compared to traditional lectures were very positive and highlighted the benefits of using cooperative learning as a teaching strategy. Hence the responses were divided into five categories: ‘Cognitive benefits for students’, ‘Social benefits for students’, ‘Emotional benefits for students’, ‘Benefits for the teacher: Personal’ and ‘Benefits for the teacher: In the teaching learning process’. Figure 4.5 shows that the respondents opined that ‘the use of cooperative learning teaching strategy had a lot of social and cognitive benefits for students. In addition they felt that it was also beneficial for the teacher for improving the teaching and learning process.’ This was the theme that emerged from Axial Coding.
12 (a) The benefits of using cooperative learning strategy for teachers:

**Figure 4.6 Reponses regarding the benefits of using cooperative learning for teachers**

**Observation:**

The responses for the benefits of using cooperative learning for teachers were organized to three main categories benefits related to: ‘Pedagogy’, ‘Rapport with Students’, ‘Gaining Knowledge’. Though rapport with students can be integrated with pedagogy, however as there were a number of responses which mentioned the student teacher rapport it was considered as a separate category. The figure 4.6 indicates that the
respondents found cooperative learning beneficial for teachers. The theme that emerged from Axial Coding from the teacher educators’ responses showed that teachers benefit by using cooperative learning teaching strategy as it improves their pedagogy in the classroom teaching learning process.

12 (b) Benefits of using Cooperative Learning strategy for students:

**FIGURE 4.7** Responses regarding the benefits of using cooperative learning for students

**Observation:**

The respondents gave a number of benefits of using cooperative learning for students. As seen in figure 4.7 the benefits were categorized into five categories: ‘Cognitive benefits’, ‘Affective benefits’, ‘Beneficial for Communication Skills’,
‘Beneficial for Social Skills’ and ‘Benefits – promotes active learning’. As the responses were equally divided in each category it can be inferred that the respondents opined that learners benefit in all the above mentioned categories when cooperative learning is used as a teaching strategy. Thus through Axial coding the theme that emerged was that ‘Learners benefit regarding all aspects i.e. cognitive development, affective development, improvement in communication and social skills as active learners.

13. Problems one might encounter in the classroom when using cooperative learning strategy:

![Figure 4.8 Responses regarding the problem that might be encountered while using cooperative learning teaching strategy in classroom teaching.](image)

**Observation:**

The respondents were aware of the problems that they might encounter while using cooperative learning teaching strategy. These were divided into four categories:
Problems related to – ‘Management of classroom activities’, ‘Behavioural Management’, ‘Management of physical resources’, ‘Time management’. Figure 4.8 highlights that the theme (Axial Coding) emerging from the responses was that ‘Management of classroom activities’ and ‘behaviour of students’ as the main problems that teachers may encounter while using Cooperative learning teaching strategies.

14. a. Use of a Teacher’s Handbook on conducting cooperative learning techniques at the pre service level:

![FIGURE 4.9 Responses to the usefulness of a Teacher’s Handbook on conducting Cooperative Learning techniques at the Pre Service Level]
Observation:

The respondents were asked how a Teacher’s Handbook on conducting cooperative learning techniques at pre service level will be useful. These responses were arranged into three categories: ‘Theoretical Utility’, ‘Provide Guidelines’ and ‘Practical Utility’. From the figure 4.9 signifies (Axial Coding) that ‘The hand book will be useful during actual implementation of the Cooperative Learning techniques’.

14 (b) Contents to be included in the Handbook:

FIGURE 4.10 Responses regarding the contents to be included in the Teacher’s Handbook.

Discussion:

The respondents have given suggestions regarding the content to be included in the Teacher’s Handbook on conducting cooperative learning. Figure 4.10 shows the responses were organized into four main categories: ‘Implementation’, ‘Theoretical
Aspects’, ‘Lesson Notes’ and ‘Learning Resources’. Using Axial Coding the theme that arose from the responses was that ‘The teacher educators wanted the Handbook to include more material regarding actual implementation of the cooperative learning techniques’. This response matches with their previous responses which indicated that they had more theoretical knowledge than practical knowledge of cooperative learning. The responses regarding the usefulness of the Handbook and suggestions regarding the inclusion of material regarding the implementation of cooperative learning also indicates the respondents’ willingness to learn more about cooperative learning teaching strategies.

The axial coding or themes were then converted into a theory using the selective coding. This was the final step in the grounded theory for analyzing the qualitative data obtained from the teacher educators through their responses given in the questionnaire. Figure 4.11 shows the process and the final theory reached by the researcher using the grounded theory, which was relevant for the next phase of the research.
7) The teacher educators use constructive teaching strategies along with traditional teaching strategies while teaching Educational Psychology.

8) Teacher educators know more about the theoretical aspect of Cooperative learning teaching strategy.

9) Teacher educators use more of group work than pair work during their classroom teaching and are not much aware of the different types of pair work and group work activities.

10) The teacher educators use more of other teaching strategies as compared to using Cooperative Learning teaching strategy.

11) They have experienced that the use of Cooperative Learning techniques has social and cognitive benefits for students and benefits the teachers as it improves the teaching learning process.

12 a.) The use of Cooperative Learning teaching strategy benefits Teachers as it improves their pedagogy in the classroom teaching learning process.

12 b.) Learners benefit regarding all aspects i.e. cognitive development, affective development, improvement in communication and social skills as well as become active learners.

13) Management of Classroom activities and behaviour of students are the problems that teachers may encounter while using Cooperative learning teaching strategies.

14. a) The hand book will be useful during actual implementation of the Cooperative Learning techniques.

14. b) The Teacher educators wanted the hand book to include more material regarding actual implementation of the Cooperative Learning techniques.

The Teacher Educators are aware of the theoretical aspects of cooperative learning and acknowledge its benefits, but rarely use the cooperative learning techniques as they are apprehensive due to their insufficient practical knowledge of implementing them, however are willing to learn them.

FIGURE 4.11 ‘Axial Coding’ and ‘Selective Coding’ of the qualitative data.
After analysing the responses using the ‘axial coding’ the data was put into ‘themes’. Figure 4.11 shows the ‘themes’ generated and the ‘final theory’ reached by the researcher using the ‘selective coding’ phase in Grounded theory. The final theory indicates the teacher educators knew about the theoretical aspects of cooperative learning but hesitated in using it in their classrooms. Their responses showed that this hesitation could be because they did not have sufficient practical knowledge in implementing cooperative learning teaching techniques. However they were prepared to learn how these techniques can be implemented in classrooms. This indicated a need for training in using cooperative learning techniques in teacher education.

4.3. Diagrammatic representation of the Product which is the Programme presented in a form of a Teacher’s Handbook based on Cooperative learning related to Objective 2.

Objective 2: To develop a programme based on the teaching strategy using cooperative learning for teaching Paper II Section I of the subject ‘Psychology of Development and Learning’ to pre service teachers.

The details regarding the procedure of the product developed i.e. the Teachers Handbook for Cooperative Learning (APPENDIX F) has been given in Chapter III.
FIGURE 4.12 The components of the Product developed through this research

4.4. Quantitative Analysis and Interpretation of Data for Objective 3.

Objective 3: To find out the effectiveness of the teaching strategy

4.4.1. Method: Experimental Method

4.4.2. Population and Sample: English Medium preservice teachers form Teacher Education Colleges in Pune City affiliated to Savitribai Phule Pune University formally the University of Pune

The sample consisted of English medium pre service teachers of Adarsha Comprehensive College of Education & Research, (ACCER) Pune as the experimental group and for the control group English medium pre service teachers of Tilak College of Education, Pune was selected.

4.4.3. Raven’s Progressive Matrices:

Raven’s Progressive Matrices was used to equate the two groups.
The Raven’s Progressive Matrices scores obtained by the experimental group and control group (APPENDIX K) were tested for Normality. It was tested using the criteria given by George and Mallery (2001) that states if the skewness and kurtosis values lie between \( \pm 1.96 \) then the data can be considered as normally distributed.

