Chapter V

Analysis, Interpretation and Discussion of Results
CHAPTER - V

ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

The objectives set for the present study influenced the formulation of various hypotheses. It is extremely necessary to systematically arrange and analyze the data in view of these hypotheses. The hypotheses formulated for this investigation have been mentioned in the second chapter. In the present chapter, data analysis of scores for Mathematics Teaching Competency, Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Achievement Motivation and Teaching Aptitude have been done in order to test the hypotheses of the present study and draw conclusions.

The present study involves the exit competencies, namely, Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies; and Mathematics Teaching Competency as dependent variables; Achievement Motivation, Teaching Aptitude; and the Training Strategies, namely, Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) as independent variables. Achievement Motivation and Teaching Aptitude were used as classifying variables and Training Strategies as treatment variables.

This chapter is divided into three sections.

SECTION I: - DESCRIPTIVE STATISTICS

This section deals with descriptive statistics which includes Mean, Median, Standard deviation, Skewness and Kutosis to ascertain the nature of distribution of scores on the variables of Mathematics Teaching Competency, Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Achievement Motivation and Teaching Aptitude for group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS).
Skewness and kurtosis were worked out to study the trend of departure of the sample from the normal probability curve for group trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS).

SECTION II: MATCHING OF GROUPS

This section examines the significant differences, if any, in mean scores on Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies and Mathematics Teaching Competency in pre-test, and Achievement Motivation and Teaching Aptitude between two groups prior to treatment. The purpose was to ensure matching of the two groups on these variables.

SECTION III: INFERENTIAL STATISTICS: ANALYSIS OF VARIANCE (2 X 2)

This section examines the significant difference, if any, in mean gain scores on Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Mathematics Teaching Competency among groups trained through Training Strategies, namely, Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) between groups with High Achievement Motivation and Low Achievement Motivation and also between groups with High Teaching Aptitude and Low Teaching Aptitude.

This section also deals with the interaction effects of Training Strategies, Achievement Motivation and Teaching Aptitude.

SECTION I

5.1 DESCRIPTIVE STATISTICS

Descriptive statistics such as mean, median, standard deviation, skewness, and kurtosis were worked out for scores on Achievement Motivation and Teaching Aptitude for both the groups. Mean, median, standard deviation, skewness and kurtosis were also calculated for gain scores on the variables of Mathematics Content.
Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, and Mathematics Teaching Competency for both the groups. These values are entered in table 5.1 and 5.2.

Table 5.1
Mean, Median, Standard deviation, Skewness and Kurtosis of gain scores for the variables of Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, and Mathematics Teaching Competency and of scores on Achievement Motivation and Teaching Aptitude of group exposed to Mathematics Competency Based Training Strategy (MCBTS).

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>MEDIAN</th>
<th>STANDARD DEVIATION</th>
<th>SKEWNESS</th>
<th>KURTOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Content Competencies</td>
<td>81.05</td>
<td>80.50</td>
<td>21.84</td>
<td>.308</td>
<td>.301</td>
</tr>
<tr>
<td>Mathematics Process Competencies</td>
<td>98.11</td>
<td>99.00</td>
<td>25.74</td>
<td>-.357</td>
<td>.735</td>
</tr>
<tr>
<td>Mathematical Pedagogical competencies</td>
<td>94.08</td>
<td>92.00</td>
<td>31.25</td>
<td>.086</td>
<td>-.063</td>
</tr>
<tr>
<td>Mathematics Teaching competency</td>
<td>180.00</td>
<td>186.00</td>
<td>31.51</td>
<td>-.061</td>
<td>-.873</td>
</tr>
<tr>
<td>Achievement Motivation</td>
<td>19.29</td>
<td>21.00</td>
<td>4.49</td>
<td>-.193</td>
<td>-.019</td>
</tr>
<tr>
<td>Teaching Aptitude</td>
<td>117.76</td>
<td>115.00</td>
<td>13.61</td>
<td>.717</td>
<td>.558</td>
</tr>
</tbody>
</table>
5.1.1 Interpretation and Discussion Based On Table 5.1

The numerical measures of mean, median, standard deviation, skewness and kurtosis given in table 5.1 were used to see the nature of distribution of scores.

Though the variables Mathematics Content Competencies, Mathematical Pedagogical Competencies and Teaching Aptitude were slightly positively skewed (the value of skewness ranged from .086 to .717) but the score distribution tended to be near normal (for normal distribution skewness is equal to zero). The variables Mathematics Process Competencies, Mathematics Teaching Competency and Achievement Motivation were slightly negatively skewed as the values of skewness were -.357, -.061 and -.193 respectively, but the distribution of scores for all the variables tended to be approximately normal.

From the values of kurtosis it is evident that the distribution of scores on the variables of Mathematical Pedagogical Competencies, Mathematics Teaching Competency and Achievement Motivation was leptokurtic as the values of kurtosis was less than 0.263. For the variables of Mathematics Content Competencies, Mathematics Process Competencies and Teaching Aptitude the distribution of scores was platykurtic as the value of kurtosis was higher than 0.263. The kurtosis in case of all the variables did not show marked departure from normality as the values of kurtosis were close to 0.263 which is value of kurtosis for normal distribution.

The similar conclusions were drawn on the basis of values of mean and median which were almost equal with nominal variations in case of all the variables.
Table 5.2

Mean, Median, Standard deviation, Skewness and Kurtosis of gain scores for the variables of Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Mathematics Teaching Competency and scores on Achievement Motivation and Teaching Aptitude of group exposed to Traditional Training Strategy (TTS)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>MEDIAN</th>
<th>STANDARD DEVIATION</th>
<th>SKEWNESS</th>
<th>KURTOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Content Competencies</td>
<td>27.15</td>
<td>28.50</td>
<td>10.58</td>
<td>-.302</td>
<td>-.137</td>
</tr>
<tr>
<td>Mathematics Process Competencies</td>
<td>39.12</td>
<td>37.50</td>
<td>10.11</td>
<td>.297</td>
<td>-.877</td>
</tr>
<tr>
<td>Mathematical Pedagogical Competencies</td>
<td>38.18</td>
<td>40.00</td>
<td>11.43</td>
<td>-.106</td>
<td>-.368</td>
</tr>
<tr>
<td>Mathematics Teaching Competency</td>
<td>21.59</td>
<td>16.00</td>
<td>16.94</td>
<td>0.26</td>
<td>.62</td>
</tr>
<tr>
<td>Achievement Motivation</td>
<td>19.50</td>
<td>19.50</td>
<td>4.26</td>
<td>.231</td>
<td>-.986</td>
</tr>
<tr>
<td>Teaching Aptitude</td>
<td>106.09</td>
<td>106.00</td>
<td>13.54</td>
<td>.056</td>
<td>-.509</td>
</tr>
</tbody>
</table>

5.1.2 Interpretation and Discussion Based On Table 5.2

The numerical measures of mean, median, standard deviation, skewness and kurtosis given in table 5.2 were used to see the nature of distribution of scores.
Although the variables Mathematics Process Competencies, Mathematics Teaching Competency, Achievement Motivation and Teaching Aptitude were slightly positively skewed (the value of skewness ranged from .056 to .297) yet the score distribution of all these variables tended to be near normal (for normal distribution skewness is equal to zero). The value of skewness for Mathematics Content Competencies and Mathematical Pedagogical Competencies was -.302 and -.106 respectively, which indicates that these variables were slightly negatively skewed. But the distribution of scores on these variables also tended to be approximately normal.

The values of kurtosis show that the distribution of scores on the variables of Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Achievement Motivation and Teaching Aptitude was leptokurtic as the values of kurtosis was less than 0.263. For the variable of Mathematics Teaching Competency, the distribution of scores was platykurtic as the value of kurtosis was higher than 0.263. The kurtosis in case of all the variables did not show marked departure from normality as the values of kurtosis were close to 0.263.

The similar picture was presented by the values of mean and median which were almost equal with nominal variations in case of all the variables.

SECTION II

5.2 MATCHING OF GROUPS

The group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) were matched on the variable of Mathematics Teaching Competency (pre-test), Mathematics Content Competencies (pre-test), Mathematics Process Competencies (pre-test), Mathematical Pedagogical Competencies (pre-test), Achievement Motivation and Teaching Aptitude. t-ratios were worked out between the mean scores of group trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) on these variables. Results are entered in table no 5.3.
### Table no 5.3

**t-ratios between mean scores of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variables of Mathematics Teaching Competency (pre-test), Mathematics Content Competencies (pre-test), Mathematics Process Competencies (pre-test), Mathematical Pedagogical Competencies (pre-test), Achievement Motivation and Teaching Aptitude**

<table>
<thead>
<tr>
<th>S.no</th>
<th>Variable</th>
<th>Experimental group</th>
<th>Control group</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>mean</td>
<td>mean</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SD</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Mathematics Content Competencies (Pre-test)</td>
<td>75.68</td>
<td>75.15</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.68</td>
<td>10.56</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Mathematics Process Competencies (Pre-test)</td>
<td>104.8</td>
<td>103.86</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17.78</td>
<td>18.68</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Mathematical Pedagogical Competencies (Pre-test)</td>
<td>113.53</td>
<td>112.64</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.97</td>
<td>21.32</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Mathematics Teaching Competency (Pre-test)</td>
<td>136.71</td>
<td>135.53</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.78</td>
<td>26.64</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Achievement Motivation</td>
<td>120.20</td>
<td>121.30</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24.87</td>
<td>25.64</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Teaching Aptitude</td>
<td>135.32</td>
<td>135.92</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.45</td>
<td>26.76</td>
<td>(NS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>63</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

$t = 2.62$ to be significant at .01 level of significance for 124 df
$t = 1.98$ to be significant at .05 level of significance for 124 df

** = significant at .01 level of significance
* = significant at .05 level of significance
NS = Not Significant

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5.2.1 Interpretation and Discussion of results based on Table 5.3

- The t-ratio (0.29), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Mathematics Content Competencies is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) do not differ significantly on the variable of Mathematics Content Competencies.

- The t-ratio (0.31), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Mathematics Process Competencies is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) do not differ significantly on the variable of Mathematics Process Competencies.

- The t-ratio (0.24), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Mathematical Pedagogical Competencies is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) do not differ significantly on the variable of Mathematical Pedagogical Competencies.

- The t-ratio (0.21), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Mathematics Teaching Competency is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training
Strategy (TTS) do not differ significantly on the variable of Mathematics Teaching Competency.

• The t-ratio (0.26), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Achievement Motivation is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) do not differ significantly on the variable of Achievement Motivation.

• The t-ratio (0.29), between mean scores (Pre-test) of group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variable of Teaching Aptitude is insignificant at .05 level of significance. This implies that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) do not differ significantly on the variable of Teaching Aptitude.

From the above discussion, it can be inferred that there was no significant difference between the group exposed to Mathematics Competency Based Training Strategy (MCBTS) and group exposed to Traditional Training Strategy (TTS) on the variables of, Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies and Mathematics Teaching Competency, Achievement Motivation and Teaching Aptitude. Hence, both the groups can be treated as equivalent groups.

SECTION III
5.3 ANALYSIS OF VARIANCE (2X2)

The relative effectiveness of the two Training Strategies i.e. Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS), in terms of development of Mathematical Exit Competencies, namely, Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies and Mathematics Teaching Competency; in
relation to Achievement Motivation and Teaching Aptitude was determined by analyzing the gain scores. To evaluate the main effects and interaction effects, 2X2 analysis of variance was used on gain scores on these variables. 2 X 2 X 2 analysis of variance was not employed as the number of candidates in each cell came out to be too less. So, in the present study second order interactions were not studied.

The following assumptions for applying analysis of variance to data were tested:

- Observations within cells should be drawn from normally distributed population.
- Observations within cells should be random and mutually exclusive.
- The variance within cells must be approximately equal.
- The contribution to total variance must be additive.

The analysis of variance must be applied only if the above assumptions are fully met with data otherwise the entire analysis will be suspected from statistical/mathematical point of view.

The first assumption of normality of distribution of dependent variables of Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies and Mathematics Teaching Competency, and independent variable of Achievement Motivation and Teaching Aptitude in the population was tested by working out the measures of central tendency in terms of mean, median and the measures of dispersion in terms of skewness and kurtosis. The results have been already discussed in Section I. The results indicate the distribution to be normal, thereby fulfilling the first basic assumption of analysis of variance.

The second assumption of assigning random and mutually exclusive cases in each cell of 2X2 factorial design of analysis of variance was satisfied by assigning exclusive cases in each cell. The number of cases in each cell was made equal by randomly excluding extra cases.

The third assumption of equal variation in cells in terms of homogeneity of variance was tested with the help of Bartlett's test of homogeneity of variance (for ANOVA). \( \chi^2 \) was computed for each of the dependent variable and the results are placed in table 5.4.
Table 5.4
Bartlett’s Test of Homogeneity of Variance

<table>
<thead>
<tr>
<th>S.no</th>
<th>Variable</th>
<th>df = k-1</th>
<th>$\chi^2$</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mathematics Content Competencies</td>
<td>3</td>
<td>1.243</td>
<td>NS</td>
</tr>
<tr>
<td>2</td>
<td>Mathematics Process Competencies</td>
<td>3</td>
<td>2.032</td>
<td>NS</td>
</tr>
<tr>
<td>3</td>
<td>Mathematical Pedagogical Competencies</td>
<td>3</td>
<td>3.123</td>
<td>NS</td>
</tr>
<tr>
<td>4</td>
<td>Mathematics Teaching Competency</td>
<td>3</td>
<td>1.784</td>
<td>NS</td>
</tr>
<tr>
<td>5</td>
<td>Achievement Motivation</td>
<td>3</td>
<td>1.986</td>
<td>NS</td>
</tr>
<tr>
<td>6</td>
<td>Teaching Aptitude</td>
<td>3</td>
<td>2.302</td>
<td>NS</td>
</tr>
</tbody>
</table>

$\chi^2 = 7.815$ to be significant at .05 level of significance for 3 df
NS = Not Significant

The value of chi-square required to be significant for df 3 at .05 level of significance is 7.815. Since the obtained values of chi-square for Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies, Mathematics Teaching Competency, Achievement Motivation and Teaching Aptitude are less than the table value; the variance within the cells may be treated as homogeneous.

