CHAPTER VI
DATA ANALYSIS AND INTERPRETATION

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6.6.2 Interactive Effects

6.6.2.1 First Order Interactive Effects

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Study-7  Problem Solving Approach without discussion and Caste (A₂ & B) v/s Academic Performance

Study-8  Problem Solving Approach without discussion and Socio Economic status (A₂ & C) v/s Academic Performance

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6.2.2.2 Second Order Interactive Effects

Study-10  Problem Solving Approach with discussion, Caste and Socio Economic Status (A₁, B & C) v/s Academic Performance

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6.8 RESUME
6.1 INTRODUCTION

Keeping in view with the various hypotheses formulated in the fourth chapter, there were mainly three independent variables under study. The independent variables incorporated are:

(i) Treatment: Three levels,
   (a) PSA with discussion
   (b) PSA without discussion
   (c) No PSA i.e., no approach

(ii) Caste levels: Two levels,
    (a) Non-backward caste
    (b) Backward caste

(iii) Socio Economic Status: Two levels,
     (a) High
     (b) Low

The independent variables were the scores of academic
performance and creative personality test obtained by pupils. Every due care was taken while administering, scoring and conducting the research study. As described earlier the entire research study was done through factorial design.

According to the design and the main, as well as interactive effects which may occur a complete structural model for a score in 3x2x2 factorial design is postulated below:

\[ Y = G + A + B + C + AB + AC + BC + ABC + E \]

where,

\( Y \) = Dependent variable score

\( G \) = Usual Grand mean

\( A \) = Effects due to treatment (Problem Solving Approach Programme)

\( B \) = Effects due to Caste

\( C \) = Effects due to Socio Economic Status

\( E \) = Effects due to Errors

The predetermined procedure for analysing data is briefed in the next caption.

6.2 PROCEDURE OF ANALYSIS

The analysis of the data for CPT (Creative Personality Test) and AP (Academic Performance Test) was done with the help of calculator in the order given as under:
(1) The mean and variance of 3x2x2 factorial design were computed.

(2) The test of homogeneity of variance were given prior to ANOVA to the data of F.D.

(3) Orthogonal Contrast Matrix were constructed to partition sum of square for one/two degree/s of freedom for F.D.

(4) To locate significance among means, testing of mean differences sequence by t-test was done to arrive at appropriate inferences.

6.3 HOMOGENEITY OF VARIANCE

Prior to carrying out ANOVA on the data, Homogeneity of variance must be tested according to Ray Meddis.¹

"When there are three or more samples it is necessary to test whether all groups were drawn from the population with the same variance."

Despite the fact, there is an equal number of observations per cell, the investigator was anxious to know whether or not the independent variables produced unusual

---

differences in the variability of response measures. The descriptive data together with scored X mean and variances of the F.D. are given below in table 6.1(a) and 6.1(b), for creative personality and academic performance respectively.

The statistics shown in these could be easily used for analysis of variance in next captions.

Hartley's Fmax statistics for 3x2x2 factorial design can be used appropriately on the cell variance.\(^2\)

6.3.1 \textbf{F-max value for creative personality}

\[
F_{\text{max}} = \frac{\text{Highest variance}}{\text{Lowest variance}}
\]

\[
= \frac{11.88}{3.17}
\]

\[
= 3.75 \quad \text{for df 11/108}
\]

The value of Fmax is 3.75 which is not significant. Then it was held that the variance were homogeneous.

The above test of homogeneity of variance paved the way for the ANOVA for the study undertaken for creative personality.

\[-----------------------------\]

6.3.2 **F-max value for Academic Performance**

\[
F_{\text{max}} = \frac{\text{Highest variance}}{\text{Lowest variance}}
\]

\[
= \frac{165.88}{24.17}
\]

\[
= 6.86 \quad \text{for df 11/108}
\]

The value of \( F_{\text{max}} \) is 6.86 which is not significant. Then it was held that the variances were homogeneous.

The above test of homogeneity of variance paved the way for the ANOVA for the study undertaken for Academic performance.

6.4 **ANALYSIS OF VARIANCE**

The ANOVA model, the primary ANOVA, Orthogonal Matrix and detailed ANOVA are discussed hereunder and computed statistics are shown in the tables.