The Descriptive Statistics along with the skewness and kurtosis values for the score obtained experimental and control group on the Raven’s Progressive Matrices have been shown in the following table:

**TABLE 4.2**

Descriptive Statistics and the Test of Normality for both the groups

<table>
<thead>
<tr>
<th>Description</th>
<th>Raven’s Progressive Matrices</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Experimental Group</td>
<td>Control Group</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>68</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>50.24</td>
<td>50.34</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>4.52</td>
<td>4.89</td>
<td></td>
</tr>
<tr>
<td>Skewness</td>
<td>.034</td>
<td>-.07</td>
<td></td>
</tr>
<tr>
<td>Std. Error of Skewness</td>
<td>.291</td>
<td>.299</td>
<td></td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-.604</td>
<td>-.789</td>
<td></td>
</tr>
<tr>
<td>Std. Error of Kurtosis</td>
<td>.574</td>
<td>.590</td>
<td></td>
</tr>
<tr>
<td>Z score of Skewness</td>
<td>.15</td>
<td>.23</td>
<td></td>
</tr>
<tr>
<td>Z score of Kurtosis</td>
<td>1.05</td>
<td>1.34</td>
<td></td>
</tr>
</tbody>
</table>
Observation:

The z scores of Skewness and Kurtosis for the Raven’s Progressive Matrices obtained from both the experimental group and control group are given in the table 4.1. This has been obtained by dividing the Skewness value with the Standard Error (SE) of Skewness and the Kurtosis values with the Standard Error of Kurtosis respectively. The z value of Skewness for the experimental group is .15 and for the control group is .23. The z value of Kurtosis for the experimental group is 1.05 and for control group is 1.34.

Interpretation:

The z values for both Skewness and Kurtosis are within the range of ± 1.96. As the values are within the threshold it can be concluded that the sample is approximately normally distributed (Cramer, 1998; Cramer & Howitt, 2004; Doane & Seward, 2011).

FIGURE 4.13 Histogram depicting the distribution of the scores of the Raven’s Progressive Matrices obtained by the Experimental Group showing normality.
FIGURE 4.14 Histogram depicting the distribution of the scores of the Raven’s Progressive Matrices obtained by the Control Group showing normality.

Observation:

Both the above figures i.e. Figure 4.13 and Figure 4.14 show that both the experimental group and control group are approximately normally distributed.

FIGURE 4.15 Box Plot depicting the distribution of the scores of the Raven’s Progressive Matrices obtained by the Experimental Group.
FIGURE 4.16 Box Plot depicting the distribution of the scores of the Raven’s Progressive Matrices obtained by the Control Group.

Observation:

The figures 4.15 and 4.16 show the Box plots of the scores of the Raven’s Progressive Matrices obtained from the experimental group and the control group respectively. Both the figures show that there are no outliers.

Interpretation:

The Box plots indicate the homogeneity in scores for both experimental and control groups. No extreme scores are visible. Therefore the data fulfils the assumptions of normality and hence the data is subjected to parametric statistics.

The Independent Samples t-test was used to find out if there was a significant difference in the scores obtained by the experimental group and control group on the Raven’s Progressive Matrices. The t value has been given in table 4.3
### TABLE 4.3

**Group Difference in Raven’s Progressive Matrices**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group</th>
<th>Experimental Group</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Raven’s Progressive Matrices</td>
<td>50.34</td>
<td>4.89</td>
<td>50.24</td>
</tr>
</tbody>
</table>

**Observation:**

The t value obtained as seen in Table 4.3 is .13 which is less than 1.96 and 2.58, the critical values required to reach 5% and 1% levels of significance respectively.

**Interpretation:**

Thus we can conclude that there is no significant difference between the mean scores of the experimental group and control group on their Raven’s Progressive Matrices scores. This further shows that the two groups are equated and are not significantly different at the beginning of the experiment.

**4.4.4. Achievement Test: MANOVA**

The one way Multivariate Analysis of Variance (one-way MANOVA) is a generalisation of analysis of variance that allows the researcher to analyse more than one dependent variable (Bray & Maxwell, 1985). In the present study the dependent variable i.e. the achievement scores of the experimental group and control group had been categorised into three correlated dependent variables – learning objectives, types of questions and units. They have been shown in Figure 4.17.
FIGURE 4.17 The correlated Dependent Variables in the study

Thus MANOVA was used for the analysis of the achievement scores of the subcategories of the dependent variable.

Levene's test (Levene, 1960) is used to test if samples have equal variances across samples, which is called homogeneity of variance (Engineering Statistics, 2012). The values obtained through the Levene's Test of Equality of Error Variance were all more than 0.05 level of significance (p > 0.05) indicating the samples have equality in variances. Hence based on the series of Levene’s F tests, the homogeneity of variance assumption was considered satisfied. Thus MANOVA can be computed as the assumption of equal variances was not violated.

Table 4.4

Wilk’s Lambda Test Values

<table>
<thead>
<tr>
<th>Value (λ)</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>sig</th>
<th>Partial Eta squared (η²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.564</td>
<td>10.809</td>
<td>8</td>
<td>112</td>
<td>.0</td>
<td>.436</td>
</tr>
</tbody>
</table>

Observation:

As seen from table 4.4 the transformation of Wilk’s Lambda test provided $F (8, 112) = 10.81, p < .001; \text{Wilk’s } \lambda = 0.564, \text{partial } \eta^2 = .44.$
Interpretation:

The F value is significant at .001 indicating statistically significant difference between the experimental and control group. As the Wilk’s $\lambda$ value is 0.56 which close to 0 and less than 1 means that the difference between the mean scores on the achievement test obtained by the experimental group and control group is not likely due to change and are probably due to the Independent Variable i.e. Intervention programme. The Partial eta square ($\eta^2$) indicates the effect size. The Effect size can be interpreted with the help the guidance by Cohen (1992) small ($\eta^2 = .01$), medium ($\eta^2 = .09$), and large, ($\eta^2 = .25$) effects. Hence the partial $\eta^2$ value of .44 indicates a large effect size of the intervention programme on the differences in the achievement of the experimental and control group.

**TABLE 4.5**

Group Differences on achievement test. (MANOVA)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total</th>
<th>Experimental</th>
<th>Control</th>
<th>F</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Total Achievement</td>
<td>30.68</td>
<td>7.88</td>
<td>34.60</td>
<td>6.21</td>
<td>26.41</td>
</tr>
<tr>
<td>Objective questions</td>
<td>12.44</td>
<td>2.91</td>
<td>13.92</td>
<td>2.37</td>
<td>10.83</td>
</tr>
<tr>
<td>Short answers</td>
<td>13.09</td>
<td>3.93</td>
<td>14.43</td>
<td>3.40</td>
<td>11.64</td>
</tr>
<tr>
<td>Essay type questions</td>
<td>5.15</td>
<td>2.74</td>
<td>6.25</td>
<td>2.27</td>
<td>3.95</td>
</tr>
<tr>
<td>Knowledge Objective</td>
<td>10.02</td>
<td>2.35</td>
<td>11.08</td>
<td>2.14</td>
<td>8.88</td>
</tr>
<tr>
<td>Comprehension Objective</td>
<td>12.40</td>
<td>3.96</td>
<td>13.86</td>
<td>3.31</td>
<td>10.81</td>
</tr>
<tr>
<td>Application Objective</td>
<td>8.26</td>
<td>2.99</td>
<td>9.67</td>
<td>2.19</td>
<td>6.72</td>
</tr>
<tr>
<td>Unit 1</td>
<td>1.91</td>
<td>.91</td>
<td>2.33</td>
<td>.80</td>
<td>1.45</td>
</tr>
<tr>
<td>Unit 2</td>
<td>8.58</td>
<td>3.44</td>
<td>9.62</td>
<td>3.22</td>
<td>7.45</td>
</tr>
<tr>
<td>Unit 3</td>
<td>3.29</td>
<td>1.08</td>
<td>3.70</td>
<td>.98</td>
<td>2.84</td>
</tr>
<tr>
<td>Unit 4</td>
<td>16.90</td>
<td>4.71</td>
<td>18.95</td>
<td>3.83</td>
<td>14.67</td>
</tr>
</tbody>
</table>

Note: * P < 0.05 ** P < 0.01.
Observation:

Table 4.5 shows the descriptive statistics and MANOVA for the analysis of the performance of both experimental group and control group. A multiple univariate F test was carried out to find out if there was a significant difference in the scores obtained by the experimental group and control group. The F values are significant.