The fourth assumption of additivity of variance has been satisfied through the procedural operations of calculations.

After having the basic assumptions underlying ANOVA satisfied, the calculations of (2X2) ANOVA were computed through computer. Summaries of 2X2 analysis of variance for the variables of Training Strategies, Achievement Motivation and Teaching Aptitude are given in tables 5.5, 5.7, 5.9, 5.11, 5.13, 5.15, 5.17 and 5.19 for gain scores on Mathematics Content Competencies, Mathematics Process Competencies, Mathematical Pedagogical Competencies and Mathematics Teaching Competency.
5.3.1 Analysis, Interpretation and Discussion of results based on 2x2 analysis of variance for variables of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on Mathematics Content Competencies

Table 5.5

Summary of 2X2 analysis of variance for the variable of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on gain scores on dependent variable of Mathematics Content Competencies.

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-values</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>26841.361</td>
<td>1</td>
<td>26841.361</td>
<td>151.46</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Achievement Motivation (B)</td>
<td>1013.361</td>
<td>1</td>
<td>1013.361</td>
<td>5.71</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>AXB</td>
<td>992.250</td>
<td>1</td>
<td>992.250</td>
<td>5.59</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>Error in groups</td>
<td>5670.667</td>
<td>56</td>
<td>177.208</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df  
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance  
**= significant at .05 level of significance
INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.5

5.3.1.1 Main effects of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Content Competencies

The F-value of 151.46 for the main effects of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematics Content Competencies was found to be significant at .01 level of significance as it is more than table value of 7.12 for 1/56 degrees of freedom. It signifies that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis la namely ‘There exists no significant differences between group trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Content Competencies’ stands rejected. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on the variable of Mathematics Content Competencies.

In order to determine which group performed better in acquisition of Mathematics Content Competencies, the mean gain scores of two groups were compared. Since mean gain scores of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 79.00 and Traditional Training Strategy (TTS) is 24.38, it can be concluded that the group trained through Mathematics Competency Based Training Strategy (MCBTS) developed significantly higher Mathematics Content Competencies than the group trained through Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result for the present study:

‘Mathematics Content Competencies’ is the mathematical exit competency addressing content and its delivery - based exit sub-competencies. It includes four exit...
sub-competencies namely, ‘Mathematics Content Knowledge’, ‘Illustration with Examples’, ‘Selection and Organization of Content’ and ‘Mathematical Connections’.

The Training Strategy developed by the investigator i.e. Mathematics Competency Based Training Strategy (MCBTS) was framed such that instructions were individualized and the participants progressed through the instructional program at their own rate by demonstrating the attainment of the specified exit competencies. The exit sub-competencies identified by the investigator were related to mathematics content knowledge as well as content delivery. One particular exit competency was practiced till the set criterion of 80/80 was met. The prospective mathematics teacher was provided feedback after his/her demonstration of the lesson. Analytic-Synthetic approach was the foundation of the strategy. Systematic approach to the strategy enabled prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS) to perform effectively in acquisition of Mathematics Content Competencies.

On the other hand, the group trained through Traditional Training Strategy (TTS) was given training in micro teaching skills, namely, Blackboard Writing, Introduction of Topic, Illustration with Examples, Questioning and Explanation. Demonstration lessons were given by the investigator. Prospective teachers of the group were given time to practice skills. One skill was practiced till satisfactory feedback from peer group and supervisor. The practice focused more on acquisition of specific skills, and less on mathematics content and other related skills competencies. This might be the reason behind superior acquisition of Mathematics Content Competencies by the group exposed to Mathematics Competency Based Training Strategy (MCBTS) as compared to group exposed to Traditional Training Strategy (TTS).

Thus the present finding regarding effectiveness of MCBTS in developing Mathematics Content Competencies is justified in light of the above discussion.

Mean gain scores of main effects of Training Strategies on Mathematics Content Competencies are depicted in figure 5.1.
Figure 5.1 shows that mean gain scores of group trained through Mathematics Competency Based Strategy (MCBTS) is more than mean gain scores of group trained through Traditional Training Strategy (TTS) on Mathematics Content Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.1.2 Main effects of Achievement Motivation (High and Low) on Mathematics Content Competencies

From table 5.5, the F-value of 5.71 for the main effects of Achievement Motivation on Mathematics Content Competencies was found to be significant at .05 level of significance as it is more than the table value 4.01 for 1/56 degrees of freedom.

The significant F-value indicates that the two groups namely, High Achievement Motivation group and Low Achievement Motivation group have yielded significantly different mean gain scores on Mathematics Content Competencies. Hence the hypothesis 1b, namely 'There exists no significant difference between High Achievement Motivation group and Low Achievement Motivation group in mean
gain scores on Mathematics Content Competencies’; is refuted. This implies that there is significant difference between High Achievement Motivation group and Low Achievement Motivation group on the variable of Mathematics Content Competencies. Therefore, Achievement Motivation does account for differential Mathematics Content Competencies.

With a purpose to identify which group performed better in acquisition of Mathematics Content Competencies, the mean gain scores of both the groups, namely, with High Achievement Motivation and Low Achievement Motivation were compared. Since the mean gain score for High Achievement Motivation group was 57.00 and for Low Achievement Motivation group was 46.38, it can be concluded that High Achievement Motivation group was significantly better than Low Achievement Motivation group in acquisition of Mathematics Content Competencies.

The above finding seems to be justifiably true in the light of the following arguments:

Mathematics Content Competencies is mathematical exit competency comprising of four exit sub-competencies namely; Mathematics Content Knowledge, Giving Illustrations with Examples, Selection and Organization of Mathematics Content and making Mathematical Connections. These exit sub-competencies are a combination of body of knowledge, set of skills and cluster of appropriate motives/traits that a prospective mathematics teacher should possess to perform a given task effectively and efficiently. The acquisition of this set of exit competencies is based on the cognitive aspect of an individual.

Achievement Motivation may be regarded as a goal oriented behavior of an individual with a felt need and a power to achieve higher. It is “the need to perform well or striving for success, and evidenced by persistence and efforts in the face of difficulties; achievement motivation is regarded as the central human motivation”. People who have a strong need for achievement often exhibit certain characteristics. One of the most significant characteristics of achievement motivated people is that they seek challenging tasks so that their expertise can be recognized i.e. they exercise extra efforts to demonstrate the given task in an efficient and effective manner. The above facts indicate that people with higher Achievement Motivation possess a need for success or attainment of excellence, and therefore satisfy their needs through
different means, and are driven to succeed for varying reasons both internal and external. The prospective mathematics teachers with high level of Achievement Motivation might suitably utilize their analytical skills to acquire Mathematics Content Competencies in order to fulfill their need to be recognized for successful outcomes due to their actions; and consequently satisfy themselves which is the core essence of achievement motivated people.

From the above discussion, it can be concluded that people with High Achievement Motivation might practice a set of cognitive based exit competencies better than those with Low Achievement Motivation. The finding ‘High Achievement Motivation group was significantly better than Low Achievement Motivation group’ seems to be justified.

Mean gain scores of main effect corresponding to main effect of Achievement Motivation (High and Low) on Mathematics Content Competencies are shown in figure 5.2.

**FIGURE 5.2**
Graphical Representation Showing Mean Gain Scores of Main Effect Corresponding To Achievement Motivation (High Achievement Motivation and Low Achievement Motivation) on Mathematics Content Competencies
Figure 5.2 depicts mean gain scores of High Achievement Motivation group and Low Achievement Motivation group. The mean gain score of High Achievement Motivation group is higher than Low Achievement Motivation group in acquisition of Mathematics Content Competencies.

Moreover, the difference between the groups is significant as the calculated F-value is significant.

5.3.1.3 Interaction effect between Training Strategies and Achievement Motivation on Mathematics Content Competencies

Interaction effect of Training Strategies and Achievement Motivation was found to be significant at 0.05 level of significance as F-value was found to be 5.59 (table 5.5), which is more than the table value of 4.01 for 1/56 degrees of freedom. This significant ratio indicates that two variables, namely, Training Strategies and Achievement Motivation interact to produce significant effect on Mathematics Content Competencies.

Hence the null hypothesis lc stating that ‘There exists no significant interaction between Training Strategies and Achievement Motivation on acquisition of Mathematics Content Competencies by prospective mathematics teachers’ is discarded.

In order to determine which groups differ significantly on the variable Mathematics Content Competencies, t-ratios were computed for different combinations of A X B. The results are entered in table 5.6.
Table 5.6

t-ratios for different combinations of A X B on Mathematics Content Competencies

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>68.44</td>
<td>18.96</td>
<td>2.92*</td>
</tr>
<tr>
<td></td>
<td>A1B1</td>
<td>15</td>
<td></td>
<td>89.55</td>
<td>10.44</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>68.44</td>
<td>18.96</td>
<td>5.95*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td></td>
<td>24.33</td>
<td>11.60</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>68.44</td>
<td>18.96</td>
<td>6.12*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td></td>
<td>24.44</td>
<td>10.26</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>89.55</td>
<td>10.44</td>
<td>12.53*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td></td>
<td>24.333</td>
<td>11.60</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>89.55</td>
<td>10.44</td>
<td>13.34*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td></td>
<td>24.44</td>
<td>10.26</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>24.33</td>
<td>11.60</td>
<td>.02 (NS)</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td></td>
<td>24.44</td>
<td>10.26</td>
<td></td>
</tr>
</tbody>
</table>

A1- MCBTS group                B1- High Achievement Motivation group
A2- TTS group                  B2- Low Achievement Motivation group

\[ t = 2.76 \] to be significant at .01 level of significance for 28 degrees of freedom
\[ t = 2.05 \] to be significant at .05 level of significance for 28 degrees of freedom

* = significant at .01 level of significance
** = significant at .01 level of significance
NS = Not Significant
Interpretation and discussion based on table 5.4

The perusal of table 5.4 reveals the following facts.

- The t-ratio (2.92), between groups with High Achievement Motivation and Low Achievement Motivation in respect of Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The results show that mean gain scores on Mathematics Content Competencies of High Achievement Motivation group (89.55) are higher than Low Achievement Motivation group (68.44), trained through Mathematics Competency Based Training Strategy (MCBTS). This implies that High Achievement Motivation group has developed significantly superior Mathematics Content Competencies than the Low Achievement Motivation group when exposed to Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (5.95) between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. Further results show that mean gain scores on Mathematics Content Competencies of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (68.44) was found to be higher than Low Achievement Motivation group trained through Traditional Training Strategy (TTS) (24.33). This implies that group trained through Mathematics Competency Based Training Strategy (MCBTS) has developed significantly better Mathematics Content Competencies than group trained through Traditional Training (TTS) Strategy having Low Achievement Motivation.

- The t-ratio (6.12) between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) Strategy was found to be significant at .01 level of significance. The results show that mean gain scores of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (68.44) is higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (24.44). This implies that Low
Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) has developed significantly better Mathematics Content Competencies than High Achievement Motivation group exposed to Traditional Training (TTS) Strategy.

➢ The t-ratio (12.53), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (89.55) was found to be higher than Low Achievement Motivation group exposed to Traditional Training Strategy (TTS) (24.33). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly better in the acquisition of Mathematics Content Competencies than Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

➢ The t-ratio (13.34) between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (89.55) is found to be higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (24.44). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior in the acquisition of Mathematics Content Competencies than the High Achievement Motivation group trained through Traditional Training Strategy (TTS).

➢ The t-ratio (.02) between High Achievement Motivation group and Low Achievement Motivation group, when both the groups trained through Traditional Training Strategy (TTS), was found to be insignificant at .05 level of significance. This implies that the two groups do not differ significantly in the acquisition of Mathematics Content Competencies.
5.3.2 Analysis, interpretation and discussion based on 2x2 analysis of variance for variable of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on Mathematics Process Competencies

Table 5.7

Summary of 2X2 analysis of variance for the variable of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on gain scores on dependent variable of Mathematics Process Competencies

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-VALUE</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>37377.778</td>
<td>1</td>
<td>37377.778</td>
<td>228.51</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Achievement Motivation (B)</td>
<td>1393.778</td>
<td>1</td>
<td>1393.778</td>
<td>8.52</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>AxB</td>
<td>1178.778</td>
<td>1</td>
<td>1178.778</td>
<td>7.20</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Error in groups</td>
<td>5234.222</td>
<td>56</td>
<td>163.569</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance
**= significant at .05 level of significance

Interpretation and Discussion of Results On The Basis Of Table 5.7

5.3.2.1 Main effects of Training strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Process Competencies

The F-value of 228.51 for the main effect of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training strategy (TTS) on Mathematics Process Competencies was found to be significant at .01 level of significance as it is more than the table value of 7.12 for
1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 2a namely, “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Process Competencies”, is rejected. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Process Competencies.