6.4.1 **ANOVA Model**

The academic performance and creative personality are dependent variables while treatment, caste and socio economic status are independent variables. Each of the independent variables was dichotomized into three and two levels respectively.
SCORING FOR 3X2X2 (TREATMENT X CASTEX X SES) FACTORIAL DESIGN FOR CREATIVE PERSONALITY

<table>
<thead>
<tr>
<th></th>
<th>PSA With Discussion</th>
<th>PSA Without Discussion</th>
<th>NO PSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non BC 1</td>
<td>BC 2</td>
<td>Non BC 1</td>
</tr>
<tr>
<td></td>
<td>HSES 1</td>
<td>LSES 1</td>
<td>HSES 2</td>
</tr>
<tr>
<td>No 1</td>
<td>18</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>No 2</td>
<td>16</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>No 3</td>
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<td>14</td>
<td>11</td>
</tr>
<tr>
<td>No 7</td>
<td>11</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>No 8</td>
<td>15</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>No 9</td>
<td>18</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>No 10</td>
<td>13</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Ex</td>
<td>14.9</td>
<td>11.6</td>
<td>12.8</td>
</tr>
<tr>
<td>Ex</td>
<td>14.9</td>
<td>11.6</td>
<td>12.8</td>
</tr>
<tr>
<td>6</td>
<td>5.66</td>
<td>5.60</td>
<td>4.18</td>
</tr>
</tbody>
</table>

Discussion: | 5.65  | 5.51  | 4.28  | 3.17  | 5.12  | 6.45  | 3.73  |

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TABLE 6.1(b)

SCORES FOR 3X2X2 (TREATMENTXCASTEXSES) FACTORIAL DESIGN FOR ACADEMIC PERFORMANCE

<table>
<thead>
<tr>
<th>With Discussion</th>
<th>Without Discussion</th>
<th>No PSA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PSA</td>
<td>PSA</td>
</tr>
<tr>
<td>Non BC 1</td>
<td>BC 2</td>
<td>Non BC 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H SES 1</td>
<td>L SES 1</td>
<td>H SES 1</td>
</tr>
<tr>
<td>NO 111</td>
<td>211</td>
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<td>6</td>
<td>50</td>
<td>39</td>
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<td>7</td>
<td>46</td>
<td>47</td>
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<tr>
<td>8</td>
<td>63</td>
<td>65</td>
</tr>
<tr>
<td>9</td>
<td>63</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>EX</td>
<td>558</td>
<td>461</td>
</tr>
<tr>
<td>X</td>
<td>55.8</td>
<td>46.1</td>
</tr>
<tr>
<td>EX²</td>
<td>32134</td>
<td>21807</td>
</tr>
<tr>
<td>X²</td>
<td>33344</td>
<td>25989</td>
</tr>
<tr>
<td>VARIABLES</td>
<td>TREATMENT</td>
<td>GRAND</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>PSA With Discussion</td>
<td>PSA Without Discussion</td>
</tr>
<tr>
<td>Non BC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High SES</td>
<td>149</td>
<td>126</td>
</tr>
<tr>
<td>Low SES</td>
<td>116</td>
<td>115</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High SES</td>
<td>128</td>
<td>118</td>
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<tr>
<td>Low SES</td>
<td>111</td>
<td>99</td>
</tr>
<tr>
<td>GRAND</td>
<td>504</td>
<td>458</td>
</tr>
<tr>
<td>VARIABLES</td>
<td>TREATMENT</td>
<td>GRAND</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>PSA With Discussion</td>
<td>PSA Without Discussion</td>
</tr>
<tr>
<td>Non</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High SES</td>
<td>Ex</td>
<td>558</td>
</tr>
<tr>
<td></td>
<td>Ex²</td>
<td>321.34</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>55.8</td>
</tr>
<tr>
<td></td>
<td>Vx</td>
<td>110.84</td>
</tr>
<tr>
<td>Low SES</td>
<td>Ex</td>
<td>461</td>
</tr>
<tr>
<td></td>
<td>Ex²</td>
<td>21807</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>46.1</td>
</tr>
<tr>
<td></td>
<td>Vx</td>
<td>61.66</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High SES</td>
<td>Ex</td>
<td>493</td>
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<td></td>
<td>Ex²</td>
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<tr>
<td></td>
<td>X</td>
<td>49.3</td>
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<tr>
<td></td>
<td>Vx</td>
<td>131.34</td>
</tr>
<tr>
<td>Low SES</td>
<td>Ex</td>
<td>402</td>
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<tr>
<td></td>
<td>Ex²</td>
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<tr>
<td></td>
<td>X</td>
<td>40.2</td>
</tr>
<tr>
<td></td>
<td>Vx</td>
<td>24.178</td>
</tr>
<tr>
<td>GRAND</td>
<td>Ex</td>
<td>1914</td>
</tr>
<tr>
<td></td>
<td>Ex²</td>
<td>95806</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>47.85</td>
</tr>
</tbody>
</table>
According to Edward A.L. 3