The partial eta square was computed to find out the effect size. 'Effect size' is simply a way of quantifying the size of the difference between two groups (Coe, 2002). Effect size can be interpreted with the help the guidance by Cohen (1992) small (η² = .01), medium (η² = .09), and large, (η²= .25) effects. From table 4.5 it is observed that the effect size is between medium and large across the types of questions, types of learning objectives and different units. The partial eta square for the total achievement is η²=.27.

Interpretation:

The MANOVA results showed that there were statistically significant differences between the achievement test scores of both experimental and control group. All the F values are significant and more than $P <0.01$ hence the null hypothesis is rejected and there was statically significant difference between the achievement of the experimental and control group. The difference is significant at various levels, where the items of the questionnaire has been categorised into question types, learning objectives and units. The partial eta square value for the total achievement test also indicates a large effect of the intervention programme on the achievement of the experimental group as compared to the control group. Hence the intervention programme based on cooperative learning is effective for teaching pre service teachers.
FIGURE 4.18 Mean scores of Experimental group and Control group according to types of questions.

Observation:

The questions in the achievement test or post-test were categorized according to the types of questions for analysis (APPENDIX L). The graphs indicate that the mean scores of the experimental group is higher than that of the control group for all types of questions i.e. objective type, short answers and essay type questions.
FIGURE 4.19 Mean scores of Experimental group and Control group according to types of learning objectives.

Observation:

The graphs indicate that the mean scores of the experimental group are higher than that of the control group for all types of teaching learning objectives – knowledge, comprehension and application objectives (APPENDIX M).
FIGURE 4.20 Mean scores of Experimental group and Control group according to the units of the paper.

Observation:

Section I of the paper ‘Psychology of development and learning’ consisted of four units. The graphs indicate that the mean scores of the experimental group are higher than that of the control group for all units given in the concerned paper (APPENDIX N).
FIGURE 4.21 Mean scores on the total Achievement test or post-test of Experimental group and Control group.

Interpretation:

Figures 4.18 to 4.21 shows that the Experimental group scored higher mean scores than those of the Control group irrespective of the types of questions, learning objectives and units covered in the paper. Therefore the mean scores also show the same. The mean score of the Experimental group of pre service teachers is higher than that of the Control group on the total Achievement test or post-test (APPENDIX O).

4.5. Analysis and Interpretation of Data for Objective 4

Objective 4: To gather and analyse the feedback from Neutral Observers and the pre service teachers of the Experimental Group regarding the intervention programme and link it with the researcher’s reflections.

4.5.2. Population and Sample/ Informants:

Informants: Neutral Observers who were teacher educators (APPENDIX R) observed while the Intervention Programme was being conducted.

Sample: 68 Pre service Teachers of the Experimental Group

Informant: Researcher

4.5.3. Quantitative Analysis of responses from Neutral Observers:

The observation sheet for the neutral observers consisted of both close ended and open ended items (APPENDIX G). The data obtained from the 24 close ended items were analysed using percentage. The questionnaire consisted of a four point rating scale where 1 – (SD) strongly disagree; 2 – (D) disagree; 3 – (A) agree and 4 – (SA) strongly agree. The qualitative data obtained from the 2 open ended questions was analysed using the grounded theory approach of analysing qualitative data.

TABLE 4.6

Responses of the Neutral Observers (in percentage) regarding the teaching aspect of the intervention programme

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Items</th>
<th>1 (SD) (%)</th>
<th>2 (D) (%)</th>
<th>3 (A) (%)</th>
<th>4 (SA) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Teaching</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Teacher was well prepared for the session.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>2.</td>
<td>The cooperative learning technique was selected appropriately according to the objectives of the unit.</td>
<td>0</td>
<td>0</td>
<td>23</td>
<td>78</td>
</tr>
<tr>
<td>3.</td>
<td>The techniques were appropriate for learning the concepts.</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Item No.</td>
<td>Items</td>
<td>1 (SD) (%)</td>
<td>2 (D) (%)</td>
<td>3 (A) (%)</td>
<td>4 (SA) (%)</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>4.</td>
<td>Goals of each group were clearly stated.</td>
<td>0</td>
<td>0</td>
<td>33</td>
<td>68</td>
</tr>
<tr>
<td>5.</td>
<td>Teacher supervised and monitored the groups during the activities.</td>
<td>0</td>
<td>0</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>6.</td>
<td>The program was properly developed and implemented by the staff member.</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td><strong>80</strong></td>
</tr>
<tr>
<td>7.</td>
<td>The Cooperative Learning techniques used gave scope to the teacher for evaluating the students.</td>
<td>0</td>
<td>0</td>
<td><strong>43</strong></td>
<td><strong>58</strong></td>
</tr>
<tr>
<td>8.</td>
<td>Changing group members helped maintain heterogeneity</td>
<td>0</td>
<td>0</td>
<td>48</td>
<td>53</td>
</tr>
<tr>
<td>9.</td>
<td>Teacher gave additional inputs wherever necessary.</td>
<td>0</td>
<td>0</td>
<td>45</td>
<td>55</td>
</tr>
</tbody>
</table>

**Observation:**

All the neutral observers strongly agreed that the teacher was well prepared for the respective sessions. A large majority i.e. 80% of them also opined that the program was properly developed and implemented by the teacher. Further 78% of the neutral observers strongly agreed that the cooperative learning technique selected was appropriate according to the objectives of the units. 70% of the neutral observers also agreed that the techniques were appropriate for learning the concepts. More than half i.e. 58% of them agreed that the cooperative learning techniques used gave scope to the teacher for evaluating the students. This signified the presence of the cooperative learning element namely ‘**Group Processing**’. Not a single neutral observer selected the strongly disagree (SD) or disagree (D) for any of the items.

**Interpretation:**

The neutral observers gave a positive feedback regarding the teaching aspect namely – lesson preparation, establishing link between objectives, content and
cooperative learning techniques; and evaluation of the students during the implementation of the intervention programme.

**TABLE 4.7**

Responses of the Neutral Observers (in percentage) regarding the learning aspect of the intervention programme

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Items</th>
<th>1 (SD) (%)</th>
<th>2 (D) (%)</th>
<th>3 (A) (%)</th>
<th>4 (SA) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>Students followed the instructions about the pair/group activity given by the teacher.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>10.</td>
<td>Group size was appropriate according to the student’s strength in the class.</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>11.</td>
<td>The students fulfilled his/her responsibility to complete their share of work.</td>
<td>0</td>
<td>24</td>
<td>27</td>
<td>49</td>
</tr>
<tr>
<td>12.</td>
<td>Students were able to plan and work to achieve their goal.</td>
<td>0</td>
<td>29</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>13.</td>
<td>There was face to face interaction among students.</td>
<td>0</td>
<td>0</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>14.</td>
<td>The techniques helped in decision making among students.</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>15.</td>
<td>Students were active during group work</td>
<td>0</td>
<td>23</td>
<td>32</td>
<td>45</td>
</tr>
<tr>
<td>16.</td>
<td>The classroom environment was free and conducive.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>17.</td>
<td>Students were given an opportunity to work together.</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>18.</td>
<td>Students worked with peers, other than their close friends.</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>19.</td>
<td>Students showed acceptance to listen to each other’s views</td>
<td>0</td>
<td>24</td>
<td>35</td>
<td>41</td>
</tr>
<tr>
<td>20.</td>
<td>Cooperative learning techniques helped the students to come up with diverse answers from different perspectives.</td>
<td>0</td>
<td>0</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>21.</td>
<td>The program gave scope for developing communication skills among students.</td>
<td>0</td>
<td>0</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>22.</td>
<td>Students participated without any tension.</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>83</td>
</tr>
<tr>
<td>23.</td>
<td>The activities helped develop conflict resolving skills among students.</td>
<td>0</td>
<td>0</td>
<td>70</td>
<td>30</td>
</tr>
</tbody>
</table>
Observation:

All the neutral observers strongly agreed the pre service teachers followed the instructions about the techniques given by the teacher and that the classroom environment was free and conducive. A few percentages of the responses given by the observers showed disagreement with respect to the students fulfilling their responsibility (24%) and their ability to plan and complete their work to achieve their goal (29%). Similarly 23% have shown disagreement about students remaining active during group work 24% indicated disagreement to the pre service teacher’s acceptance to listen to each other’s views. However, the percentage of responses for all these items is low as compared to the responses given in the ‘agree’ and ‘strongly agree’ columns. This indicates the presence of the cooperative learning elements of ‘individual responsibility and group accountability’ and ‘positive interdependence’. A large majority of 83% and 80% of the neutral observers strongly agreed that ‘the students participated without any tension’ and that ‘the students were given an opportunity to work together’ respectively. These two reflect the element of cooperative learning i.e. ‘face to face promotive interaction’. A majority of 70% also agreed that the activities helped develop conflict resolving skills among students. This showed that the cooperative learning element of ‘Interpersonal and Small group skills’ was developed during the sessions.