In order to determine which group performed significantly better in acquisition of Mathematics Process Competencies, the mean gain scores of two groups were compared. Since mean gain scores on Mathematics Process Competencies of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 101.83 and group trained through Traditional Training Strategy (TTS) is 37.38, it can be concluded that group trained through Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematics Process Competencies than the group trained through Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result for the present study:

‘Mathematics Process Competencies’ is the mathematical exit competency encompassing four mathematical exit sub-competencies, namely, ‘Mathematical Communication’, ‘Questioning and Response Management’, ‘Mathematical Problem Solving’ and ‘Evaluation’. ‘Mathematical Communication’ includes familiarity with mathematical language, using relevant mathematical language, effective use of mathematics language i.e. translate from natural language to symbolic mathematical language and vice versa, using listening skills and interacting with students by deliberately changing interaction style from one pattern to another. ‘Questioning And Response Management’ involves structuring of question, types of questions and various means of response management like prompting, seeking further information, refocusing, redirecting and increasing critical awareness. ‘Mathematical Problem Solving’ focuses on problem solving as an integral part of all mathematics learning. It includes posing various kinds of problems, helping students to identify the
information given and information that needs to be determined, helping students to check suitability of strategy, helping students to execute the chosen strategy and helping students to analyze the applied strategy. ‘Evaluation’ refers to summative evaluation of a student by a mathematics teacher. It includes apperceptive mass judgment, observing general weaknesses; prepare remedial strategy, techniques of evaluation, test construction, test administration, scoring the test, analyzing the test and reporting the results. All these exit competencies are mainly concerned with communication skills and assessment skills of a mathematics teacher.

The strategy developed by the investigator was framed such that the prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS), due to flexible training approach, had sufficient opportunities to practice and acquire these exit competencies. After every demonstration lesson, feedback was given to the prospective mathematics teacher and was discussed in the small group activities. Peer interaction through cooperative learning in small group activities, provided optimal opportunities for prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS); to communicate mathematically; to question and to manage student’s responses; to solve mathematical problems; to evaluate; and, to bring out his/her strengths through group efforts. The self paced comprehensive learning strategy provides for the individual development and therefore, enables the prospective mathematics teachers of group trained through Mathematics Competency Based Training Strategy (MCBTS), to demonstrate expertise in attainment of exit competencies.

The group trained through Traditional Training Strategy (TTS) practiced micro teaching skills essential for classroom teaching learning process. Investigator introduced skills and its components to the prospective mathematics teacher. One skill was taken at a time. Investigator demonstrated model lesson to prospective mathematics teachers of the group. Thereafter, prospective mathematics teachers practiced the skill. After the lesson, feedback was given by peers and supervisor on the basis of observation tables filled by them. Re-teach was given to poor performers. Micro teaching cycle was repeated till satisfactory feedback by peers and supervisor. The strategy enabled prospective mathematics teachers to acquire specific skills
through practice; but it could not make prospective mathematics teachers familiar with processes involved in mathematics teaching.

The above discussion supports the finding that there exists significant difference between group exposed to Mathematics Competency Based Training Strategy (MCBTS) and the group exposed to Traditional Training Strategy (TTS) on the variable of Mathematics Process Competencies.

Mean gain scores of main effects of Training Strategies on Mathematics Process Competencies are depicted in figure 5.3.

**FIGURE 5.3**
Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding to Training Strategies On Mathematics Process Competencies

Figure 5.3 shows that mean gain scores of group exposed to Mathematics Competency Based Training Strategy (MCBTS) is more than mean gain scores of group exposed to Traditional Training Strategy (TTS) on the variable of Mathematics Process Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.
5.3.2.2 Main effects of Achievement Motivation (High and Low) on Mathematics Process Competencies

From table 5.7, F-value of 8.52 for main effects of Achievement Motivation on Mathematics Process Competencies was found to be significant at .01 level of significance as it is more than the table value 7.12 for 1/56 degrees of freedom.

This significant F-ratio indicates that two groups, namely, Low Achievement Motivation group and High Achievement Motivation group have yielded significantly different mean gain scores on Mathematics Process Competencies. Hence the hypothesis 2b namely, “There exists no significant difference between High Achievement Motivation group and Low Achievement Motivation group in mean gain scores of Mathematics Process Competencies” is refuted. This implies that there is significant difference between High Achievement Motivation group and Low Achievement Motivation group on the variable of Mathematics Process Competencies. Therefore, the Achievement Motivation does account for differential Mathematics Process Competencies.

In order to determine which group performed significantly better in acquisition of Mathematics Process Competencies, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Process Competencies of High Achievement Motivation group is 75.83 and of Low Achievement Motivation group is 63.38, it can be concluded that High Achievement Motivation group performed significantly better in acquisition of Mathematics Process Competencies than Low Achievement Motivation group.

The above finding seems to be justifiably true in the light of the following arguments:

‘Mathematics Process Competencies’ is the Mathematical Exit Competency encompassing the exit sub-competencies associated to processes involved in mathematics. These exit sub-competencies are Mathematical Communication, Questioning and Response Management, Mathematical Problem Solving and Evaluation.
Achievement Motivation is a psychological concept that links personality traits and social background of an individual with his or her level of ‘need for achievement’. It involves the individual in competing with others at some standards of excellence. Achievement Motivation is based on reaching success and achieving all of our aspirations in life. Achievement goals can affect the way a person performs a task and represent a desire to show competence (Harackiewicz, Barron, Carter, Lehto, & Elliot, 1997). The study shows that people who set higher achievement goals represent stronger desire to demonstrate competence to achieve the set goals. The higher is the achievement motivation in an individual, the stronger is the desire to demonstrate expertise in task allotted to them. The fact indicate that highly achievement motivated people might suitably employ their communication and assessment skills being strongly desirous of acquisition of a set of process-based exit competencies as compared to those prospective mathematics teachers with low achievement motivation. The finding ‘acquisition of Mathematics Process Competencies are dependent on Achievement Motivation’ seems to be justified.

Mean gain scores of Main Effects corresponding to Achievement Motivation (High and Low) on Mathematics Process Competencies are shown in figure 5.4.

**FIGURE 5.4**

Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding to Achievement Motivation on Mathematics Process Competencies
Figure 5.4 shows that mean gain scores of High Achievement Motivation group is more than the mean gain score of Low Achievement Motivation group in acquisition of Mathematics Process Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.2.3 Interaction effect between Training Strategies and Achievement Motivation on Mathematics Process Competencies

Interaction effect of Training Strategies and Achievement Motivation was found to be significant as the F-value was 7.20 (Table 5.7), which is more than the table value of 7.12 for degrees of freedom 1/56 at 0.01 level of significance. This significant F-ratio indicates that two variables of Training Strategies and Achievement Motivation interact to produce significant effect on Mathematics Process Competencies.

Hence, the null hypothesis 2c stating that “There exists no significant interaction between Training Strategies and Achievement Motivation on acquisition of Mathematics Process Competencies by prospective mathematics teachers” is rejected.

In order to determine which groups differ significantly on the variable Mathematics Process Competencies, t-ratios were calculated for different combinations of A X B. The results are entered in table 5.8.
Table 5.8

t-ratios for different combinations of A X B on Mathematics Process Competencies

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>89.88</td>
<td>13.204</td>
<td>3.30*</td>
</tr>
<tr>
<td></td>
<td>A1B1</td>
<td>15</td>
<td></td>
<td>113.77</td>
<td>17.217</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>89.88</td>
<td>13.204</td>
<td>9.74*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td></td>
<td>36.88</td>
<td>9.584</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>89.88</td>
<td>13.204</td>
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<td>15</td>
<td>28</td>
<td>113.77</td>
<td>17.217</td>
<td>11.70*</td>
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<td>36.88</td>
<td>9.584</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>113.77</td>
<td>17.217</td>
<td>11.55*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td></td>
<td>37.88</td>
<td>9.571</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>36.88</td>
<td>9.584</td>
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<td>A2B2</td>
<td>15</td>
<td></td>
<td>37.88</td>
<td>9.571</td>
<td></td>
</tr>
</tbody>
</table>

A1- MCBTS group  B1-High Achievement Motivation group
A2- TTS group  B2-Low Achievement Motivation group

\[ t = 2.67 \] to be significant at .01 level of significance for 28 df
\[ t = 2.00 \] to be significant at .05 level of significance for 28 df

* = significant at .01 level of significance
** = significant at .05 level of significance
NS = Not Significant

Interpretation and discussion based on table 5.8

The perusal of table 5.8 reveals the following facts.

- The t-ratio (3.30), between groups with Low Achievement Motivation and High Achievement Motivation in respect of Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of
significance. The results show that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (113.77) is higher than Low Achievement Motivation group exposed to Mathematics Competency Based Strategy (MCBTS) (89.88). This implies that High Achievement Motivation group has performed significantly superior on the acquisition of Mathematics Process Competencies than the Low Achievement Motivation group and both the groups exposed to Mathematics Competency Based Training Strategy (MCBTS).

The t-ratio (9.74), between Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group exposed to Traditional Training (TTS) strategy was found to be significant at .01 level of significance. The results show that mean gain scores of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (89.88) is higher than Low Achievement Motivation group exposed to Traditional Training strategy (TTS) (36.88). This implies that Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Process Competencies than the Low Achievement Motivation group trained through Traditional Training strategy (TTS).

The t-ratio (9.56), between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (89.88) is higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (37.88). This implies that Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) differ significantly on the acquisition of Mathematics Process Competencies.
The t-ratio (11.70), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (113.77) is higher than Low Achievement Motivation group exposed to Traditional Training Strategy (TTS) (36.88). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Process Competencies than the group with Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (11.55), between High Achievement Motivation group trained through Mathematics Competency Based Teaching Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that the mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (113.77) is higher than High Achievement Motivation group exposed to Traditional Training (TTS) strategy (37.88). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Process Competencies than the High Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (.22), between High Achievement Motivation group and Low Achievement Motivation group and both the groups trained through Traditional Training Strategy (TTS) was found to be insignificant. This implies that these two groups do not differ significantly on the acquisition of Mathematics Process Competencies.
5.3.3 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on Mathematical Pedagogical Competencies

Table 5.9
Summary of 2X2 analysis of variance for the variables of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on gain scores on dependent variable of Mathematical Pedagogical Competencies

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-VALUE</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>23921.778</td>
<td>1</td>
<td>23921.778</td>
<td>61.72</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Achievement Motivation (B)</td>
<td>2209.000</td>
<td>1</td>
<td>2209.000</td>
<td>5.70</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>AXB</td>
<td>2500.000</td>
<td>1</td>
<td>2500.000</td>
<td>6.45</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>Error in groups</td>
<td>12402.222</td>
<td>56</td>
<td>387.569</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance
**= significant at .05 level of significance
INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.9

5.3.3.1 Main effects of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematical Pedagogical Competencies

The F-value of 61.72 for the main effect of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematical Pedagogical Competencies was found to be significant at .01 level of significance as it is more than the table value of 7.12 for 1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 3a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) in mean gain scores of Mathematical Pedagogical Competencies”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematical Pedagogical Competencies.

In order to determine which group performed significantly better in acquisition of Mathematical Pedagogical Competencies, the mean gain scores of the two groups were compared. Since mean gain scores of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 91.94 and group trained through Traditional Training Strategy (TTS) is 40.38, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematical Pedagogical Competencies than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:

Mathematical Pedagogical Competencies is the mathematical exit competency pertaining to pedagogical exit competencies in a mathematics classroom. ‘Pedagogy’ refers to the art or profession of teaching i.e. the act, process or art of imparting
knowledge and skill. Pedagogy discusses the conditions of appropriateness of educational practices and aims to provide a knowledge base for educational professionals. Central to the idea of pedagogy is to distinguish between what is more appropriate and what is less appropriate for children and what are appropriate ways of teaching and giving assistance to children. Mathematical Pedagogical Competencies focuses on learning of mathematics teaching-in-action rather than learning-about-action. The mathematical exit competency encompasses two exit sub-competencies, namely, ‘Blackboard Writing’ and ‘Multiple Instructional Strategies’. ‘Blackboard writing’ focuses on checking physical aspects of blackboard, neat presentation on blackboard, writing in proper sequence, legibility of handwriting, appropriateness of written work and use of blackboard effectively. The exit sub-competency ‘Multiple Instructional Strategies’ includes various components like use appropriate instructional strategy, employ instructional strategy suitable to arouse and maintain interest of students in mathematics, use instructional strategy to help student to think mathematically, uses inductive-deductive approach, uses analytic-synthetic approach, and use heuristic approach.

The Training Strategy developed by the investigator i.e. MCBTS has been framed in such a way that prospective mathematics teachers were given sufficient time to practice one particular exit sub-competency till the set criterion of 80/80 was met. The unit of progression was mastery of a specific mathematical exit sub-competency. The strategy was participant centered. The flexible self paced learning strategy was based on analytic-synthetic approach. Investigator gave demonstration lessons to prospective mathematics teachers. The demonstration lessons were based on the use of multiple instructional strategies like inductive-deductive approach and heuristic approach. Criterion to be used in assessing achievement and conditions under which achievement was assessed was explicitly stated and made public in advance. The prospective mathematics teachers of group exposed to Mathematics Competency Based Training Strategy (MCBTS) were aware of ‘what’ was to be achieved, ‘how’ achievement would be assessed, and ‘conditions’ under which assessment would be carried out. The awareness consciously directed their behavior towards acquisition of exit sub-competencies.

The group exposed to Traditional Training Strategy (TTS) aimed at acquisition of micro skills, and got limited exposure to various instructional strategies.
that could be employed in mathematics classroom teaching learning process in order to make it effective. The prospective mathematics teachers of this group were not exposed to comprehensive outlook of analyzing, choosing, adopting and blending of various instructional strategies in a mathematics classroom. This might be the reason of inferior performance of group exposed to Traditional Training Strategy (TTS).

The above discussion supports the present finding that prospective mathematics teachers of group exposed to Mathematics Competency Based Training Strategy (MCBTS) demonstrated superior performance in acquisition of Mathematical Pedagogical Competencies than the group exposed to Traditional Training Strategy (TT).

Mean gain scores of main effects of Training Strategies (Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS)) on Mathematical Pedagogical Competencies are depicted in figure 5.5.