"When the levels of factors are not randomly selected, the ANOVA model is referred to as a fixed effect model when the levels of each factor have been randomly selected from the large population. The ANOVA model is referred to as a random effect model. If the levels of some factors have been randomly selected and those of others, have not, the ANOVA model is referred to as a mixed model."

Before proceeding with the ANOVA, it would be useful to look into the assumption underlying the ANOVA technique. They are parametric assumption.

(i) An equal unit scale is assumed for the measurement of the dependent variable.

(ii) Homogeneity of variance is the basic assumption. That is the sample of the group coming from the same population have equal variance.

6.4.2 Primary ANOVA

For the dependent variables (a) creative personality and (b) academic performance, the total sum of squares (SST) between sum of squares (SSB) and within sum of squares(SSW) are to be computed for the significance of the mean square

for observed data and have been shown in Table 6.3(a) and 6.3(b) respectively.

**TABLE 6.3(a)**

COMPUTATION OF SUM OF SQUARES : \( (n=16, \ k=12) \), FOR CREATIVE PERSONALITY (C.P.)

\[
\begin{align*}
\text{SST} & = x_1^2 + x_2^2 + \ldots + x_{120}^2 - \left( \frac{\sum x}{N} \right)^2 \\
& = 16267 - 15390.7 = 876.3 \\
\text{SSW} & = \text{SST} - \text{SSB} \\
& = 876.3 - 278.8 \\
& = 597.5
\end{align*}
\]
TABLE 6.3(b)

COMPUTATION OF SUM OF SQUARE
(n=10, K=12)

FOR ACADEMIC PERFORMANCE (A.P.)

\[
\begin{align*}
\text{SST} &= x_1^2 + x_2^2 + \ldots + x_{12}^2 - \frac{(x)^2}{N} \\
&= 291060 - 277537.01 \\
&= 13522.99 \\

\text{SSB} &= \frac{(x_1)^2}{n_1} + \frac{(x_2)^2}{n_2} + \ldots + \frac{(x_{12})^2}{n_{12}} - \frac{(x)^2}{N} \\
&= 282547.9 - 277537.01 \\
&= 5010.89 \\

\text{SSW} &= \text{SST} - \text{SSB} \\
&= 13522.99 - 5010.89 \\
&= 8512.1
\end{align*}
\]

The analysis of variance resulted into a partitioning of the total sum of squares and the degree of freedom into two parts. One part was associated with the differences among twelve group means and was based on \(K-1=11\), degree of freedom. The other part was associated with the variation within each of the 12 groups, and have \(K(n-1)=108\).
degree of freedom. This analysis is shown in table 6.4(a).

**TABLE 6.4(a)**

PRIMARY ANOVA 3x3x2 FACTORIAL DESIGN FOR CREATIVE PERSONALITY (C.P.)

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>278.8</td>
<td>11</td>
<td>25.35</td>
<td>4.76</td>
</tr>
<tr>
<td>Within group</td>
<td>597.5</td>
<td>108</td>
<td>5.33</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>876.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the above table the F was found to be significant for 11/108 degree of freedom.

Hence it was concluded that the group means differed significantly.

**TABLE 6.4(b)**

PRIMARY ANOVA 3x2x2 FACTORIAL DESIGN FOR ACADEMIC PERFORMANCE

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between group</td>
<td>5010.89</td>
<td>11</td>
<td>455.53</td>
<td>5.78</td>
</tr>
<tr>
<td>Within Groups</td>
<td>8512.10</td>
<td>108</td>
<td>78.81</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13522.99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the above table the F was found to be significant for 11/108 degree of freedom.

Hence it was concluded that the group means differed significantly.
6.4.3 Orthogonal Matrix for ANOVA

This research study consisted of a factorial design which studied three main effects i.e. one at three levels and other two at two levels. It also studied the partitioning of the sum of squares of each main effect. As it was felt that the factorial design would take a lot of time, the investigator tried to compute ANOVA by means of orthogonal contrast. The concept of orthogonal contrast is described in short in the following paragraphs.