Interpretation:

The responses from the neutral observers show that all the five elements of cooperative learning were present during the sessions. The observers have opined very favourably regarding the sessions using cooperative learning techniques for facilitating learning of the pre service teachers. It created a conducive learning
atmosphere facilitated by appropriate instructions given by the teacher, opportunity to interact freely, resolve conflicts and take decisions appropriately. The essential aspects of a constructivist classroom and the crucial elements for successful cooperative learning existed during the sessions.

4.5.4. Qualitative Analysis of responses from Neutral Observers:

There were two open ended items regarding the advantages and limitations of using cooperative learning teaching techniques in the classroom. The qualitative analysis of the data using ‘Grounded Theory’ is given below according to item no.:

25. Advantages of using cooperative learning teaching techniques for pre service teachers:

![Figure 4.22](image)

**FIGURE 4.22** Responses regarding the advantages of Cooperative Learning for pre service teachers.
Observation:

The neutral observers’ responses for each item were labelled using ‘Open coding’. These were categorised using ‘axial coding’. There were three categories identified as shown in figure 4.22 i.e. ‘learning’, ‘teaching’ and ‘classroom interaction and atmosphere’ related to the advantages of using cooperative learning teaching techniques in the classrooms.

26. Possible limitations of using cooperative learning teaching techniques for pre service teachers:

![Diagram showing possible limitations]

**FIGURE 4.23** Responses regarding the possible limitations of using Cooperative Learning techniques for pre service teachers.

Observation:

There were only two limitations as depicted in figure 4.23 that were stated by the neutral observers namely difficulty in ‘time management’ and the possibilities of a few students remaining passive as they are shy during the initial sessions of the
experiment. However as the sessions progressed the neutral observers did not give any responses to this item. This indicated that the neutral observers realised that with practice the limitations of cooperative learning techniques could be reduced.

FIGURE 4.24 ‘Selective Coding’ of the qualitative data analysis regarding the advantages and limitations of using Cooperative Learning teaching strategies.

Interpretation:

The responses of the neutral observers were categorized into themes using ‘axial coding’ and the final theory was reached using ‘selective coding’ which has been represented in figure 4.24. The final theory indicates that the neutral observers acknowledge that experiencing cooperative learning teaching techniques during classroom interaction helps pre service teachers as learners and future teachers. However they realise that while using cooperative learning teaching techniques, the skill of the teacher in dealing with passive students and time management is also vital for the benefit of the learners.
4.5.5. Analysis of feedback from Experimental Group:

The feedback sheet for the pre service teachers had 19 close ended items on a four point rating scale and 6 open ended questions. Hence the sheet had a total of 25 items (APPENDIX H). The responses obtained from both the close ended items and the open ended items were converted into percentage. The analysis of the data is given below.

**TABLE 4.8**

**Feedback of the pre service teachers of the Experimental group (in percentage)**

regarding their personal benefits they acquired from the intervention programme

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Items</th>
<th>SA (%)</th>
<th>A (%)</th>
<th>D (%)</th>
<th>SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I learnt to encourage others in their learning</td>
<td>64</td>
<td>33</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Helped me learn how to communicate accurately and clearly</td>
<td>82</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>I learnt how to deal with conflicts constructively.</td>
<td>58</td>
<td>42</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Improved my tolerance other’s opinions and respect for others.</td>
<td>70</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>The environment was free so I learnt to share my opinions without fear of rejection.</td>
<td>85</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Improved my self-esteem when my group achieved the goals.</td>
<td>76</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Observation:**

A large majority of 85% of the pre service teachers opined that the free classroom environment taught them to share their opinions without the fear of rejection. Further a large number of 82% of the pre service teachers felt that using cooperative
learning techniques helped them learn how to communicate accurately and clearly. 70% of them felt that it helped them to become tolerant and respectful towards other’s opinions. This showed that the sessions comprised of the essential elements of cooperative learning namely ‘face to face positive interaction’ and ‘interpersonal and small group skills’. 76% of the pre service teachers experienced an improvement in their self-esteem when the group achieved the goals. This indicates that opportunities were given to evaluate the group work which reflects the cooperative learning element of ‘Group Processing’. There is almost an absence of responses given by pre service teachers in the ‘Disagree’ and ‘Strongly Disagree’ columns.

**Interpretation:**

Using cooperative learning techniques in the classroom helped the pre service teachers in improving their personal qualities like communicating accurately, increasing tolerance of other’s views and developing self esteem.

**TABLE 4.9**

Feedback of the pre service teachers of the Experimental group (in percentage) regarding their benefits they got as a learner from the intervention programme

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Items</th>
<th>SA (%)</th>
<th>A (%)</th>
<th>D (%)</th>
<th>SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Was more interesting than merely listening to lectures as I could actively participate in the class.</td>
<td>88</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Got an opportunity to work with a classmate with whom I was not very well acquainted.</td>
<td>79</td>
<td>21</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>Learnt to be accountable to my group by fulfilling my roles and sharing my knowledge.</td>
<td>76</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Got sufficient opportunity to share my opinion while working with my classmates.</td>
<td>76</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sr. No</td>
<td>Items</td>
<td>SA (%)</td>
<td>A (%)</td>
<td>D (%)</td>
<td>SD (%)</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
<td>--------</td>
<td>-------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>As a Learner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Helped my learning through discussions and sharing of ideas.</td>
<td>85</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>Learnt better when a classmate explained something.</td>
<td>76</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>Understood that each member requires fulfilling their respective roles to attain the group goal.</td>
<td>88</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Observation:**

Table 4.9 shows that 88% of the pre service teachers found the sessions more interesting as compared to listening to lectures as they could actively participate. The same percentage i.e. 88% of pre service teachers understood the importance of fulfilling their respective roles to achieve the group goal. These large percentages of responses indicate that the pre service teachers realised the importance of the cooperative learning elements of ‘**individual responsibility and group accountability**’ for achieving the group goal. Further the responses show that the pre service teachers were given the opportunity for evaluating their performances using the ‘**Group processing**’ element of cooperative learning. A large number of 85% pre service teachers also opined that discussions and sharing of ideas helped their learning. This shows that the sessions gave the chances to the pre service teachers for ‘**face to face promotive interaction.**’ Many of the per service teachers i.e. 79% experienced that they got an opportunity to work with not very acquainted classmates. Hence informal cooperative learning groups were used for the sessions, where the teacher changed the members of the groups for different techniques. The pre service teachers have given a large number of responses of more than 76% for all the statements under the ‘strongly agree’ column. None of the pre service teachers responded under the ‘disagree (D)’ or ‘strongly disagree (SD)’ columns.
Interpretation:

The pre service teachers benefited from the sessions as learners. They not only learnt the academic subject matter (task work), but also personal and group accountability which is essential for good team work.

**TABLE 4.10**

**Feedback of the pre service teachers of the Experimental group (in percentage)** regarding their benefits they gained as a teacher from the intervention programme

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Items</th>
<th>SA (%)</th>
<th>A (%)</th>
<th>D (%)</th>
<th>SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>As a Teacher</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Helped understanding the concept of cooperative learning.</td>
<td>82</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>Learnt the cooperative learning techniques which can be used in everyday teaching.</td>
<td>91</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>Learnt how to form groups and assign roles to students while using cooperative learning techniques.</td>
<td>88</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>Learnt how to actually conduct lessons using cooperative learning techniques.</td>
<td>85</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>Learnt to plan interesting and engaging activities for students while conducting school lessons.</td>
<td>94</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>Understood the role of a teacher as a facilitator in cooperative learning.</td>
<td>85</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Observation:**

An overwhelming majority of 94% of the pre service teachers expressed that they learnt to plan interesting and engaging activities for students while conducting their school lessons. Similarly table 4.10 also shows a huge number of 91% of the pre service teachers indicated that they learnt cooperative learning techniques which they could use as future teachers in everyday teaching. More than 80% of the pre service
teachers opined that they learnt various aspects of using cooperative learning techniques including understanding the concept, preparing groups, assigning roles to the students, actual implementation of the techniques and the role of the teacher as a facilitator in cooperative learning.