FIGURE 5.5
Graphical Representation Showing Mean Gain Scores of Main Effect Corresponding to Training Strategies On Mathematical Pedagogical Competencies

Figure 5.5 shows that mean gain scores of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is more than the group trained through Traditional Training Strategy (TTS) on acquisition of Mathematical Pedagogical Competencies.
Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.3.2 Main effects of Achievement Motivation (High and Low) on Mathematical Pedagogical Competencies

From table 5.9, F-value of 5.7 for main effects of Achievement Motivation on Mathematical Pedagogical Competencies was found to be significant at .05 level of significance as it is more than the table value 4.01 for 1/56 degrees of freedom. This significant F-ratio indicates that two groups’ namely Low Achievement Motivation and High Achievement Motivation have yielded significantly different mean gain scores on Mathematical Pedagogical Competencies. Hence the hypothesis 3b namely, “There exists no significant difference between High Achievement Motivation group and Low Achievement Motivation group in mean gain scores on Mathematical Pedagogical Competencies” is refuted. This implies that there is significant difference between High Achievement Motivation group and Low Achievement Motivation group on Mathematical Pedagogical Competencies. Therefore, the Achievement Motivation does account for differential Mathematical Pedagogical Competencies.

In order to determine which group performed significantly better in acquisition of Mathematical Pedagogical Competencies, the mean gain scores of the two groups were compared. Since mean gain scores of High Achievement Motivation group is 74 and of Low Achievement Motivation group is 58.33, it can be concluded that High Achievement Motivation group performed significantly better in acquisition of Mathematical Pedagogical Competencies than Low Achievement Motivation group.

The above finding seems to be justifiably true in the light of the following arguments: Mathematical Pedagogical Competencies is the mathematical exit competency which includes the exit sub-competencies linked to pedagogical practices in mathematics. These exit sub-competencies are Black Board Writing and Multiple Instructional Strategies.

McClelland (1961) described n-ach person as ‘achievement motivated’ and therefore seeks achievement, attainment of realistic but challenging goals, and advancement in the job. There is a strong need of feedback as to achievement and
progress, and a need for sense of accomplishment. A desire by people with a high need for achievement to seek situations in which they get concrete feedback on how well they are doing is closely related to this concern for personal accomplishment. In addition to concrete feedback, the nature of feedback is more important to achievement motivated people. They respond favorably to information about their work i.e. achievement motivated people might want job-relevant feedback. For personal accomplishment in job related performances as a mathematics teacher with high achievement motivation, prospective mathematics teacher might demonstrate superior acquisition of pedagogy-based competencies in mathematics, as compared to prospective mathematics teacher with low achievement motivation. Consequently, the finding ‘acquisition of Mathematical Pedagogical Competencies are dependent on Achievement Motivation’ seems to be justified.

Mean gain scores of main effects corresponding to Achievement Motivation (High and Low) on Mathematical Pedagogical Competencies are depicted in figure 5.6.

**FIGURE 5.6**

Graphical Representation of Mean Gain Scores of Main Effects Corresponding To Achievement Motivation (High and Low) on Mathematical Pedagogical Competencies
Figure 5.6 shows that mean gain scores of High Achievement Motivation group is more than mean gain score of Low Achievement Motivation group in acquisition of Mathematical Pedagogical Competencies.

Moreover, the difference is statistically significant as F-value is significant at .05 level of significance.

5.3.3.3 Interaction effect between Training Strategies and Achievement Motivation on Mathematical Pedagogical Competencies

Interaction effect of Training Strategies and Achievement Motivation was found to be significant at 0.05 level of significance as the F-value was 6.45 (Table 5.9), which is more than the table value of 4.01 for 1/56 degree of freedom. This significant F-ratio indicates that two variables of Training Strategies and Achievement Motivation interact to produce significant effect on Mathematical Pedagogical Competencies.

Hence, the null hypothesis 3c stating that “There exists no significant interaction between Training strategies and Achievement Motivation on acquisition of Mathematical Pedagogical Competencies by prospective mathematics teachers” is rejected.

In order to determine which groups differ significantly on the variable Mathematical Pedagogical Competencies, t-ratios were computed for different combinations of A X B and the results are entered in table 5.10.
Table 5.10

$t$-ratios for different combinations of A X B on Mathematical Pedagogical Competencies

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>75.77</td>
<td>23.857</td>
<td>2.77*</td>
</tr>
<tr>
<td></td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>108.11</td>
<td>25.536</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>75.77</td>
<td>23.857</td>
<td>3.91*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td>28</td>
<td>40.88</td>
<td>12.035</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>75.77</td>
<td>23.857</td>
<td>3.92*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>39.88</td>
<td>13.568</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>108.11</td>
<td>25.536</td>
<td>7.14*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td>28</td>
<td>40.88</td>
<td>12.035</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>108.11</td>
<td>25.536</td>
<td>7.07*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>39.88</td>
<td>13.568</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>40.88</td>
<td>12.035</td>
<td>.16 (NS)</td>
</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TTS group  
B1- High Achievement Motivation group  
B2- Low Achievement Motivation group

$t = 2.67$ to be significant at .01 level of significance for 28 df  
$t = 2.05$ to be significant at .05 level of significance for 28 df

* = significant at .01 level of significance  
** = significant at .05 level of significance  
NS = Not Significant
Interpretation and discussion based on table 5.10

The perusal of table 5.10 reveals the following facts:

- The t-ratio (2.77), between groups with Low Achievement Motivation and High Achievement Motivation in respect of Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group (108.11) is higher than Low Achievement Motivation group (75.77), when trained through Mathematics Competency Based Training Strategy (MCBTS). This implies that High Achievement Motivation group performed significantly better on the acquisition of Mathematical Pedagogical Competencies than the Low Achievement Motivation when exposed to Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (3.91), between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS), was found to be significant at .01 level of significance. The results show that mean gain scores of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (75.77) is higher than Low Achievement Motivation group exposed to Traditional Training Strategy (TTS) (40.88). This implies that Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

- The t-ratio (3.92), between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results showed that mean gain scores of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (75.77) is higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (39.88). This implies that Low
Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) has developed significantly better Mathematical Pedagogical Competencies than High Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (7.14), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results showed that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (108.11) is higher than Low Achievement Motivation group exposed to Traditional Training Strategy (TTS) (40.88). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (7.07), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (108.11) is higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (39.88). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the High Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (.16), between groups with High Achievement Motivation and with Low Achievement Motivation in respect of Traditional Training Strategy (TTS) was found to be insignificant at .05 level of significance. This implies
that these two groups do not differ significantly on the variable of Mathematical Pedagogical Competencies.

5.3.4 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on Mathematics Teaching Competency

Table 5.11
Summary of 2x2 analysis of variance for the variable of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Achievement Motivation on gain scores on dependent variable of Mathematics Teaching Competency

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES (SS)</th>
<th>df</th>
<th>MEAN SUM OF SQUARES (MS)</th>
<th>F-VALUE</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>260270.028</td>
<td>1</td>
<td>260270.028</td>
<td>578.89</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Achievement Motivation (B)</td>
<td>5700.250</td>
<td>1</td>
<td>5700.250</td>
<td>12.67</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>AXB</td>
<td>3823.361</td>
<td>1</td>
<td>3823.361</td>
<td>8.50</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Error in groups</td>
<td>14387.111</td>
<td>56</td>
<td>449.597</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

* = significant at .01 level of significance
** = significant at .05 level of significance
INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.9

5.3.4.1 Main effects of Training strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Teaching Competency

The F-value of 578.89 for the main effects of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematics Teaching Competency was found to be significant at .01 level of significance as it is more than the table value of 7.12 for 1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 4a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) in mean gain scores on Mathematics Teaching Competency”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Teaching Competency.

In order to determine which group performed significantly better in acquisition of Mathematics Teaching Competency, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Teaching Competency of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 191.11 and group trained through Traditional Training Strategy (TTS) is 21.05, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematics Teaching Competency than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:
Mathematics Teaching Competency refers to teaching competency of a mathematics teacher in classroom teaching learning process. Mathematics teachers are responsible for developing appropriate instructional strategies to help students achieve the curriculum expectations, and for developing appropriate methods for assessing and evaluating student learning in order to provide numerous opportunities to students to develop their ability to solve problems, reason mathematically, and connect the mathematics they are learning to the real world around them. Mathematics Teaching Competency recognizes that students need a solid conceptual foundation in mathematics in order to further develop and apply their knowledge effectively, teachers endeavor to create classroom environment that engages students interest and helps them arrive at understanding of mathematics that is critical to further learning.

In the present study, the context of Mathematics Teaching Competency refers to the combination of all the basic mathematical exit sub-competencies relative to the three mathematical exit competencies, namely, Mathematics Content Competencies, Mathematics Process Competencies and Mathematical Pedagogical Competencies.

‘Mathematics Competency Based Training Strategy’ (MCBTS) developed by the investigator was framed such that supporting theory was integrated with competency practice. The investigator developed lesson plans for each of the ten identified and selected mathematical exit sub-competencies. Competency based lesson was planned prior to the demonstration by investigator as well as mathematics prospective teachers. A variety of support material including laboratory apparatus, handmade experimental aids like models, etc were used by the investigator during the demonstration lessons. Prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy, developed expertise in preparing competency-based lesson plans and experimental aids; use them during their practice lessons; and therefore gained confidence as they succeeded in mastering mathematical exit competencies. Satisfactory completion of training was based on achievement of all specified mathematical exit competencies. The participant centered Training Strategy provided optimum background and sufficient opportunities to prospective mathematics teachers of group exposed to Mathematics Competency Based Training Strategy (MCBTS) to attain the ‘Mathematics Teaching Competency’. 

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The group trained through Traditional Training Strategy (TTS) was exposed to demonstration of model lesson and micro skill lessons by the investigator. Model lesson plan and skill based lesson plans were prepared prior to demonstration in class. The group was not provided any kind of support material. The exposure was limited and confined to traditional curriculum. The approach of this strategy did not focus on expertise in mathematical content, process and pedagogy.

The Prospective mathematics teachers trained through Mathematics Competency Based Training Strategy (MCBTS) might have been significantly better equipped with the mathematical exit sub-competencies under the three mathematical exit competencies, namely, Mathematics Content Competencies, Mathematics Process Competencies and Mathematical Pedagogical Competencies, due to more permanent retention in their minds as a result of analytic-synthetic approach of Mathematics Competency Based Training Strategy, which was further based on principles of individualized instructions, immediate feedback and practice. On the other hand, it would have remained in superficial and fluid state of mind of prospective mathematics teachers trained through Traditional Training Strategy (TTS). The above discussion supports the present finding that the prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy demonstrated superior performance than prospective mathematics teachers exposed to Traditional Training Strategy (TTS).

Therefore, the effectiveness of Mathematics Competency Based Training Strategy (MCBTS) in developing Mathematics Teaching Competency is justified in light of the above discussion.

Mean gain scores of Main effects corresponding to Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Teaching Competency are depicted in figure 5.7.
FIGURE 5.7

Graphical Representation of Mean Gain Scores Corresponding To Main Effects Of Training Strategies On Mathematics Teaching Competency

Figure 5.7 shows that mean gain scores of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is more than the group trained through Traditional Training Strategy (TTS) in acquisition of Mathematics Teaching Competency.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.4.2 Main effects of Achievement Motivation (High and Low) on Mathematics Teaching Competency

From table 5.11, F-value of 12.67 for Main effects of Achievement Motivation on Mathematics Teaching Competency was found to be significant at .01 level of significance as it is more than the table value 7.12 for 1/56 degrees of freedom.

This significant F-ratio indicates that two groups’ namely Low Achievement Motivation and High Achievement Motivation have yielded significantly different mean gain scores on Mathematics Teaching Competency. Hence the hypothesis 4b namely, “There exists no significant difference between High Achievement Motivation group and Low Achievement Motivation group in mean gain scores on Mathematics Teaching Competency” is refuted. This implies that there is significant difference between High Achievement Motivation group and Low Achievement
Motivation group on the variable of Mathematics Teaching Competency. Therefore, Achievement Motivation does account for differential Mathematics Teaching Competency.

In order to determine which group performed significantly better in acquisition of Mathematics Teaching Competency, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Teaching Competency of High Achievement Motivation group is 118.66 and of Low Achievement Motivation group is 93.5, it can be concluded that High Achievement Motivation group performed significantly better in acquisition of Mathematics Teaching Competency than Low Achievement Motivation group.

The above finding seems to be justifiably true in the light of the following arguments:

Mathematics Teaching Competency enables a mathematics teacher to facilitate a classroom environment where students learn to communicate mathematically, need to employ multiple instructional strategies/techniques, multiple approaches to teaching mathematics; so as to allow learners to develop appropriate reading, writing, listening, and speaking skills necessary for communicating mathematically in numerous settings; discuss with others, reflect and clarify their own thinking about mathematical outcomes, and make convincing arguments and decisions based on the learning experiences.

Motivational researchers are of the view that achievement behaviour is an interaction between situational variables and individual subject’s motivation to achieve. Achievement motives can be seen as direct predictors of achievement-relevant outcomes (Elliot & McGregor, 1999). Highly achievement motivated people set higher achievement motives/goals. Achievement goals are viewed as more solid cognitive representations pointing individuals towards a specific end. There are three types of achievement goals: a performance-approach goal, a performance-avoidance goal, and a mastery goal. A performance -approach goal is focused on attaining competence relative to others, a performance-avoidance goal is focused on avoiding incompetence relative to others, and a mastery goal is focused on the development of competence itself and of task mastery. An individual with high achievement motivation might frame any of these three kinds of achievement goals in order to exhibit superior performance in the allotted task. This implies that prospective mathematics teachers with High Achievement Motivation might have set achievement motives to develop solid conceptual foundation in mathematics, thereby exhibiting
greater competence in acquisition of Mathematics Teaching Competency as compared to mathematics prospective teachers with Low Achievement Motivation. The above discussion supports the finding ‘acquisition of Mathematics Teaching Competency is dependent on Achievement Motivation’.

Mean gain scores of Main effect corresponding to Achievement Motivation (High and Low) on Mathematics Teaching Competency are depicted in figure 5.8.