An unique and silent features of a set of orthogonal contrast is that they form the basis for a complete partitioning of the treatment sum of squares from the analysis of squares from the analysis of variances. For samples of equal size, the following conditions define a set of orthogonal contrast.

(i) The sum of gross products of co-efficients for every pairs of contrasts must be zero.

(ii) The sum of contrasts co-efficients for contrast must be zero.

For a set of n sample, means set of n-1 orthogonal contrasts 'consume', the degree of freedom available in the set of sample means. Various sets of orthogonal contrasts can be built on the same set of sample means. The number of orthogonal contrast depends on the nature of research.
design and the interest of the investigator, each set will absorb the n-1 degree of freedom and will completely partition the treatment sum of squares. In the present factorial design the cell in the phase were 3x2x2 = 12. Thus under the phase, there might be 12-1=11 orthogonal contrast. The orthogonal matrices of 3x2x2 phase factorial design for both the dependent variables are given in table 5.5(a) and 6.5(b).

From the tables 6.5 (a) and (b), it can be seen that, from the orthogonal contrast matrices the ANOVA summary for factorial design was extracted. The computation for error variance was made and entered into the ANOVA summary of 3x2x2 phase factorial design. The ANOVA summary for factorial design for both the independent variables are given in the tables 6.6 (a) and 6.6 (b).

6.4.4 Detailed ANOVA

The sum of all the MSS for each degree of freedom is also shown in the table 6.6 (a,b) which is equal to the sum of square within the groups and is shown in the table 6.4 (a,b). It confirms the right process of constructing the orthogonal matrix for detailed analysis of variance.

The computed ANOVA summary for 3x2x2 factorial design is shown in table 6.6(a,b).
TABLE 6.5 (a)

ORTHOGONAL MATRIX OF 3X2X2 DESIGN (N=10, K=12) FOR CREATIVE PERSONALITY

<table>
<thead>
<tr>
<th>EFFECT</th>
<th>PSA WITH DISCUSSION</th>
<th>PSA WITHOUT DISCUSSION</th>
<th>NO PSA</th>
<th>$\sum d^2$</th>
<th>$C$</th>
<th>$SS = \frac{C^2}{ed^2 \times \eta}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non BC</td>
<td>BC</td>
<td>Non BC</td>
<td>BC</td>
<td>Non BC</td>
<td>BC</td>
</tr>
<tr>
<td></td>
<td>H SES 1</td>
<td>L SES 2</td>
<td>H SES 3</td>
<td>L SES 4</td>
<td>H SES 5</td>
<td>L SES 6</td>
</tr>
<tr>
<td>$A_1$</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_2$</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$B$</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$A_1B$</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_1C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_2B$</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_2C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>$B_C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$A_1BC$</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>+1</td>
</tr>
<tr>
<td>$A_2BC$</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
</tr>
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</table>
**TABLE 6.5 (b)**

ORTHOGONAL MATRIX. OF 3x2x2 DESIGN (n=10, k=12) FOR ACADEMIC PERFORMANCE

<table>
<thead>
<tr>
<th>EFFECT</th>
<th>PSA With Discussion</th>
<th>PSA Without Discussion</th>
<th>NO PSA</th>
<th>$E_{d}^2$</th>
<th>C</th>
<th>$SS = \frac{C^2}{E_{d}^2 \times \eta}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non BC</td>
<td>BC</td>
<td>Non BC</td>
<td>BC</td>
<td>Non BC</td>
<td>BC</td>
</tr>
<tr>
<td></td>
<td>H SES</td>
<td>L SES</td>
<td>H SES</td>
<td>L SES</td>
<td>H SES</td>
<td>L SES</td>
</tr>
<tr>
<td>$A_{1}$</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_{2}$</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_{1}B$</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>$A_{1}C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>$A_{2}B$</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$A_{2}C$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>BC</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_{1}BC$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>$A_{2}BC$</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
</tbody>
</table>
Table 6.6(a) and 6.7(a) are for creative personality and Table 6.6(b) and 6.7(b) are for academic performance.