Interpretation:

The pre service teachers stated that the sessions were useful for them as future teachers since the experience helped them to understand how to use these cooperative learning techniques. They followed how to plan activities, form groups and assign roles to students while using cooperative learning techniques.

Analysis of the responses to the open ended questions according to the item no.in percentage is as follows:

20. Techniques of cooperative learning enjoyed by the pre service teachers along with the reasons:

**TABLE 4.11**

Techniques of Cooperative learning enjoyed by students (response in percentage):

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Names of the Cooperative Learning techniques</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Three Minute Review</td>
<td>48</td>
</tr>
<tr>
<td>2</td>
<td>Think Pair Share</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>Three Minute Interview</td>
<td>39</td>
</tr>
<tr>
<td>4</td>
<td>Numbered Heads</td>
<td>58</td>
</tr>
<tr>
<td>5</td>
<td>Round Table Technique</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>Paired Heads Together</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>Pair Compare</td>
<td>64</td>
</tr>
<tr>
<td>8</td>
<td>Circle the Sage</td>
<td>70</td>
</tr>
<tr>
<td>9</td>
<td>Formulate, Listen, Share and Create</td>
<td>45</td>
</tr>
<tr>
<td>10</td>
<td>Timed, Pair, Share</td>
<td>58</td>
</tr>
</tbody>
</table>
Observation:

The above table 4.11 shows a majority of 70% of per service teachers enjoyed ‘Circle the sage’ cooperative learning technique. More than 60% enjoyed the pair cooperative learning techniques of ‘Pair Compare’ and ‘Think pair share’. 58% of the pre service teachers enjoyed both ‘Numbered heads’ and ‘Timed, Pair, Share.’

Interpretation:

‘Circle the sage’ was the most enjoyed cooperative learning technique for the pre service teachers.

FIGURE 4.25 Feedback regarding enjoying ‘Circle the Sage’ Cooperative learning technique.

Observation:

Figure 4.25 depicts more than half i.e. 52% of the pre service teachers expressed that they enjoyed the ‘Circle the sage’ activity as they got to learn from a peer
who was an expert and a resource person. 24% felt that it was enjoyable as they understood the concept from their peer and 14% stated that they learnt through asking questions that made it enjoyable. These responses also indicate that the sessions comprised the cooperative learning elements of ‘face to face promotive interaction’, ‘individual accountability and group accountability’ and ‘Group processing’.

Interpretation:

The pre service teachers enjoyed ‘Circle the sage’ as they learnt the concept by asking questions to their peer who was selected as an expert by the teacher.

Their preference of the technique ‘Circle the Sage’ was again reflected in their answers they wrote in the examination papers. (APPENDIX I)

21. Preferences of the pre service teachers of studying in groups or alone:

![Preference of studying in groups or alone](image)

**FIGURE 4.26 Preference of studying in groups or alone (response in percentage):**
Observation:

A large majority of 82% of the pre service teachers preferred to study in groups as it helped to clear concepts and share ideas as seen in figure 4.26. Hence the sessions promoted ‘interpersonal and small group skills’ related to being able to communicate accurately. Around 70% of them preferred to study in groups as it helped them to remain active in class. This is the fundamental characteristic of a constructivist classroom, where students are active learners. Only 2% of the students preferred to study alone as they felt others slowed their pace of learning.

Interpretation:

Most of the students enjoyed working in groups as it kept them active and they were able to clear their concepts and share their ideas.

22. Responses regarding preferences to learn concepts from peers or from the teacher:

![Bar chart showing responses](image)

**FIGURE 4.27** Learnt concepts better from classmates. (response in percentage)
**Observation:**

Figure 4.27 indicates 27% of the pre service teachers felt they learnt the concepts better from their classmates as the classmates explained using a number of real life examples. Equal number of per service teachers i.e. 24% experienced that due to same level of thinking and free atmosphere for sharing ideas helped in learning concepts better from classmates. This indicated that the cooperative learning element of ‘**face to face promotive interaction**’ reflected in the sessions. Very few of around 9% of the pre service teachers felt that they learnt the concepts better when explained by the teacher.

**Interpretation:**

The pre service teachers learnt concepts better from their classmates as various examples were discussed freely amongst themselves.

**23. Personal qualities and skills were developed while working with others:**

![Graph showing development of personal qualities and skills](image)

**FIGURE 4.28** Personal qualities and skills developed while working with others (response in percentage)
Observation:

Figure 4.28 shows a large majority of 93% responded that it helped them to develop appreciation for others, followed by helping them improve their communication skills. Thus the sessions helped develop ‘Interpersonal and small group skills.’ A little under 65% felt that learning through cooperative learning helped in their analytical thinking. Hence sessions gave opportunity for ‘Group processing.’

Interpretation:

The above data shows that learning through cooperative learning techniques helped student develop social skills related to appreciation for others, communication, team spirit and confidence as compared to the development of analytical thinking, which is more related to cognition.

24. Frequency of cooperative learning techniques as a teacher:

**TABLE 4.12**

**Frequency of using cooperative learning techniques as future teachers (response in percentage):**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Frequency of using Cooperative Learning</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Always</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>Frequently</td>
<td>36</td>
</tr>
<tr>
<td>3</td>
<td>Occasionally</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>Rarely</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Never</td>
<td>0</td>
</tr>
</tbody>
</table>

Observation:

More than half of the pre service teachers i.e. 58% indicated that they would always use cooperative learning techniques as teachers. 36% expressed that they would
use the techniques frequently and 18% stated that they would use it occasionally. However none of the pre service teachers showed that they would rarely or never use the cooperative learning techniques.

**Interpretation:**

The pre service teachers showed readiness to use cooperative learning techniques as teachers.

**25. Possible barriers the pre service teachers might face while using cooperative learning teaching techniques:**

**TABLE 4.13**

Possible barriers ranked by the pre service teachers while using cooperative learning techniques (response in percentage):

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Barriers</th>
<th>1st rank % of responses</th>
<th>2nd rank % of responses</th>
<th>3rd rank % of responses</th>
<th>4th rank % of responses</th>
<th>5th rank % of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Time restriction</td>
<td>61</td>
<td>15</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Reluctance/unwillingness to participate by a few students</td>
<td>30</td>
<td>6</td>
<td>3</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Overcrowded classrooms</td>
<td>24</td>
<td>12</td>
<td>15</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Indiscipline during the sessions/loss of class control</td>
<td>12</td>
<td>9</td>
<td>18</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Imbalanced grouping</td>
<td>6</td>
<td>6</td>
<td>15</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Any other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Observation:

Table 4.13 indicates a majority of 61% of the pre service teachers have ranked ‘time restriction’ as the number one barrier they might face while using cooperative learning teaching techniques. 30% ranked ‘unwillingness to participate by a few students’ as the number one barrier. Further 24% of the pre service teachers selected ‘over crowded classrooms’ as the number one possible barrier while implementing cooperative learning teaching techniques.

Interpretation:

Time restriction is the major barrier which the pre service teacher felt they might face while using cooperative learning teaching techniques.

4.5.6. Qualitative Analysis of Researcher’s Reflections:

The researcher maintained observation regarding each sessions of the intervention programme. The observations helped the researcher keep a track on the things that worked and things that hindered using cooperative learning techniques while interacting with the pre service teachers of the experimental group (APPENDIX J). This document i.e. Researcher’s reflections has been used in this study as a source of data that has been used for triangulation. The qualitative data obtained from the researcher’s reflections was analysed using grounded theory and the analysis is given below in the form of figures.