Figure 5.8
Graphical Representation of Mean Gain Scores of Main Effect Corresponding To Achievement Motivation (High and Low) on Mathematics Teaching Competency

Figure 5.8 shows that mean gain scores of High Achievement Motivation group is more than the mean gain scores of Low Achievement Motivation group in acquisition of Mathematics Teaching Competency.

Moreover, the difference is statistically significant as the F-value is significant at .01 level of significance.

5.3.4.3 Interaction effect between Training Strategies and Achievement Motivation on Mathematics Teaching Competency

Interaction effect of Training Strategies and Achievement Motivation was found to be significant as the F-value was 8.50 (Table 5.11), which is more than the table value of 7.12 for degrees of freedom 1/56 at 0.01 level of significance. This significant F-ratio indicates that two variables of Training Strategies and Achievement
Motivation interact to produce significant effect on Mathematics Teaching Competency.

Hence, the null hypothesis 4c stating that “There exists no significant interaction between Training Strategies and Achievement Motivation on the acquisition of Mathematics Teaching Competency by prospective mathematics teachers” is rejected.

In order to determine which groups differ significantly on the variable Mathematics Teaching Competency, t-ratios were calculated for different combinations of A X B and the results are entered in table 5.12.

**Table 5.12**

**t-ratios for different combinations of A X B on Mathematics Teaching Competency**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>168.22</td>
<td>23.758</td>
<td>5.08*</td>
</tr>
<tr>
<td></td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>214.00</td>
<td>12.864</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>168.22</td>
<td>23.758</td>
<td>14.86*</td>
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<td></td>
<td>A2B2</td>
<td>15</td>
<td>18.77</td>
<td>18.572</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1B2</td>
<td>15</td>
<td>28</td>
<td>168.22</td>
<td>23.758</td>
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<td></td>
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<td>15</td>
<td>23.33</td>
<td>26.897</td>
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</tr>
<tr>
<td>4</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>214.00</td>
<td>12.864</td>
<td>25.92*</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td>18.77</td>
<td>18.572</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1B1</td>
<td>15</td>
<td>28</td>
<td>214.00</td>
<td>12.864</td>
<td>19.18*</td>
</tr>
<tr>
<td></td>
<td>A2B1</td>
<td>15</td>
<td>23.33</td>
<td>26.897</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2B1</td>
<td>15</td>
<td>28</td>
<td>18.77</td>
<td>18.572</td>
<td>.41 (NS)</td>
</tr>
<tr>
<td></td>
<td>A2B2</td>
<td>15</td>
<td>23.33</td>
<td>26.897</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TTS group  
B1- High Achievement Motivation group  
B2- Low Achievement Motivation group

$t = 2.67$ to be significant at .01 level of significance for 28 df  
$t = 2.00$ to be significant at .05 level of significance for 28 df

* = significant at .01 level of significance  
** = significant at .01 level of significance  
NS = Not Significant
Interpretation and discussion based on table 5.12

The perusal of table 5.12 reveals the following facts.

- The t-ratio (5.08), between Low Achievement Motivation group and High Achievement Motivation group in respect of Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The results show that mean gain score of High Achievement Motivation group (214.00) is higher than mean gain score of Low Achievement Motivation group (168.22) when both the groups were exposed to Mathematics Competency Based Training Strategy (MCBTS). This implies that High Achievement Motivation group performed significantly superior on the acquisition of Mathematics Teaching Competency than with Low Achievement Motivation group when both the groups trained through Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (14.86), between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS) was significant at .01 level of significance. The results showed that the mean gain scores of Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) (168.22) is higher than Low Achievement Motivation group trained through Traditional Training Strategy (TTS) (18.77). This implies that Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Teaching Competency than the Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

- The t-ratio (12.11), between Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The
results show that mean gain score of Low Achievement Motivation group exposed to Mathematics Competency Based Training Strategy (MCBTS) (168.22) is higher than High Achievement Motivation group exposed to Traditional Training Strategy (TTS) (23.33). The above fact implies that Low Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior than High Achievement Motivation group trained through Traditional Training Strategy (TTS) on the acquisition of Mathematics Teaching Competency.

The t-ratio (25.92), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) (214) was found to be higher than Low Achievement Motivation group trained through Traditional Training Strategy (TTS) (18.77). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Teaching Competency than the Low Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (19.18), between High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Achievement Motivation group trained through Traditional Training Strategy (TTS) was found to be significant .01 level of significance. The results show that mean gain score of High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) (214.00) is higher than High Achievement Motivation group trained through Traditional Training Strategy (TTS) (23.33). This implies that High Achievement Motivation group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior than of
Mathematics Teaching Competency than the High Achievement Motivation group trained through Traditional Training Strategy (TTS).

The t-ratio (.41), between High Achievement Motivation group and Low Achievement Motivation group and both the groups trained through Traditional Training Strategy (TTS) was found to be insignificant at .05 level of significance. This implies that High Achievement Motivation group and Low Achievement Motivation group and both the groups trained through Traditional Training Strategy (TT) did not differ significantly on the acquisition of Mathematics Teaching Competency.

5.3.5 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on Mathematics Content Competencies

Table 5.13
Summary of 2X2 analysis of variance for the variable of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on gain scores on dependent variable Mathematics Content Competencies

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-VALUE</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>28617.361</td>
<td>1</td>
<td>28617.361</td>
<td>138.83</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Teaching Aptitude (C)</td>
<td>1456.694</td>
<td>1</td>
<td>1456.694</td>
<td>7.06</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>AXC</td>
<td>1586.694</td>
<td>1</td>
<td>1586.694</td>
<td>7.69</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Error in groups</td>
<td>6596.000</td>
<td>56</td>
<td>206.125</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance
**= significant at .05 level of significance
INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.13

5.3.5.1 Main effects of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Content Competencies

The F-value of 138.83 for the main effect of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematics Content Competencies was found to be significant at .01 level of significance since it is more than the table value of 7.12 for 1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 5a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training (TTS) Strategy in mean gain scores on Mathematics Content Competencies”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Content Competencies.

In order to determine which group performed significantly better in acquisition of Mathematics Content Competencies, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Content Competencies of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 80.44 and group trained through Traditional Training Strategy (TTS) is 24.05, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematics Content Competencies than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:

The Mathematical Exit Competency ‘Mathematics Content Competencies’ includes exit sub-competencies pertaining to mathematics content/subject matter. It includes four Exit Sub-Competencies, namely, ‘Mathematics Content Knowledge’, ‘Illustration with Examples’, ‘Selection and Organization of Mathematical Content’
and ‘Mathematical Connections’. The first Mathematical Exit Sub-Competency ‘Mathematics Content Knowledge’ deals with making subject content meaningful and constructing mathematics content knowledge. Nationally and internationally, teacher’s subject content knowledge is recognized as being of crucial importance (Goulding, Rowland & Barker, 2002). The second Mathematical Exit Sub-Competency, ‘Illustration with Examples’ refers to making clear and distinct; also that which illustrates using a comparison or example intended to make clear or apprehensible, or to remove obscurity. The third Mathematical Exit Sub-Competency, ‘Selection and Organization of Mathematical Content’ discusses the coherent building of mathematics from grade to grade i.e. the content increases in complexity. The fourth Mathematical Exit Sub-Competency, ‘Mathematical Connections’ enables prospective teachers to recognize how ideas in different areas of mathematics are related.

Mathematics Competency Based Training Strategy (MCBTS) developed by the investigator was framed such that prospective mathematics teachers acquire an optimal background on which to exercise their profession. Prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy were given sufficient opportunities to achieve mathematical exit competencies and exit sub-competencies essential for their superior performance at their workplace. They gained confidence as they succeeded in mastering a set of mathematical exit competencies. Demonstration lessons were given by the investigator at the initial level. Follow up assistance was provided to the prospective mathematics teachers of group exposed to Mathematics Competency Based Training Strategy (MCBTS) during their practice lessons so as to avoid the tendency to “teach as we were taught”. Regular feedback to the prospective mathematics teachers trained through Mathematics Competency Based Training Strategy (MCBTS) prevented them from quickly slipping back into the role of a traditional teacher. Mathematics is a discipline which deepens its roots with practice. In training through Mathematics Competency Based Training Strategy (MCBTS), mistakes in the content were identified and were clarified through practice. Accuracy was taken care of. Clarity in presentation of content was sought. One specific exit sub-competency was practiced till the mastery of the exit sub-competency up to the set criterion of 80/80.
The group exposed to Traditional Training Strategy (TTS) was introduced with micro teaching skills. Demonstrations were given by the investigator and prospective mathematics teachers of the group were given time to practice and acquire micro skills. The practice continued till satisfactory feedback from peers and supervisor. During practice, the focus was on acquisition of specific micro skills. Feedback was given by peers. No extra efforts were made to identify and rectify content based problems during practice lessons. There was lack of follow up assistance.

This might be the reason for the superior performance of group of prospective mathematics teachers trained through Mathematics Competency Based Training Strategy (MCBTS) in acquisition of Mathematics Content Competencies as compared to group of prospective mathematics teachers trained through Traditional Training Strategy (TTS).

Mean gain scores of main effects of Training Strategies on Mathematics Content Competencies are depicted in figure 5.9.

**Figure 5.9**

Graphical Representation of Mean Gain Scores corresponding to Main Effects of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Content Competencies
Figure 5.9 shows that mean gain scores of group trained through Mathematics Competency Based Strategy (MCBTS) is more than mean gain scores of group trained through Traditional Training Strategy (TTS) on the variable of Mathematics Content Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.5.2 Main effects of Teaching Aptitude (High and Low) on Mathematics Content Competencies

From table 5.13, the F-value of 7.06 for the main effects of Teaching Aptitude on Mathematics Content Competencies was found to be significant at .05 level of significance as it is more than the table value 4.01 for 1/56 degrees of freedom.

The significant F-value indicates that the two groups namely, High Teaching Aptitude group and Low Teaching Aptitude group have yielded significantly different mean gain scores on Mathematics Content Competencies. Hence the hypothesis 5b, namely, ‘There exists no significant difference between High Teaching Aptitude group and Low Teaching Aptitude group in mean gain scores on Mathematics Content Competencies’; is refuted. This implies that there is significant difference between High Teaching Aptitude group and Low Teaching Aptitude group on the variable of Mathematics Content Competencies. Therefore, the Teaching Aptitude does account for differential Mathematics Content Competencies.

With a purpose to identify which group performed better in acquisition of Mathematics Content Competencies, the mean gain scores of both the groups namely with High Teaching Aptitude and Low Teaching Aptitude were compared. Since the mean gain score for High Teaching Aptitude group was 58.61 and for Low Teaching Aptitude group as 45.88, it can be concluded that High Teaching Aptitude group was significantly better than Low Teaching Aptitude group in acquisition of Mathematics Content Competencies.

The above finding seems to be justifiably true in the light of the following arguments:

‘Mathematics Content Competencies’ is the mathematical exit competency addressing the need to understand the importance of ‘what’ they are teaching at
school level and ‘how’ it connects to mathematics at higher level or to daily life situations. The mathematical exit competency includes four exit sub-competencies, namely, ‘Mathematical Content Knowledge’, ‘Illustration with Examples’, ‘Selection and Organization of Content’ and ‘Mathematical Connections’.

An aptitude refers to potential to acquire skills; a natural tendency to do something well, especially one that can be further developed; and quickness in learning. John Caroll stated that aptitude reflects not a predilection for proficiency but rather a potential rate of acquisition by older learners, under optimal conditions of motivation, opportunity, and quality of instruction (Caroll, 1973).

Teaching refers to the action of a person who teaches; profession of a teacher; something taught; precept, a doctrine that is taught, or instruction.

Teaching Aptitude is a capacity to acquire proficiency or skill, with a given amount of training. Teaching Aptitude is necessary for the teachers to do their holy job a successful one. Without having considerable amount of teaching aptitude, no teacher can make teaching learning process effective. In a modern mathematics classroom, for mathematics teachers the objective is to strive for promotion of mathematics education progress equally and fairly for all of our mathematics students. Mathematics teachers are expected to devise courses and lesson plans to reach instructional goals for the class as a whole, and to carry these plans forward as best as they can each day with evenhanded classroom management. Sometimes these goals mean that mathematics teachers are to find a style of presentation or forms of participation that fits the particular character of a given class and differs from they have done in previous years. This indicates that the prospective mathematics teachers with high Teaching Aptitude might practice the domain addressing the need to understand the importance of ‘what’ and ‘how’ of teaching mathematics better than the prospective mathematics teachers with Low Teaching Aptitude. It indicates that prospective mathematics teachers with higher teaching aptitude possess potential to make classroom teaching learning process more effective as compared to the prospective teachers with Low Teaching Aptitude. The above discussion supports the present finding that there exists significant difference between High Teaching
Aptitude group and Low Teaching Aptitude group in mean gain scores on ‘Mathematics Content Competencies’.

Mean gain scores of Main effect corresponding to Teaching Aptitude (High and Low) on Mathematics Content Competencies are shown in figure 5.10.

**FIGURE 5.10**

Graphical Representation of Mean Gain Scores Corresponding To Main Effects of Teaching Aptitude on Mathematics Content Competencies

![Graphical Representation](image)

Figure 5.10 depicts mean gain scores of High Teaching Aptitude group and Low Teaching Aptitude group. The mean gain score of High Teaching Aptitude group is higher than Low Teaching Aptitude group in acquisition of Mathematics Content Competencies.

Moreover, the difference between the groups is significant as the calculated F-value is significant.

### 5.3.5.3 Interaction effect between Training Strategies and Teaching Aptitude on Mathematics Content Competencies

Interaction effect of Training Strategies and Teaching Aptitude was found to be significant at 0.01 level of significance as F-value was found to be 7.69 (table 5.13), which is more than the table value of 7.12 for 1/56 degrees of freedom. This
significant F-ratio indicates that two variables of Training Strategies and Teaching Aptitude interact to produce significant effect on Mathematics Content Competencies. Hence the null hypothesis 5c, stating that ‘There exists no significant interaction between Training Strategies and Teaching Aptitude on acquisition of Mathematics Content Competencies by prospective mathematics teachers’ is discarded.