**TABLE 6.6(a)**

ANOVA SUMMARY FOR 3x2x2 FACTORIAL DESIGN FOR CREATIVE PERSONALITY

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MSS</th>
<th>F</th>
<th>Significant level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>26.45</td>
<td>26.45</td>
<td>0.011</td>
<td>4.78</td>
</tr>
<tr>
<td>A1</td>
<td>1</td>
<td>117.6</td>
<td>117.6</td>
<td>21.27</td>
<td>0.01</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>39.68</td>
<td>39.68</td>
<td>7.18</td>
<td>0.01</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>63.08</td>
<td>63.08</td>
<td>11.41</td>
<td>0.01</td>
</tr>
<tr>
<td>A1B</td>
<td>1</td>
<td>0.05</td>
<td>0.05</td>
<td>0.01</td>
<td>NS</td>
</tr>
<tr>
<td>A1C</td>
<td>1</td>
<td>5.0</td>
<td>5.0</td>
<td>0.90</td>
<td>NS</td>
</tr>
<tr>
<td>A2B</td>
<td>1</td>
<td>0.6</td>
<td>0.6</td>
<td>0.11</td>
<td>NS</td>
</tr>
<tr>
<td>A2C</td>
<td>1</td>
<td>18.15</td>
<td>18.15</td>
<td>3.28</td>
<td>0.05</td>
</tr>
<tr>
<td>BC</td>
<td>1</td>
<td>0.21</td>
<td>0.21</td>
<td>0.04</td>
<td>NS</td>
</tr>
<tr>
<td>A1BC</td>
<td>1</td>
<td>7.2</td>
<td>7.2</td>
<td>1.30</td>
<td>NS</td>
</tr>
<tr>
<td>A2BC</td>
<td>1</td>
<td>0.82</td>
<td>0.82</td>
<td>0.15</td>
<td>NS</td>
</tr>
</tbody>
</table>

**Error** 108 597.5 5.53

For df 11/108

\[
F \text{ at } 0.05 = 2.45
\]

\[
F \text{ at } 0.01 = 3.70
\]
TABLE 6.6(b)
ANOVA SUMMARY FOR 3x2x2 FACTORIAL DESIGN
FOR ACADEMIC PERFORMANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MSS</th>
<th>F</th>
<th>Significant Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A_1</td>
<td>1</td>
<td>2.11</td>
<td>2.11</td>
<td>0.03</td>
<td>NS</td>
</tr>
<tr>
<td>A_2</td>
<td>1</td>
<td>1.50</td>
<td>1.50</td>
<td>0.02</td>
<td>NS</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>2193.0</td>
<td>2193.0</td>
<td>27.82</td>
<td>0.01</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>1928.0</td>
<td>1928.0</td>
<td>24.46</td>
<td>0.01</td>
</tr>
<tr>
<td>A_1B</td>
<td>1</td>
<td>25.3</td>
<td>25.3</td>
<td>0.32</td>
<td>NS</td>
</tr>
<tr>
<td>A_2C</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
<td>0.02</td>
<td>NS</td>
</tr>
<tr>
<td>A_2B</td>
<td>1</td>
<td>90</td>
<td>90</td>
<td>1.14</td>
<td>NS</td>
</tr>
<tr>
<td>A_2C</td>
<td>1</td>
<td>165.0</td>
<td>165.0</td>
<td>2.10</td>
<td>NS</td>
</tr>
<tr>
<td>BC</td>
<td>1</td>
<td>330.0</td>
<td>330.0</td>
<td>4.20</td>
<td>0.01</td>
</tr>
<tr>
<td>A_1BC</td>
<td>1</td>
<td>255.6</td>
<td>255.6</td>
<td>3.24</td>
<td>0.05</td>
</tr>
<tr>
<td>A_2BC</td>
<td>1</td>
<td>18.7</td>
<td>18.7</td>
<td>0.24</td>
<td>NS</td>
</tr>
</tbody>
</table>

Error 108 8512.1 78.82

For df 11/108

F at 0.05 2.45
F at 0.01 3.70
After analysing the data, the next step would be to test the various hypotheses enumerated in the fourth chapter one by one in two parts:

(i) Main effects

(ii) Interactive effects.
### TABLE 6.7(b)

**MEAN FOR THE LEVELS OF THE MAIN VARIABLES UNDER THE STUDY FOR ACADEMIC PERFORMANCE**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Variables</th>
<th>Mean for the levels</th>
<th>M.D. between Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PSA with D</td>
<td>47.85</td>
<td>-0.32</td>
</tr>
<tr>
<td></td>
<td>PSA without D</td>
<td>48.17</td>
<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>NO PSA</td>
<td>48.25</td>
<td>-0.40</td>
</tr>
<tr>
<td>2.</td>
<td>Caste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non BC</td>
<td>52.37</td>
<td>8.56</td>
</tr>
<tr>
<td></td>
<td>BC</td>
<td>43.81</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Socio Economic Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>52.10</td>
<td>8.02</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>44.08</td>
<td></td>
</tr>
</tbody>
</table>