The whole document was categorised into 6 categories using the ‘open coding’. The categories along with the observations are given below.
Category 1: Student – Student Interaction:
- answered together as a pair: ‘we feel…’ or ‘my partner and I think…’ (Session 5 and 11)
- resolved conflicts (Session 4)
- acknowledged others ideas (Session 5)
- shared their answers with the whole class. (Session 14)
- shared without hesitation (Session 14)
- motivated to discuss with their group members (Session 16)
- continued working with the team members even after the session was over (Session 17)
- took less time to assign roles (Session 19)
- used soft voices in groups and loud voices when sharing with the class (Session 19)
- less number of conflicts occurred in later sessions (Session 22)
- responded freely (Session 22)

FIGURE 4.29 Reflections regarding student-student interaction

Observation:

The first category i.e. student-student interaction revealed how the pre-service teachers shared their answers freely in the class and learnt to resolve conflicts as illustrated in figure 4.29. Further they developed appreciation for other’s responses. This indicated that the researcher observed the elements of ‘face to face promotive interaction’, development of ‘interpersonal and small group skills.’ They also realised the importance of how to communicate within the group and with the whole class. This in turn showed that they followed the instructions given by the teacher who was the researcher appropriately.
FIGURE 4.30 Reflections regarding impact of the intervention programme on the affective domain the pre service teachers

Observation:

The affective domain deals with the emotions of an individual. The reflections of the researcher showed as represented in figure 4.30 that the pre service teachers were interested and enjoyed the cooperative learning teaching techniques. The ‘Circle the Sage’ activity was highly liked by the pre service teachers and after the session was over a few came to show their appreciation for the technique. The activity where they were shown how written text appears to a dyslexic child made some of the pre service teachers very emotional as they realised the problems these children face in academics.
Category 3: Impact on the Cognitive Domain of the Preservice Teachers:

- shared their ideas (Session 5)
- came up with very good rational regarding their answers (Session 6)
- came up with answers in great detail (Session 7)
- prepared interesting concept maps (Session 12)
- followed the modified version of the ‘round table’ (Session 13)
- realized the importance of hearing in communication (Session 15)
- realized the importance of vision (Session 19)
- came up with very good answers (Session 19)
- followed the steps of the various cooperative learning teaching techniques with less instructions from the researcher/ teacher (Session 21)
- identified ‘circle the sage’ technique as a useful technique to cater to the needs of gifted students (II Internal Answer papers)

FIGURE 4.31 Reflections regarding impact of the intervention programme on the cognitive domain the pre service teachers

Observation:

Figure 4.31 shows that using the cooperative learning teaching techniques helped the pre service teachers to come up with a variety of answers. This reflected the elements of ‘face to face positive interaction’ and ‘positive interdependence’ during the sessions. They also were able to justify their answers too. Learning through these techniques helped the pre service teachers learn about the theoretical aspects and the techniques used in cooperative learning. As the sessions proceeded with more experience the per service teachers were able to identify the techniques and even carry out the steps in the respective techniques with less instructions as compared to previous sessions. During the II Internal Exam the pre service teachers identified ‘Circle the
Sage’s technique as a way to cater to the needs of the gifted students, though the teacher/researcher had not mentioned about it and had used the technique to deal with the topic regarding gifted students. This indicated that the pre service teachers had learnt to select the cooperative learning techniques according to the topics.

**Category 4: Self Evaluation by the Pre service teachers:**
- realized they will be appreciated only if they work as a team (Session 4)
- they answered during the ‘three minute reviews’ without requiring to be given instructions (Session 6)
- modified the ‘round table’ technique to improve efficiency of the group (Session 8)
- automatically discussed the strengths and weaknesses of the group/ pair work at the end of the session (Session 24)

**FIGURE 4.32 Reflections regarding self-evaluation by the pre service teachers**

**Observation:**

The researcher made it clear to the pre service teachers that they had to come to a consensus regarding their answers. When they had given individual answers they were not appreciated. This made the pre service teachers realise that they had to work through their conflicts and reach a unanimous answer as illustrated in figure 4.32. The group evaluation activity after the end of every session proved to be beneficial as the pre service teachers discussed the strengths and weaknesses of their group’s performance. This enabled them to modify cooperative learning techniques that would improve their performance as a group. Thus the element of ‘**Group Processing**’ in the sessions benefited the pre service teachers performance in group and pair activities.
Category 5: Student – Teacher Interaction:
- teacher/researcher reminded the group to come to a consensus regarding the answer (Session 2 and 3)
- researcher selected the shy students to answer (Session 3)
- pre service teachers resolved conflicts as the researcher did not appreciate different answers from the same group (Session 4)
- researcher just need to mention the technique and the students followed the steps without much instructions (Session 10)

FIGURE 4.33 Reflections regarding student-teacher interaction

Observation:

Figure 4.33 indicates that the sessions helped the pre service teachers become free and interact with one another. While supervising the sessions the researcher also motivated the group members to include the members who were passive. These members were also selected by the researcher to represent the group and share the answer with the class. This gave them the experience of success in the classroom and in turn made them less hesitant to give answers and participate in the class in the following sessions. The researcher also encouraged the groups to resolve conflicts and reach to a consensus regarding answers especially to the objective questions given in the worksheets. The role of the researcher as an instructor for giving instructions about the steps of the techniques reduced as the sessions went along as the pre service teachers became acquainted with the techniques. This in turn helped save time which was better utilized in more group discussions.
FIGURE 4.34 Reflections regarding impact of the intervention programme on the psychomotor domain the pre service teachers

Observation:

There was a lot of interest shown by the per service teachers for using cooperative learning teaching techniques for their practice lessons as illustrated in figure 4.34. Some of them approached the researcher for guiding them to plan such lessons. The pre service teacher, Ms. Purvi Gada who had conducted the peer tutoring session too used Think-Pair-Share technique effectively. The pre service teachers also became accustomed to the phases in the cooperative learning techniques starting from forming groups to discussing the strengths and weakness of the group’s performance.
Observation:

All the categories were combined to obtain three main themes using ‘axial coding.’ Figure 4.34 depicts the themes i.e. ‘Personal Benefits’, ‘Benefits as a Learner’ and ‘Benefits as a Future Teacher.’
Interpretation:

Using the last step of Grounded Theory, the ‘Selective Coding’ the themes were combined to reach to a theory. This has been shown in figure 4.35

**4.5.7. Connection between the Survey (need identified) and the product developed**

*(needs fulfilled by the Teacher’s Handbook):*

The responses from the survey and the expert’s opinions about the product developed have been linked to show that the needs revealed in the survey were satisfied by the product developed in the study. The connection is given in figure 4.36.

**FIGURE 4.37 Connection between the Survey and Product Development**

Interpretation:

The survey conducted on teacher educators revealed the need for a Teacher’s Handbook for using cooperative learning teaching techniques. The teacher educators also suggested the inclusion of detailed lesson notes, a variety of techniques, the
advantages and precautions while using these techniques in the classroom. During product development the researcher included these suggestions. The product was shown to experts who verified the inclusion of the above mentioned aspects as per the needs of the teacher educators as shown in figure 4.37.

4.6. Triangulation:

Triangulation is the means of reducing bias and increases the rate of certainty of research findings. Introducing triangulation into a research design is one means whereby the evidence collected from one source is corroborated with evidence collected from another source, with the discrepancy emerging between the two sets of data altering researchers to potential analytical errors.

According to Esterby – Smith, (2002), Denzin (1970), (as sited in Thomas, 2004) four types of triangulations are identified:

i. Data Triangulation:

ii. Theoretical Triangulation

iii. Triangulation by investigator


In the present study Data Triangulation and Theoretical Triangulation were done.