In order to determine which groups differ significantly on the variable Mathematics Content Competencies, t-ratios were calculated for different combinations of A X C and the results are entered in table 5.14.

Table 5.14

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>67.44</td>
<td>17.022</td>
<td>3.41*</td>
</tr>
<tr>
<td></td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>93.44</td>
<td>15.281</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>67.44</td>
<td>17.022</td>
<td>6.27*</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>24.33</td>
<td>11.608</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>67.44</td>
<td>17.022</td>
<td>6.13*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>23.77</td>
<td>12.901</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>93.44</td>
<td>15.281</td>
<td>10.80*</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>24.33</td>
<td>11.608</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>93.44</td>
<td>15.281</td>
<td>10.45*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>23.77</td>
<td>12.901</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>24.33</td>
<td>11.608</td>
<td>.09 (NS)</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>23.77</td>
<td>12.901</td>
<td></td>
</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TTS group  
C1-High Teaching Aptitude group  
C2-Low Teaching Aptitude group

$ t = 2.67 $ to be significant at .01 level of significance for 28 df  
$ t = 2.00 $ to be significant at .05 level of significance for 28 df  
$ * = $ significant at .01 level of significance  
$ ** = $ significant at .05 level of significance  
NS = Not Significant
Interpretation and discussion based on table 5.14

The perusal of table 5.14 reveals the following facts:

- The t-ratio (3.41), between Low Teaching Aptitude group and High Teaching Aptitude group and both the groups trained through Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The result shows that mean gain score of High Teaching Aptitude group (93.44) is higher than Low Teaching Aptitude group (67.44) in relation to Mathematics Content Competencies when exposed to Mathematics Competency Based Training Strategy (MCBTS). This implies that High Teaching Aptitude group performed significantly superior on the acquisition of Mathematics Content Competencies than the Low Teaching Aptitude group when both the groups were exposed to Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (6.27), between Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (67.44) was found to be higher than Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (24.33). This implies that Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Content Competencies than the Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

- The t-ratio (6.13), between Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (67.44) was found to be higher than High Teaching Aptitude group trained through Traditional Training Strategy (TTS) (23.77). This implies that Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy
(MCBTS) performed significantly superior on the acquisition of Mathematics Content Competencies than High Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

- The t-ratio (10.80), between High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (93.44) was found to be higher than Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (24.33). This implies that High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Content Competencies than the Low Teaching Aptitude group trained through Traditional Training Strategy (TTS).

- The t-ratio (10.45), between High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group trained through Traditional Training Strategy was found to be significant at .01 level of significance. The results show that mean gain scores of High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (93.44) was found to be higher than High Teaching Aptitude group trained through Traditional Training Strategy (TTS) (23.77). This implies that High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Content Competencies than the High Teaching Aptitude group trained through Traditional Training Strategy (TTS).

- The t-ratio (.09), between High Teaching Aptitude group and Low Teaching Aptitude group, when both the groups trained through Traditional Training Strategy (TTS) was found to be insignificant. This implies that Low Teaching Aptitude group and High Teaching Aptitude group did not differ significantly on the acquisition of Mathematics Content Competencies when exposed to Traditional Training Strategy (TTS).
5.3.6 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on Mathematics Process Competencies

Table 5.15

Summary of 2X2 analysis of variance for the variables of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on gain scores on dependent variable of Mathematics Process Competencies

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-value</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>44310.250</td>
<td>1</td>
<td>44310.250</td>
<td>338.24</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Teaching Aptitude (C)</td>
<td>1034.694</td>
<td>1</td>
<td>1034.694</td>
<td>7.89</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>AXC</td>
<td>910.028</td>
<td>1</td>
<td>910.028</td>
<td>6.94</td>
<td>SIGNIFICANT**</td>
</tr>
<tr>
<td>Error in groups</td>
<td>4192.000</td>
<td>56</td>
<td>131.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance
**= significant at .05 level of significance

INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.15

5.3.6.1 Main effects of Training strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Process Competencies

The F-value of 338.24 for the main effect of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematics Process Competencies was found to be significant at .01 level of significance since it is more than the table value of 7.12 for
1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 6a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training (TTS) Strategy in mean gain scores on Mathematics Process Competencies”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Process Competencies.

In order to determine which group performed significantly better in acquisition of Mathematics Process Competencies, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Process Competencies of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 107.61 and group trained through Traditional Training Strategy (TTS) is 37.44, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematics Process Competencies than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:

‘Mathematics Process Competencies’ is the Mathematical Exit Competency addressing the processes involved in teaching learning process of a mathematics classroom. The Exit Sub-Competencies included in this Mathematical Exit Competency deal with the processes of communication, questioning, problem solving and evaluation in mathematics. The first Mathematical Exit Sub-Competency, i.e. ‘Mathematical Communication’ includes decoding and interpreting symbolic, pictorial, diagrammatic, graphic and formal mathematical language; use mathematical symbols, pictures, diagrams, graphs, etc according to age, grade and mental level of students; translate from natural language to formal/symbolic mathematical language and vice versa; handle and manipulate mathematical statements appropriately; use appropriate listening skills; and deliberately change the interaction style from one pattern to another. The second Mathematical Exit Sub-Competency i.e. ‘Questioning And Response Management’ involves asking lesson developing questions; asking
thought provoking questions; asking lower, middle and higher order questions; prompting; seek for more information after incomplete or partially correct response; asking same question to a number of students; and increasing critical awareness. The third Mathematical Exit Sub-Competency, namely, ‘Mathematical Problem Solving’ focuses on posing various kinds of problems; helping students to identify the information given and information that needs to be determined; enabling students to develop relationships and develop repertoire of strategies for problem solving; enabling students to check suitability of strategy; enabling students to execute the strategy; and verify the result obtained. The fourth Mathematical Exit Sub-Competency, namely, ‘Evaluation’ focuses on diagnosing pre-requisite entry behavior of students; enlisting general weaknesses in mathematics; analyse responses during classroom teaching learning process; planning suggestive measures for improving upon weaknesses in mathematics; asking various types of questions; test construction, administration and scoring; analyzing the scores; and informing the students about their achievement and provide remedies for removing weaknesses.

The strategy developed by the investigator, i.e. MCBTS was framed such that the investigator instead of providing the information; facilitated the learning for the prospective mathematics teachers of group exposed to Mathematics Competency Based Training Strategy (MCBTS). The investigator provided them a list of mathematical exit competencies and exit sub-competencies that were to be practiced. At the initial level, every exit competency was discussed along with its components and behavioural indicators. The discussion was followed by demonstration lesson by the investigator. After this initial training, the prospective mathematics teachers practiced the exit competency till the attainment of set criterion of 80/80. Optimum training time was devoted to working with the prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS), individually or in small group discussions. The training program with detailed training material was keyed to the exit competencies to be achieved. The strategy enabled prospective mathematics teachers of the group to develop deeper understanding of processes involved in mathematics teaching learning process. The design of MCBTS supported the acquisition of knowledge and skills by the prospective mathematics teachers trained through Mathematics Competency Based Training Strategy.
The group exposed to Traditional Training Strategy (TTS) focused on acquisition of micro teaching skills, namely, blackboard writing, introducing the topic, illustration with examples, questioning and explanation. Training material was related to specific micro teaching skills. Components of skills were explained to them. The practice lessons were continued till satisfactory feedback from peers and supervisor. The strategy did not address various issues like management of responses in a classroom situation; evaluation; problem solving in mathematics; etc. There was lack of opportunities for understanding of mathematical processes involved in a classroom situation.

The prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy might have acquired the desired level of process-based exit competencies through practice under MCBTS, which the prospective mathematics teachers of group exposed to training through Traditional Training Strategy (TTS) could not acquire. The above discussion supports the present finding that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) demonstrated additional competence in its performance in acquisition of this set of exit competencies as compared to group exposed to Traditional Training Strategy (TTS).

Mean gain scores of main effects of Training Strategies on Mathematics Process Competencies are depicted in figure 5.11.

**FIGURE 5.11**

Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding to Training Strategies On Mathematics Process Competencies
Figure 5.11 shows that mean gain scores of group trained through Mathematics Competency Based Strategy (MCBTS) is more than mean gain scores of group trained through Traditional Training Strategy (TTS) in acquisition of Mathematics Process Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.2.6.2 Main effects of Teaching Aptitude (High and Low) on Mathematics Process Competencies

From table 5.15, the F-value of 7.89 for the main effects of Teaching Aptitude on Mathematics Process Competencies was found to be significant at .01 level of significance as it is more than the table value 7.12 for 1/56 degrees of freedom.

The significant F-value indicates that the two groups namely, High Teaching Aptitude group and Low Teaching Aptitude group have yielded significantly different mean gain scores on Mathematics Process Competencies. Hence the hypothesis 6b, namely, ‘There exists no significant difference between High Teaching Aptitude group and Low Teaching Aptitude group in mean gain scores on Mathematics Process Competencies’; is refuted. This implies that there is significant difference between High Teaching Aptitude group and Low Teaching Aptitude group in acquisition of Mathematics Process Competencies. Therefore, the Teaching Aptitude does account for differential Mathematics Process Competencies.

With a purpose to identify which group performed better in acquisition of Mathematics Process Competencies, the mean gain scores of both the groups namely with High Teaching Aptitude and Low Teaching Aptitude were compared. Since the mean gain score for High Teaching Aptitude group was 77.88 and for Low Teaching Aptitude group was 67.16, it can be concluded that High Teaching Aptitude group was significantly better than Low Teaching Aptitude group in acquisition of Mathematics Process Competencies.
The above finding seems to be justifiably true in the light of the following arguments:

‘Mathematics Process Competencies’ is the mathematical exit competency addressing the context for learning the material contained in the Mathematics Content Competencies. The exit competency encompasses the processes involved in mathematics teaching and learning. The exit competency comprises of four exit sub-competencies namely; ‘Mathematical Communication’, ‘Questioning and Response Management’, ‘Mathematical Problem Solving’ and ‘Evaluation’. These exit sub-competencies are based on communication skills of an individual.

An aptitude is an innate, acquired or learned or developed component of a competency (being the others: knowledge, understanding and attitude) to do a certain kind of work at a certain level. Teaching Aptitude is an important component of educational productivity. "Teaching Aptitude is a capacity to acquire proficiency or skill, with a given amount of training. Teaching Aptitude is necessary for the teachers to perform their holy job successfully. Without having considerable amount of teaching aptitude, a teacher cannot perform his/her duty properly. A prospective teacher needs an intellect capable of grasping not only the subject matter and its place in curriculum, but also the aims, objectives, processes, and instructional strategies involved in a subject. Teaching Aptitude of an individual is a combination of various factors like making the course interesting, content knowledge, pedagogical knowledge, enthusiasm, encourages student participation, pleasant voice, shows interest in students, teaching skill, etc. Form the above facts, it can be inferred that prospective mathematics teachers possessing high level of teaching aptitude (i.e. higher level of various factors) might practice and acquire a set of Mathematical Process Exit Competencies better than the prospective mathematics teachers with low teaching aptitude. The discussion supports the present finding that the Teaching Aptitude does account for differential Mathematics Process Competencies.

Mean gain scores of main effect corresponding to Teaching Aptitude (High and Low) on Mathematics Process Competencies are shown in figure 5.12.
Figure 5.12 describes mean gain scores of High Teaching Aptitude group and Low Teaching Aptitude group. The mean gain score of High Teaching Aptitude group is higher than Low Teaching Aptitude group in acquisition of Mathematics Process Competencies.

Moreover, the difference between the groups is significant as the calculated F-value is significant.

5.3.6.3 Interaction effect between Training Strategies and Teaching Aptitude on Mathematics Process Competencies

Interaction effect of Training Strategies and Teaching Aptitude was found to be significant at 0.05 level of significance as F-value was found to be 6.94 (table 5.15), which is more than the table value of 4.01 for 1/56 degrees of freedom. This significant F-ratio indicates that two variables of Training Strategies and Teaching Aptitude interact to produce significant effect on Mathematics Process Competencies.
Hence the null hypothesis 6c, stating that ‘There exists no significant interaction between Training Strategies and Teaching Aptitude on acquisition of Mathematics Process Competencies by prospective mathematics teachers’ is discarded.

In order to determine which groups differ significantly on the variable Mathematics Process Competencies, t-ratios were calculated for different combinations of A X C and the results are entered in table 5.16.

**Table 5.16**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>28</td>
<td>97.22</td>
<td>10.837</td>
<td>3.38*</td>
</tr>
<tr>
<td></td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>118.00</td>
<td>14.882</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>97.22</td>
<td>10.837</td>
<td>12.30*</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>37.11</td>
<td>9.867</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>97.22</td>
<td>10.837</td>
<td>12.45*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>37.77</td>
<td>9.364</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>118.00</td>
<td>14.882</td>
<td>13.59*</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>37.11</td>
<td>9.867</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>118.00</td>
<td>14.882</td>
<td>13.68*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>37.77</td>
<td>9.364</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>37.11</td>
<td>9.867</td>
<td>.14 (NS)</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>37.77</td>
<td>9.364</td>
<td></td>
</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TTS group  
C1- High teaching aptitude group  
C2- Low teaching aptitude group

\[ t = 2.67 \] to be significant at .01 level of significance for 28 df
\[ t = 2.00 \] to be significant at .05 level of significance for 28 df

* = significant at .01 level of significance  
** = significant at .01 level of significance  
NS = Not Significant
Interpretation and discussion based on table 5.16

The perusal of table 5.16 reveals the following facts:

- The t-ratio (3.38), between Low Teaching Aptitude group and High Teaching Aptitude group, when both the groups trained through Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The result shows that mean gain score of High Teaching Aptitude group (118) is higher than Low Teaching Aptitude group (97.22) when both the groups were exposed to Mathematics Competency Based Training Strategy (MCBTS). This implies that High Teaching Aptitude group performed significantly superior on the acquisition of Mathematics Process Competencies than Low Teaching Aptitude group in relation to Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (12.30), between Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that the mean gain score of Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (97.22) is higher than Low Teaching Aptitude group trained through Traditional Training Strategy (TTS) (37.11). This implies that Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Process Competencies than the Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

- The t-ratio (12.45), between Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (97.22) is higher than High
Teaching Aptitude group exposed to Traditional Training Strategy (TTS) 
(37.77). This implies that Low Teaching Aptitude group trained through 
Mathematics Competency Based Training Strategy (MCBTS) and High 
Teaching Aptitude group trained through Traditional Training Strategy (TTS) 
differ significantly on the acquisition of Mathematics Process Competencies.