After analysing the data, the next step would be to test the various hypotheses enumerated in the fourth chapter one by one into two parts:

(i) Main effects

(ii) Interactive effects.
6.5 TESTING OF HYPOTHESES WITH REFERENCE TO CREATIVE PERSONALITY

The hypotheses of the main effects viz. Problem Solving Approach (PSA), Caste and Socio Economic Status on the Creative Personality of secondary school pupils of std. IX, are formulated and put to F-test as shown below:

6.5.1 Main Effects

Study-1 Problem Solving Approach with discussion (A₁) v/s Creative personality.

In order to know the effectiveness of the problem solving approach with discussion on creative personality of secondary school pupils of std. IX, the following hypothesis was formulated and put to F-test.

H₀₁ : There is a significant effect of problem solving approach with discussion on the creative personality of secondary school pupils.

From table 6.6(a) it is observed that F-value of this treatment is 4.78 which is significant at 0.01 level hence the hypothesis is accepted and it was concluded that the students of this group and control group differed significantly in their creative personality level.
Study-2  
Problem Solving Approach without discussion (A₂) v/s Creative Personality

To know the effectiveness of above study the following hypothesis was formulated and put to F-test.

\[ H_{02} : \text{There is a significant effect of Problem solving approach without discussion on the creative personality of secondary school pupils.} \]

From the table 6.6(a) it is observed that the F value of treatment is 21.27 which is highly significant at 0.01 level. Hence the hypothesis is accepted and it was concluded that the students of this group and control group differed significantly in their creative personality level.

Means of creative personality test scores of students for Experimental groups (i.e. (Treatment groups and control groups) have been shown in graph-1.

Study-3  
Caste (B) v/s Creative Personality

To know the effectiveness of caste on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

\[ H_{03} : \text{There is no significant difference in creative personality of secondary school pupils of Backward caste and Non Backward} \]
MEAN SCORES of CPT

GRAPH - 1

TREATMENTS

MEAN OF CREATIVE PERSONALITY TEST SCORES
LEVELS OF
OF STUDENTS OF 3 TREATMENTS

PSA with Discussion
PSA without Discussion
NO PSA
caste when problem solving approach is implemented or not implemented.

From the table 6.6(a) it is observed the F value of this study is 7.18 which is highly significant at 0.01 level. Hence the hypothesis is rejected and it was concluded that the pupils coming from different caste i.e. Backward caste and Non-Backward caste show difference in creative personality which is in favour of Non BC students. Means of creative personality test scores of students for the two levels Non Backward and Backward caste have been shown in graph.2.

Study-4 Socio Economic Status (C) v/s Creative Personality

In order to know the effect of SES on Creative Personality of secondary school pupils of Std. IX, the following hypothesis was formulated and put to F-test.

\[ H_{0}^{4} : \text{There is no significant difference in creative personality of secondary school pupils of Std. IX, of high Socio Economic status and Low Socio Economic status.} \]

From the table 6.6(a) it is observed that the F value of this relation is 11.41 which is highly significant at 0.01 level. Hence, the hypothesis is rejected and it was concluded that creative personality of high SES and low SES
Means of Creative Personality Test Scores of Students of Non-Backward and Backward Caste
differed significantly and it is in favour of pupils having high SES.

Means of creative personality test scores of students for the two levels high SES and low SES have been shown in graph-3.

6.5.2 Interactive Effect

The hypothesis of first order and second order interactive effect viz. Problem Solving Approach, Caste and Socio Economic Status on creative personality of secondary school pupils of Std. IX are formulated and put to F-test as shown below:

6.5.2.1 First Order Interactive Effects

Study-5 Problem Solving Approach with discussion and caste v/s creative personality.

In order to know the interactive effect of Problem Solving Approach with discussion and caste on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

H05 : There is no first order interactive effect of problem solving approach with discussion and caste on the creative personality of the secondary school pupils.

From the table 6.6(a) it can be observed that F
MEAN SCORES OF CPT

CREATIVE PERSONALITY TEST SCORES OF STUDENTS OF HIGH AND LOW SOCIO ECONOMIC STATUS
values for $A_1 B$ is 0.01 which is not significant, hence the above null hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach with discussion and caste on creative personality of secondary school pupils.