4.6.1. Data Triangulation

Data Triangulation was done by collecting data obtained from the responses regarding the intervention program given by the neutral observers and the experimental group of pre service teachers along with the reflections of the researcher.
<table>
<thead>
<tr>
<th>Source of Data</th>
<th>Responses of the Neutral observers</th>
<th>Responses of the Experimental group</th>
<th>Researcher’s Reflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Data</td>
<td>Quantitative Data</td>
<td>Qualitative Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Aspects</strong></td>
<td><strong>Personal benefits gained by experimental group</strong></td>
<td><strong>Benefits gained as a learner</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Students learnt to listen to different opinion (Table 4.7)</strong></td>
<td><strong>Leant to be tolerant towards different ideas (Table 4.8)</strong></td>
<td><strong>Students learnt to acknowledge the ideas given by their peers (Session 5)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Free and conducive classroom (Table 4.7)</strong></td>
<td><strong>Shared opinions without fear of rejection. (Table 4.8)</strong></td>
<td><strong>Shy students communicated their ideas freely in the groups (Session 22)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Programme was properly developed and implemented (Table 4.6)</strong></td>
<td><strong>Got the opportunity to discuss and share ideas (Table 4.9)</strong></td>
<td><strong>Students came up with different ideas not mentioned in the books (Session 8).</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Students were active (Table 4.7)</strong></td>
<td><strong>Preferred the sessions compared to only listening to lectures as they could actively participate (Table 4.9)</strong></td>
<td><strong>The student enjoyed the sessions. For e.g. Hocus Focus activity Circle the sage. (Session 2 and Session 17)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>The sessions gave scope for evaluation (Table 4.6)</strong></td>
<td><strong>Leant the importance of fulfilling their roles to achieve the group goal. (Table 4.9)</strong></td>
<td><strong>They learnt that they discussed strategies on how to improve their group work in the future. They modified the ‘Round Table’ technique to increase the group performance and save time. (Session 9)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Students learnt to fulfil their roles to achieve the group goals. (Table 4.7)</strong></td>
<td></td>
<td><strong>They learnt the techniques and so played their roles in the later stages without waiting for instructions (Sessions 21 to 25)</strong></td>
</tr>
<tr>
<td>Type of Data</td>
<td>Quantitative Data</td>
<td>Qualitative Data</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Source of Data</td>
<td>Responses of the Neutral observers</td>
<td>Responses of the Experimental group</td>
<td>Researcher’s Reflections</td>
</tr>
<tr>
<td>Aspects ↓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Benefits as a future teacher | ✓ Teacher was well prepared  
✓ Instructions were clear (Table 4.6) | ✓ Understood the role of the teacher as a facilitator (Table 4.10).                 | ✓ The pre service teacher who conducted the peer tutoring used the Think-Pair-Share technique effectively. (Session 9) |
|               | ✓ Techniques selected were appropriate for the objectives and the concepts of the units (Table 4.6) | ✓ Learnt how to plan and conduct cooperative learning sessions (Table 4.10).      | ✓ They asked the teacher for guiding them to plan lesson using cooperative learning techniques.(Session 18) |
| Barriers faced while implementing Cooperative Learning teaching strategies | ✓ Shy students reluctant to share ideas and lack of time to conduct the activities. (Figure 4.23) | ✓ Time restrictions and reluctance/unwillingness to participate by a few students (Table 4.13). | ✓ The session took a long time to be conducted. (Session 1)  
✓ Few members hesitated from participating in the group (Session 2) |

Triangulation was done within the Programme Evaluation method related with Objective 4. It was also observed that there was a slight difference in the responses of the neutral observers on one side and the feedback of the pre service teachers and the researcher’s reflection on the other side. The neutral observers did not mention anything about cooperative learning teaching strategy being enjoyable for the learners while stating the advantages (Figure 4.22). However it is seen that in both the feedback of the pre service teachers (Figure 4.26) and the researcher’s reflections the sessions (Figure 4.29) were enjoyable and interesting.
**TABLE 4.15**

Data Triangulation between the experiment, feedback from the pre service teachers, observation of the neutral observers and researcher’s reflections.

<table>
<thead>
<tr>
<th>Impact on the Cognitive Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Method</strong></td>
</tr>
<tr>
<td>-The Experimental group scored higher than the control group on the achievement test. (Figures 4.18 to 4.21, Table 4.4 and Table 4.5)</td>
</tr>
</tbody>
</table>

Table 4.15 depicts the data triangulation between the data obtained through the experiment and the survey which was used for getting feedback from the neutral observers and the pre service teachers. It is apparent that the programme has had a positive impact on the cognitive domain of the pre service teachers from the experimental group. This is also visible the observations made by the researcher in the researcher’s reflections.

**4.6.2. Theory Triangulation:**

The main theories i.e. Constructivism, Social Constructivism and the elements of cooperative learning on which the study is based was triangulated using the responses of the neutral observers, the feedback from the pre service teachers and the researcher’s
reflections. This triangulation helped in verifying that the session in the intervention programme was according to the principle of the above mentioned theories. The theory triangulation is presented in Table 4.16.

### TABLE 4.16

**Theory Triangulation**

<table>
<thead>
<tr>
<th>Constructivism: Aspects of a constructivist classroom. (Murphy, 1997 as sited in CALPRO Online)</th>
<th>Features of Constructivism</th>
<th>Responses of the neutral observers</th>
<th>Responses of the experimental group</th>
<th>Researcher’s reflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>🌟 Multiple perspectives</td>
<td>✓ Students listened to different opinions (Table 4.7)</td>
<td>✓ Developed tolerance towards others ideas (Table 4.8)</td>
<td>✓ Allowed peers to express their opinions (Session 22)</td>
<td></td>
</tr>
<tr>
<td>🌟 Student directed goals- active learners</td>
<td>✓ Students were active (Table 4.7)</td>
<td>✓ Preferred the sessions to lectures as they were active (Table 4.9)</td>
<td>✓ The students actively participated in the activities</td>
<td></td>
</tr>
<tr>
<td>🌟 Teachers as coach</td>
<td>✓ Teacher supervised and monitored the groups during the activities (Table 4.6)</td>
<td>✓ Understood the role of a teacher as a facilitator (Table 4.10)</td>
<td>✓ Students didn’t wait for the teacher to give the answers and worked together to find the answers (Session 21 onwards)</td>
<td></td>
</tr>
<tr>
<td>🌟 Knowledge construction</td>
<td>✓ Students were able to plan and work to achieve their goal (Table 4.7)</td>
<td>✓ Learnt concepts better from their classmates as various examples were discussed freely amongst themselves (Figure 4.27)</td>
<td>✓ Students came up with many ideas and could go beyond what is given in books.(Session 8)</td>
<td></td>
</tr>
<tr>
<td>Features of Constructivism</td>
<td>Responses of the neutral observers</td>
<td>Responses of the experimental group</td>
<td>Researcher’s reflections</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------</td>
<td>------------------------------------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>✷ Problem solving</td>
<td>✓ The activities helped develop conflict resolving skills among students. (Table 4.7)</td>
<td>✓ Learnt how to deal with conflicts constructively (Table 4.8)</td>
<td>✓ They were able to come to a consensus regarding their answers as a pair or a group (Session 4)</td>
<td></td>
</tr>
</tbody>
</table>

✓ Social Constructivism: Social constructivists tell us that learning is a social process. It is neither simply an individual process, nor a passive process (McMahon, 1997; Pritchard, 2009)