- The t-ratio (13.59), between High Teaching Aptitude group exposed to 
  Mathematics Competency Based Training Strategy (MCBTS) and Low 
  Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was 
  found to be significant at .01 level of significance. The results show that mean 
  gain score of High Teaching Aptitude group trained through Mathematics 
  Competency Based Training Strategy (MCBTS) (118.00) is higher than Low 
  Teaching Aptitude group trained through Traditional Training Strategy (TTS) 
  (37.11). This implies that High Teaching Aptitude group exposed to 
  Mathematics Competency Based Training Strategy (MCBTS) performed 
  significantly superior on the acquisition of Mathematics Process Competencies 
  than the control group with Low Teaching Aptitude exposed to Traditional 
  Training Strategy (TTS).

- The t-ratio (13.68), between High Teaching Aptitude group trained through 
  Mathematics Competency Based Training Strategy (MCBTS) and High 
  Teaching Aptitude group trained through Traditional Training Strategy (TTS) 
  was found to be significant at .01 level of significance. The results show that 
  mean gain score of High Teaching Aptitude group exposed to Mathematics 
  Competency Based Training Strategy (MCBTS) (118.00) is higher than High 
  Teaching Aptitude group exposed to Traditional Training Strategy (TTS) 
  (37.77). This implies that High Teaching Aptitude group trained through 
  Mathematics Competency Based Training Strategy (MCBTS) performed 
  significantly superior on the acquisition of Mathematics Process Competencies 
  than the High Teaching Aptitude group trained through Traditional Training 
  Strategy (TTS).
The t-ratio (.14), between High Teaching Aptitude group and Low Teaching Aptitude group was found to be insignificant, when exposed to Traditional Training Strategy (TTS). This implies that Low Teaching Aptitude group and High Teaching Aptitude group, when trained through Traditional Training Strategy (TTS) did not differ significantly on the acquisition of Mathematics Process Competencies.

5.3.7 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on Mathematical Pedagogical Competencies

Table 5.17

Summary of 2X2 analysis of variance for the variables of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on gain scores on dependent variable Mathematical Pedagogical Competencies

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-value</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies (A)</td>
<td>29013.444</td>
<td>1</td>
<td>29013.444</td>
<td>93.54</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Teaching Aptitude (C)</td>
<td>5377.778</td>
<td>1</td>
<td>5377.778</td>
<td>17.33</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>AXC</td>
<td>5184.000</td>
<td>1</td>
<td>5184.000</td>
<td>16.71</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Error in groups</td>
<td>9925.333</td>
<td>56</td>
<td>310.167</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

*= significant at .01 level of significance
**= significant at .05 level of significance
INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.17

5.3.7.1 Main effects of Training Strategies (MCBTS and TTS) on Mathematical Pedagogical Competencies

The F-value of 93.54 for the main effect of Training Strategies, namely, Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training Strategy (TTS) on Mathematical Pedagogical Competencies was found to be significant at .01 level of significance since it is more than the table value of 7.12 for 1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 7a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training (TTS) Strategy in mean gain scores on Mathematical Pedagogical Competencies”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematical Pedagogical Competencies.

In order to determine which group performed significantly better in acquisition of Mathematical Pedagogical Competencies, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematical Pedagogical Competencies of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 95.77 and group trained through Traditional Training Strategy (TTS) is 39, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematical Pedagogical Competencies than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:

‘Mathematical Pedagogical Competencies’ is the Mathematical Exit Competency focusing on optimal preparation of mathematics teachers in the didactics and pedagogy of mathematics. The Mathematical Exit Competency includes two Mathematical Exit Sub-Competencies, namely, ‘Blackboard Writing’ and ‘Multiple Instructional Strategies’. The first Mathematical Exit Sub-Competency ‘Blackboard
Writing’ focuses on checking physical aspects of blackboard; neat presentation on blackboard; write in proper sequence; legibility of handwriting; appropriateness of written work; and use blackboard effectively. The second Mathematical Exit Sub-Competency ‘Multiple Instructional Strategies’ includes use of instructional strategy relevant to topic, objectives, age, grade, pre-conceptions and apperceptive mass of students; employs instructional strategies suitable to arouse and maintain interest of students in mathematics; use questioning for developing critical thinking and organizing open discussions for promoting divergent thinking; use inductive-deductive reasoning; use analytic-synthetic approach; and use heuristic approach by employing inquiry training through promotion of critical investigation.

MCBTS, i.e. Mathematics Competency Based Training Strategy developed by the investigator was based on identification and selection of Mathematical Exit Competencies. The selected exit competencies were made known to the prospective teachers of the group exposed to Mathematics Competency Based Training Strategy. Models and simulations were used extensively in training. Prospective mathematics teachers practiced the exit competencies till the set criterion was met. Supporting theory was integrated with the competency practice. Investigator used inductive – deductive method, analytic – synthetic method and heuristic method during demonstration lessons and these methods were discussed extensively in small group activities. The prospective mathematics teacher of the group exposed to Mathematics Competency Based Training Strategy became very familiar with various strategies and employed these strategies in their practice lessons thereby developing deeper understanding of pedagogy of teaching mathematics.

The prospective mathematics teachers trained through Traditional Training Strategy (TTS) were given opportunities to acquire micro teaching skills, namely, blackboard writing, introducing the topic, illustration with examples, questioning and explanation. These skills did not introduce prospective mathematics teachers of this group, to various instructional strategies that could be optimally utilized to make mathematics classroom teaching learning process interesting.

This might be the reason behind superior acquisition of Mathematical Pedagogical Competencies by group exposed to Mathematics Competency Based Training Strategy (MCBTS) as compared to group exposed to Traditional Training Strategy (TTS). The above discussion supports the finding that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) demonstrated
additional competence in its performance in acquisition of Mathematical Pedagogical Competencies as compared to group exposed to Traditional Training Strategy (TTS). Mean gain scores of main effects of Training Strategies on Mathematical Pedagogical Competencies are depicted in figure 5.13.

**FIGURE 5.13**

Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding To Training Strategies On Mathematical Pedagogical Competencies

![Bar graph showing mean gain scores of main effects corresponding to training strategies on mathematical pedagogical competencies.](image)

Figure 5.13 shows that mean gain scores of group trained through Mathematics Competency Based Strategy (MCBTS) is more than mean gain scores of group trained through Traditional Training Strategy (TTS) in acquisition of Mathematical Pedagogical Competencies.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.7.2 Main effects of Teaching Aptitude (High and Low) on Mathematical Pedagogical Competencies

From table 5.17, the F-value of 17.33 for the main effect of Teaching Aptitude on Mathematical Pedagogical Competencies was found to be significant at .01 level of significance as it is more than the table value 7.12 for 1/56 degrees of freedom.

The significant F-value indicates that the two groups namely, High Teaching Aptitude group and Low Teaching Aptitude group have yielded significantly different mean
gain scores on Mathematical Pedagogical Competencies. Hence the hypothesis 7b, namely, ‘There exists no significant difference between High Teaching Aptitude group and Low Teaching Aptitude group in mean gain scores on Mathematical Pedagogical Competencies’; is refuted. This implies that there is significant difference between High Teaching Aptitude group and Low Teaching Aptitude group on the variable of Mathematical Pedagogical Competencies. Therefore, Teaching Aptitude does account for differential Mathematical Pedagogical Competencies.

With a purpose to identify which group performed significantly better in acquisition of Mathematical Pedagogical Competencies, the mean gain scores of both the groups namely High Teaching Aptitude group and Low Teaching Aptitude group were compared. Since the mean gain score for High Teaching Aptitude group was 79.61 and for Low Teaching Aptitude group was 55.16, it can be concluded that High Teaching Aptitude group was significantly better than Low Teaching Aptitude group in acquisition of Mathematical Pedagogical Competencies.

The above finding seems to be justifiably true in the light of the following arguments:

The mathematical exit competency ‘Mathematical Pedagogical Competencies’ focuses on ‘how’ mathematics is taught. The exit competency intends to provide guidance to mathematics teachers in the area of preparation for instruction and using appropriate tools of instruction. It involves two exit sub-competencies, namely, ‘Blackboard Writing’ and ‘Multiple Instructional Strategies’. These exit sub-competencies are based on appropriate strategies of instruction.

Performance is the result of complex interaction between various parts of mind/body system. Aptitudes have a major impact not just on performance, but on individual and unique states of being. Aptitudes are not simply tools to be used at will. They are ongoing forces within the mind/body system.

Teaching Aptitudes, High and Low, have an extremely strong psychological, social, and even philosophical impact on the personality of a teacher. A teacher feels good to use his Teaching Aptitude, so that he / she can perform in most appropriate manner. Feeling good about self, an individual with high teaching aptitude sets higher motives for the self growth and improvement. Low Aptitude people make more errors and achieve less in that particular area, or work a lot harder to achieve the same results. However, with the same effort, teachers with High Teaching Aptitude stay
ahead and enjoy in whatever they are doing in their profession. The individuals (prospective mathematics teachers) with High Teaching Aptitude might have acquired a set of Mathematical Pedagogical exit competencies better than those with Low Teaching Aptitude. The above discussion supports the present finding that the Teaching Aptitude does account for differential Mathematical Pedagogical Competencies.

Mean gain scores of Main effects corresponding to Teaching Aptitude (High and Low) on Mathematical Pedagogical Competencies are shown in figure 5.14.

**FIGURE 5.14**

Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding To Teaching Aptitude on Mathematical Pedagogical Competencies

![Graph showing mean gain scores of High Teaching Aptitude group and Low Teaching Aptitude group.](image)

Figure 5.14 depicts mean gain scores of High Teaching Aptitude group and Low Teaching Aptitude group. The mean gain score of High Teaching Aptitude group is higher than Low Teaching Aptitude group in acquisition of Mathematical Pedagogical Competencies.

Moreover, the difference between the groups is significant as the calculated F-value is significant.

5.3.7.3 Interaction effect between Training Strategies and Teaching Aptitude on Mathematical Pedagogical Competencies

Interaction effect of Training Strategies and Teaching Aptitude was found to be significant at 0.01 level of significance as F-value was found to be 16.71 (table...
5.17), which is more than the table value of 7.12 for 1/56 degrees of freedom. This significant ratio indicates that two variables of Training Strategies and Teaching Aptitude interact to produce significant effect on Mathematical Pedagogical Competencies.

Hence the null hypothesis 7c, stating that ‘There exists no significant interaction between Training Strategies and Teaching Aptitude on acquisition of Mathematical Pedagogical Competencies by prospective mathematics teachers’ is discarded.

In order to determine which groups differ significantly on the variable Mathematical Pedagogical Competencies, t-ratios were calculated for different combinations of A X C and the results are entered in table 5.18.

### Table 5.18

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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<td>18.953</td>
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<td>24.016</td>
<td>3.64*</td>
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<td></td>
</tr>
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<td>A1C2</td>
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<td>12.387</td>
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<td>120.00</td>
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<td>12.387</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>38.77</td>
<td>12.296</td>
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<td>15</td>
<td></td>
<td>39.22</td>
<td>12.387</td>
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</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TTS group  
A1 - MCBTS group  
A2 - TTS group  
A1 - High Teaching Aptitude group  
A2 - Low Teaching Aptitude group  

\[ t = 2.67 \text{ to be significant at .01 level of significance for } 28 \text{ df} \]
\[ t = 2.00 \text{ to be significant at .01 level of significance for } 28 \text{ df} \]
* = significant at .01 level of significance  
** = significant at .05 level of significance  
NS = Not Significant  

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Interpretation and discussion based on table 5.18

The perusal of table 5.18 reveals the following facts:

- The t-ratio (4.75), between Low Teaching Aptitude group and High Teaching Aptitude group in relation to the variable Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The results show that mean gain score of High Teaching Aptitude group (120) is higher than Low Teaching Aptitude group (71.55), when both the groups were trained through Mathematics Teaching Competency Based Strategy (MCBTS). This implies that High Teaching Aptitude group performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the Low Teaching Aptitude group, when exposed to Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (3.64), between Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (71.55) is higher than Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (38.77). This implies that Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the Low Teaching Aptitude group trained through Traditional Training Strategy (TTS).

- The t-ratio (3.59), between Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (71.55) is higher than High Teaching Aptitude group trained through Traditional Training Strategy (TTS) (39.22). This implies that Low Teaching Aptitude group exposed to
Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) differ significantly on the acquisition of Mathematical Pedagogical Competencies.

- The t-ratio (10.78), between High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group trained through Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (120.00) is higher than Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (38.77). This implies that High Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the Low Teaching Aptitude trained through Traditional Training Strategy (TTS).

- The t-ratio (10.70), between High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (120.00) is higher than High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (39.22). This implies that High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematical Pedagogical Competencies than the High Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

- The t-ratio (.07), between High Teaching Aptitude group and Low Teaching Aptitude when exposed to Traditional Training Strategy (TTS) was found to be insignificant. This implies that High Teaching Aptitude group and Low Teaching Aptitude group when trained through Traditional Training Strategy...
(TTS), did not differ significantly on the acquisition of Mathematical Pedagogical Competencies.