<table>
<thead>
<tr>
<th>Features of Social Constructivism</th>
<th>Responses of the neutral observers</th>
<th>Responses of the experimental group</th>
<th>Researcher’s reflections</th>
</tr>
</thead>
<tbody>
<tr>
<td>✷ Knowledge is experience based</td>
<td>✓ Students were given an opportunity to work together (Table 4.7)</td>
<td>✓ Got sufficient opportunity to share my opinion while working with my classmates (Table 4.9)</td>
<td>✓ Shared ideas confidently (Session 3)</td>
</tr>
<tr>
<td>✷ Learning is social through language</td>
<td>✓ The program gave scope for developing communication skills among students (Table 4.7)</td>
<td>✓ Helped me learn how to communicate accurately and clearly (Table 4.8)</td>
<td>✓ Learnt to communicate in low voices in the groups and loud voices while sharing with the class (Session 19)</td>
</tr>
<tr>
<td>✷ Learning communities should be inclusive and equitable</td>
<td>✓ Students worked with peers, other than their close friends. (Table 4.7)</td>
<td>✓ Got an opportunity to work with a classmate with whom I was not very well acquainted (Table 4.9).</td>
<td>✓ Different grouping techniques were used for different sessions.</td>
</tr>
<tr>
<td>Elements of cooperative learning</td>
<td>Responses of the neutral observers</td>
<td>Responses of the experimental group</td>
<td>Researcher’s reflections</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------------------</td>
<td>-----------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Positive Interdependence</td>
<td>✓ Students were able to plan and work to achieve their goal (Table 4.7)</td>
<td>✓ learnt to appreciate others (Figure 4.28)</td>
<td>✓ they learnt to acknowledge other’s contributions (Session 5)</td>
</tr>
<tr>
<td>Face to Face Promotive Interaction</td>
<td>✓ Students were given an opportunity to work together (Table 4.7)</td>
<td>✓ Learnt the concepts better from their classmates as the classmates explained using a number of real life examples (Figure 4.27)</td>
<td>✓ Liked doing ‘Pairs Compare’ and ‘Circle the Sage’ technique. (Session 8 and Session 17)</td>
</tr>
<tr>
<td>Individual Accountability/Personal Responsibility</td>
<td>✓ The students fulfilled his/ her responsibility to complete their share of work (Table 4.7).</td>
<td>✓ Understood that each member requires fulfilling their respective roles to attain the group goal (Table 4.9)</td>
<td>✓ Assigned roles within the group faster and used correct levels of voice during group interactions and sharing with the class (Session 19)</td>
</tr>
<tr>
<td>Interpersonal and Small-Group Skills</td>
<td>✓ The program gave scope for developing communication skills among students (Table 4.7).</td>
<td>✓ Helped me learn how to communicate accurately and clearly (Table 4.8)</td>
<td>✓ Resolved conflicts (Session 4) ✓ Discuss clearly (Session 22)</td>
</tr>
<tr>
<td>Group Processing</td>
<td>✓ The sessions gave scope to the teacher for evaluating the students (Table 4.6)</td>
<td>✓ Learning through cooperative learning helped in their analytical thinking (Figure 4.28)</td>
<td>✓ Modified ‘Round Table’ technique (Session 9) ✓ Automatically started discussing the group performance after the end of the session. (Session 24)</td>
</tr>
</tbody>
</table>
4.7. Fulfilment of Objectives:

Objective 1: To explore the views of teacher educators regarding cooperative learning teaching strategies and find out if they use these strategies while teaching the subject ‘Psychology of Development and Learning’ to pre service teachers.

Fulfilment of the Objective:

A survey was conducted on teacher educators/ professors from teacher education colleges affiliated to Savitribai Phule Pune University to find out their views regarding Cooperative learning teaching strategies. The data collected dealt with their knowledge about cooperative learning teaching strategy, their experiences with using the techniques, their opinions regarding the benefits of cooperative learning techniques for students and teachers; the barriers they may face while using these techniques and their views regarding a handbook for implementing cooperative learning techniques in classrooms. The qualitative data collected was analysed using the ‘Grounded Theory Approach’.

Inference: The teachers educators are aware of the theoretical aspects of cooperative learning and acknowledge its benefits, but rarely use the techniques as they are apprehensive due to their insufficient practical knowledge of implementing them, however are willing to learn them.

Objective 2: To develop a programme based on the teaching strategy using cooperative learning for teaching Paper II Section I of the subject ‘Psychology of Development and Learning’ to pre service teachers.
**Fulfilment of the objective:**

The product was developed in the form of a handbook consisting of the concept of cooperative learning, the cooperative learning techniques used in the product, the lesson plans, learning resources in the form of Power Point Presentations and worksheets, general instructions for teachers, role of the students and evaluation which consisted of a researcher made achievement test or post-test. The responses from the teacher educators given in the survey regarding their expectations from a teacher’s handbook on cooperative learning teaching techniques helped in designing the product. This product was prepared and was shown to experts for their feedback. Necessary changes were made and the final product was implemented on the experimental group during the teaching sessions of Paper II Section I ‘Psychology of Development and Learning.’

The responses of the experts regarding the product indicated that it was as per the requirements mentioned in the survey by the teacher educators regarding the teacher’s handbook.

**Objective 3: To find out the effectiveness of the teaching strategy.**

**Fulfilment of the objective:**

A researcher made achievement test (post-test) was used to find out the effectiveness of the teaching strategy using cooperative learning teaching strategy. This achievement test was administered to the experimental and control group. MANOVA was computed to find out if there was any significant difference between the experimental group and control group’s achievement test scores which was categorized
into three levels according to the types of questions, learning objectives and units. Effect size was also computed using partial eta square.

**Inference:** The intervention programme was effective at all three levels i.e. according to the types of questions, learning objectives and units.

**Objective 4:** To gather and analyse the feedback from Neutral Observers and the pre service teachers of the Experimental Group regarding the intervention programme and link it with the researcher’s reflections.

**Fulfilment of the objective:**

The responses of the neutral observers and the pre service teachers were collected using two researcher made questionnaires. The responses were analysed using quantitative data analysis i.e. percentage.

**Inference:** The responses of the neutral observers and those of the experimental group regarding the intervention programme were favourable towards the intervention programme. The observer’s responses were very positive regarding the actual implementation of the intervention programme by the researcher. The researcher’s reflections also showed that the pre service teachers benefited from the intervention programme. The experimental group pre service teachers too showed that they preferred to learn through cooperative learning techniques and enjoyed the sessions. Their responses along with the researcher’s reflections were also used for data triangulation and theory triangulation. Through theory triangulation it was confirmed that the programme was developed using the principles of the relevant theories and the elements of cooperative learning.
4.8. Testing of Hypothesis:

$H_0$: There is no significant difference in the academic achievement of the pre service teachers from the experimental and control group.

To test the Hypothesis MANOVA was used (Table 4.3). The results obtained showed that there were statistical significant differences between the achievement test scores of both the experimental and control group. Hence the null hypothesis is rejected.

Therefore the Research Hypothesis, “The intervention programme based on cooperative learning techniques to teach pre service teachers improved their academic achievement (of the units given in Paper II Section I ‘Psychology of Development and Learning’ of the B.Ed Revised Syllabus of 2008).” is accepted.

4.9. Major Findings:

4.9.1. Findings from the Survey (Objective 1): The teacher educators

4.9.1.1. are aware of theoretical aspects of cooperative learning. (Figure 4.2)

4.9.1.2. acknowledge the benefits of cooperative learning techniques for students and teachers. (Figure 4.5, Figure 4.6 and Figure 4.7)

4.9.1.3. rarely use cooperative learning techniques as they feel they have insufficient practical knowledge of implementing them and overcoming the barriers they may face while using the techniques. (Figure 4.3, Figure 4.4 and Figure 4.8)

4.9.1.4. are keen on a handbook on cooperative learning, hence are willing to learn how to implement cooperative learning techniques in classrooms. (Figure 4.9 and Figure 4.10)
4.9.2. Findings from the Experiment (Objective 3):

4.9.2.1. The calculated effect size i.e. partial eta square values show that the intervention programme based on cooperative learning teaching techniques was effective as a teaching strategy for the pre service teachers. (Table 4.4 and Table 4.5)

4.9.3. Findings from the Responses from the neutral observers and experimental group pre service teachers (Objective 4):

4.9.3.1. The neutral observers were favourable towards the intervention programme with respect to its implementation and it facilitating learning (Table 4.6, Table 4.7, Figure 4.22, and Figure 4.24).

4.9.3.2. The pre service teachers also gave favourable responses to the intervention programme benefiting them personally (communicating accurately, increasing tolerance of other’s views and developing self esteem), as a learner and as a future teacher implementing cooperative learning teaching strategies. (Table 4.8, Table 4.9, Table 4.10, Table 4.11, Table 4.12, Figure 4.26, Figure 4.27, Figure 4.28).

4.9.3.3. The responses from the neutral observers, the feedback of the experimental group and the researcher’s reflections regarding the implementation of intervention programme reflected the theories of constructivism, social constructivism and the element of cooperative learning. These were the theoretical basis on which the intervention programme was developed (Table 4.16).
4.10. Objective wise conclusions:

4.10.1. Teacher Educators are aware about the theoretical aspects of cooperative learning however the cooperative learning teaching techniques are rarely used in teacher education colleges.

4.10.2. Cooperative learning teaching techniques are effective for learning.

4.10.3. Cooperative learning techniques are useful for teaching pre service teachers.

4.10.4. Pre service teachers and teacher educators have a positive opinion regarding the intervention programme based on cooperative learning teaching techniques.

4.11. Main Conclusion:

Cooperative learning teaching techniques improves academic achievement of pre service teachers.