5.3.8 Analysis, interpretation and discussion based on 2x2 analysis of variance for mean gain scores of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on Mathematics Teaching Competency

Table 5.19

Summary of 2X2 analysis of variance for the variables of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) and Teaching Aptitude on gain scores on dependent variable Mathematics Teaching Competency

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>SUM OF SQUARES</th>
<th>df</th>
<th>MEAN SUM OF SQUARES</th>
<th>F-value</th>
<th>LEVEL OF SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A)</td>
<td>257049.000</td>
<td>1</td>
<td>257049.000</td>
<td>644.91</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Teaching Aptitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(C)</td>
<td>4489.000</td>
<td>1</td>
<td>4489.000</td>
<td>11.26</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>AXC</td>
<td>3325.444</td>
<td>1</td>
<td>3325.444</td>
<td>8.34</td>
<td>SIGNIFICANT*</td>
</tr>
<tr>
<td>Error in groups</td>
<td>12754.444</td>
<td>56</td>
<td>398.576</td>
<td></td>
<td>SIGNIFICANT*</td>
</tr>
</tbody>
</table>

F = 4.01 to be significant at 0.05 level of significance for 1/56 df
F = 7.12 to be significant at 0.01 level of significance for 1/56 df

* = significant at .01 level of significance
** = significant at .05 level of significance

INTERPRETATION AND DISCUSSION OF RESULTS ON THE BASIS OF TABLE 5.17

5.3.8.1 Main effects of Training Strategies (Mathematics Competency Based Training Strategy and Traditional Training Strategy) on Mathematics Teaching Competency

The F-value of 644.91 for the Main effects of Training Strategies namely Mathematics Competency Based Training Strategy (MCBTS) and Traditional
Training Strategy (TTS) on Mathematics Teaching Competency was found to be significant at .01 level of significance since it is more than the table value of 7.12 for 1/56 degrees of freedom. It shows that there is a significant difference in mean gain scores of the two groups.

Hence, the null hypothesis 8a namely “There exists no significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and Traditional Training (TTS) Strategy in mean gain scores on Mathematics Teaching Competency”, is refuted. So there exists a significant difference between groups trained through Mathematics Competency Based Training Strategy (MCBTS) and group trained through Traditional Training Strategy (TTS) in the mean gain scores on Mathematics Teaching Competency.

In order to determine which group performed significantly better in acquisition of Mathematics Teaching Competency, the mean gain scores of the two groups were compared. Since mean gain scores on Mathematics Teaching Competency of the group trained through Mathematics Competency Based Training Strategy (MCBTS) is 187.44 and group trained through Traditional Training Strategy (TTS) is 18.44, it can be concluded that the group exposed to Mathematics Competency Based Training Strategy (MCBTS) have developed significantly higher Mathematics Teaching Competency than group exposed to Traditional Training Strategy (TTS).

A closer investigation suggests that the following factors might have been operational for the outcome of this result of the present study:

‘Mathematics Teaching Competency’ focuses on developing an optimal background of mathematics teachers on which to exercise their profession and provide sufficient preparation in the didactics and pedagogy of mathematics. To possess a competence (to be competent) in some domain of personal, professional or social life is to master (to a fair degree, modulo the conditions and circumstances) essential aspects of life in that domain. Mathematical competence then means the ability to understand, judge, do, and use mathematics in a variety of intra- and extra-mathematical contexts and situations in which mathematics plays or could play a role. To inculcate such mathematical competence in students, it becomes mandatory for a mathematics teacher to possess ‘mathematics teaching competency’. ‘Mathematics Teaching Competency’ enables a mathematics teacher to act mathematically on the
basis of knowledge and insight; and exercise one or more mathematical competencies to carry out a mathematical activity. In the present study, acquisition of Mathematics Teaching Competency is subjected to the acquisition of all the exit competencies respective to all the three domains, namely, Mathematics Content Competencies, Mathematics Process Competencies and Mathematical Pedagogical Competencies.

MCBTS, i.e. Mathematics Competency Based Training Strategy developed by the investigator was framed such that prospective mathematics teacher exposed to the strategy progressed through the instructional program at their own rate by demonstrating the attainment of specified exit competencies. The practice lessons were performed and feedback was given after every performance. Small group peer discussions were held. A variety of laboratory experimental aids were used by the investigator during demonstration lessons. Prospective mathematics teachers trained through Mathematics Competency Based Training Strategy (MCBTS) also practiced their lessons with use of such laboratory aids which were very easy to prepare. The strategy was a flexible training approach which included small group activities and individual study as essential components. The prospective mathematics teachers of the experimental group built confidence as they succeeded in mastering pre-specified exit competencies.

The above discussion supports the present finding that prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS) developed higher Mathematics Teaching Competency than group of prospective mathematics teachers trained through Traditional Training Strategy (TTS). The justification behind the finding may be that prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS) were significantly better equipped with Mathematical Exit Sub-Competencies associated with the three Mathematical Exit Competencies, namely, Mathematics Content Competencies, Mathematics Process Competencies and Mathematical Pedagogical Competencies; as compared to the group exposed to Traditional Training Strategy (TTS). The development of Mathematical Exit Competencies might have been permanent in the minds of prospective mathematics teachers exposed to Mathematics Competency Based Training Strategy (MCBTS) and would have remained temporary in the minds of the prospective mathematics teachers trained
through Traditional Training Strategy (TTS). The temporary fixation would not have lasted longer.

Mean gain scores of main effects of Training Strategies on Mathematics Teaching Competency are depicted in figure 5.15.

Figure 5.15
Graphical Representation Showing Mean Gain Scores Corresponding To Main Effects Of Training Strategies On Mathematics Teaching Competency

Figure 5.15 shows that mean gain scores of group trained through Mathematics Competency Based Strategy (MCBTS) is more than mean gain scores of group trained through Traditional Training Strategy (TTS) in acquisition of Mathematics Teaching Competency.

Moreover, the difference is statistically significant as F-value is significant at .01 level of significance.

5.3.8.2 Main effects of Teaching Aptitude (High and Low) on Mathematics Teaching Competency

From table 5.19, the F-value of 11.26 for the Main effects of Teaching Aptitude on Mathematical Pedagogical Competencies was found to be significant at .01 level of significance as it is more than the table value 7.12 for 1/56 degrees of freedom.
The significant F-value indicates that the two groups namely, High Teaching Aptitude group and Low Teaching Aptitude group have yielded significantly different mean gain scores on Mathematics Teaching Competency. Hence the hypothesis 8b, namely, ‘There exists no significant difference between High Teaching Aptitude group and Low Teaching Aptitude group in mean gain scores on Mathematics Teaching Competency’; is refuted. This implies that there is significant difference between High Teaching Aptitude group and Low Teaching Aptitude group on the variable of Mathematics Teaching Competency. Therefore, the Teaching Aptitude does account for differential Mathematics Teaching Competency.

With a purpose to identify which group performed better in acquisition of Mathematics Teaching Competency, the mean gain scores of both the groups namely High Teaching Aptitude group and Low Teaching Aptitude group were compared. Since the mean gain score for High Teaching Aptitude group was 114.11 and for Low Teaching Aptitude group was 91.77, it can be concluded that High Teaching Aptitude group was significantly better than Low Teaching Aptitude group on Mathematics Teaching Competency.

The above finding seems to be justifiably true in the light of the following arguments:

‘Mathematics Teaching Competency’ refers to the level of expertise in a mathematics teacher. It prepares a mathematics teacher to be competent to investigate mathematical ideas and build their confidence as mathematicians in order to pass that spirit of learning mathematics on to their students.

Aptitudes are important behavioural vectors causing certain kinds of things to happen. Teaching aptitudes impact on behaviour in both ways, subtle and obvious. At some level, a prospective teacher perceives these things even if he/she doesn’t consciously recognize them as aptitudes. Teaching aptitudes can be consciously directed towards performing certain tasks. From the above facts, it can be inferred that a prospective teacher with high teaching aptitude may consciously direct his/her efforts towards performing certain skills or competencies, and therefore exhibit desirable behavioural indicators. It appears that a prospective mathematics teacher with high teaching aptitude might demonstrate additional competence in acquisition of mathematics teaching competency to a prescribed level. Therefore, the finding
‘acquisition of Mathematics Teaching Competency is dependent on Teaching Aptitude’ seems to be justified.

Mean gain scores of main effects corresponding to Teaching Aptitude (High and Low) on Mathematics Teaching Competency are shown in figure 5.16.

**Figure 5.16**

Graphical Representation Showing Mean Gain Scores of Main Effects Corresponding To Teaching Aptitude on Mathematics Teaching Competency

Figure 5.16 depicts mean gain scores of High Teaching Aptitude group and Low Teaching Aptitude group. The mean gain score of High Teaching Aptitude group is higher than Low Teaching Aptitude group in acquisition of Mathematics Teaching Competency.

Moreover, the difference between the groups is significant as the calculated F-value is significant.

**5.3.8.3 Interaction effect between Training Strategies and Teaching Aptitude on Mathematics Teaching Competency**

Interaction effect of Training Strategies and Teaching Aptitude was found to be significant at 0.01 level of significance as F-value was found to be 8.34 (table 5.19), which is more than the table value of 7.12 for 1/56 degrees of freedom. This
significant ratio indicates that two variables of Training Strategies and Teaching Aptitude interact to produce significant effect on Mathematics Teaching Competency.

Hence the null hypothesis 8c, stating that ‘There exists no significant interaction between Training Strategies and Teaching Aptitude on acquisition of Mathematics Teaching Competency by prospective mathematics teachers’ is discarded.

In order to determine which groups differ significantly on the variable Mathematics Teaching Competency, t-ratios were calculated for different combinations of A X C and the results are entered in table 5.20.

Table 5.20

<table>
<thead>
<tr>
<th>S.NO</th>
<th>GROUP</th>
<th>N</th>
<th>df</th>
<th>M</th>
<th>SD</th>
<th>t-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1C2</td>
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<td>28</td>
<td>166.66</td>
<td>22.74</td>
<td>4.16*</td>
</tr>
<tr>
<td></td>
<td>A1C1</td>
<td>15</td>
<td>28</td>
<td>208.22</td>
<td></td>
<td>19.44</td>
</tr>
<tr>
<td>2</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>166.66</td>
<td>22.74</td>
<td>16.00*</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>16.88</td>
<td></td>
<td>16.44</td>
</tr>
<tr>
<td>3</td>
<td>A1C2</td>
<td>15</td>
<td>28</td>
<td>166.66</td>
<td>22.74</td>
<td>14.30*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>20.00</td>
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<td>16.44</td>
</tr>
<tr>
<td>5</td>
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<td>15</td>
<td>28</td>
<td>208.22</td>
<td>19.44</td>
<td>19.88*</td>
</tr>
<tr>
<td></td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>20.00</td>
<td></td>
<td>20.70</td>
</tr>
<tr>
<td>6</td>
<td>A2C1</td>
<td>15</td>
<td>28</td>
<td>16.88</td>
<td></td>
<td>16.44</td>
</tr>
<tr>
<td></td>
<td>A2C2</td>
<td>15</td>
<td>28</td>
<td>20.00</td>
<td></td>
<td>.35 (NS)</td>
</tr>
</tbody>
</table>

A1- MCBTS group  
A2- TT group  
C1- High teaching aptitude group  
C2- Low teaching aptitude group

\[ t = 2.67 \text{ to be significant at .01 level of significance for 28 df} \]
\[ t = 2.00 \text{ to be significant at .05 level of significance for 28 df} \]

* = significant at .01 level of significance  
** = significant at .01 level of significance  
NS = Not Significant
Interpretation and discussion based on table 5.20

The perusal of table 5.20 reveals the following facts:

- The t-ratio (4.16), between High Teaching Aptitude group and Low Teaching Aptitude group in relation to Mathematics Competency Based Training Strategy (MCBTS) was found to be significant at .01 level of significance. The results show that mean gain scores of High Teaching Aptitude group (208.22) is higher than Low Teaching Aptitude group (166.66), when both the groups were exposed to Mathematics Competency Based Training Strategy (MCBTS). This implies that High Teaching Aptitude group performed significantly superior on the acquisition of Mathematics Teaching Competency than Low Teaching Aptitude group, when both the groups were trained through Mathematics Competency Based Training Strategy (MCBTS).

- The t-ratio (16), between Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (166.66) is higher than Low Teaching Aptitude group trained through Traditional Training Strategy (TTS) (16.88). This implies that Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Teaching Competency than the Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

- The t-ratio (14.30), between Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of Low Teaching Aptitude group trained through Mathematics Competency Based Training Strategy (MCBTS) (166.66) is higher than High
Teaching Aptitude group trained through Traditional Training Strategy (TTS) (20.00). This implies that Low Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group when exposed to Traditional Training Strategy (TTS) differ significantly on the acquisition of Mathematics Teaching Competency.

The t-ratio (22.54), between High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that mean gain score of High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (208.22) is higher than Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (16.88). This implies that High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Teaching Competency than the Low Teaching Aptitude group exposed to Traditional Training Strategy (TTS).

The t-ratio (19.88), between High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) and High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) was found to be significant at .01 level of significance. The results show that the mean gain score of High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) (208.22) is higher than High Teaching Aptitude group exposed to Traditional Training Strategy (TTS) (20.00). This implies that High Teaching Aptitude group exposed to Mathematics Competency Based Training Strategy (MCBTS) performed significantly superior on the acquisition of Mathematics Teaching Competency than the High Teaching Aptitude group exposed to Traditional Training Strategy (TTS).
The t-ratio (.35), between High Teaching Aptitude group and Low Teaching Aptitude group when exposed to Traditional Training Strategy (TTS) was found to be insignificant. This implies that Low Teaching Aptitude group and High Teaching Aptitude group when trained through Traditional Training Strategy (TTS) did not differ significantly on the acquisition of Mathematics Teaching Competency.