**Study-6**  
**Problem Solving Approach with discussion and SES v/s Creative personality**

For above study the following hypothesis was formulated and put to F-test.

$H_{06}$: There is no first order interactive effect of problem solving approach with discussion and socio economic status on the creative personality of secondary school pupils.

From the table 6.6(a) it is observed that F-Value for $A_1 C$ is 0.90 which is not significant, hence the null hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach with discussion and SES on the creative personality of secondary school pupils.

**Study-7**  
**Problem solving Approach without discussion and Caste v/s Creative Personality.**

In order to know the effectiveness of problem solving approach without discussion and caste on creative
personality of secondary school pupils the following hypothesis was formulated and put to F-test.

\[ H_{07} \quad : \quad \text{There is no first order interactive effect of problem solving approach without discussion and caste on creative personality of secondary school pupils.} \]

From the table 6.6(a), it is observed that F value for \( A_2B \) is 0.11 which is not significant, hence the null hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach without discussion and caste on creative personality of secondary school pupils.

**Study-8** Problem Solving Approach without discussion and SES v/s Creative personality

In order to know the effectiveness of problem solving approach without discussion and socio economic status on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

\[ H_{08} \quad : \quad \text{There is no first order interactive effect of problem solving approach without discussion and SES on creative personality of secondary school pupils.} \]

From the table 6.6(a), it is observed that F value
for A₂C is 3.28 which is significant at 0.05 level, hence the null hypothesis is rejected and it was concluded that there is an interactive effect of problem solving approach without discussion and SES on creative personality of secondary school pupils.

Means of creative personality test scores of students for the first order interactive effect of problem solving approach without discussion and socio economic status have been shown in graph.4.

Study-9 Caste and SES v/s Creative Personality

In order to know the interactive effect of caste and SES on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

H₀₉ : There is no first order interactive effect of caste and SES on the creative personality of secondary school pupils.

From the table 6.6(a) it can be observed that F value for BC is 0.04, which is not significant, hence the above null hypothesis was accepted and it was concluded that there is no interactive effect of caste and SES on creative personality of secondary school pupils.
If
M£^N5 OF C RESTiYfc PERSON^tiry TEST SCORES 
OF STUDENTS CxT. UJXTH OUT TTSCU-^aIo m /MQ SES

GRAPH - 4

MEANS OF CREATIVE PERSONALITY TEST SCORES
OF STUDENTS GY. WITHOUT DISCUSSION AND SES
6.5.3 Second Order Interactive Effect

The hypothesis of second order interactive effects viz. problem solving approach, caste and socio economic status on creative personality of secondary school pupils of Std. IX are formulated and put to F-test as shown below:

Stud 10: Problem Solving Approach with discussion, Caste and SES v/s Creative personality

In order to know the interactive effect of problem solving approach with discussion, caste and SES on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

\[ H_{0_{10}} : \text{There is no second order interactive effect of problem solving approach with discussion, caste and SES on the creative personality of secondary school pupils.} \]

From the table 6.6(a) it is observed that F value for \( A_{1}BC \) is 1.30 which is not significant, hence the null hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach with discussion, caste and socio economic status on creative personality of secondary school pupils.
Study-11  Problem Solving Approach without discussion, 
Caste and Socio Economic Status v/s 
Creative personality

In order to know the interactive effect of problem 
solving approach without discussion, caste and socio economic status on creative personality of secondary school pupils the following hypothesis was formulated and put to F-test.

H₀₁₁ : There is no second order interactive effect of problem solving approach without discussion, caste and socio economic status on the creative personality of secondary school pupils.

From the table 6.6(a) it can be observed that F value for A₂BC is 0.15 which is not significant, hence the null hypothesis is accepted and it was concluded that there is no interactive effect of problem solving approach without discussion, caste and socio economic status on creative personality of secondary school pupils.
The hypothesis of the main effects, first order interactive and second order interactive effects viz. Problem solving approach, caste and socio economic status on the Academic Performance of secondary school pupils of Std. IX, are formulated and put to F-test as shown below:

6.6.1 Main Effects

Study-1 Problem Solving Approach with discussion

\( (A_1) \) v/s Academic Performance

In order to know the effectiveness of the problem solving approach with discussion on academic performance of secondary school pupils of Std. IX, the following hypothesis was formulated and put F-test.

\( H_{01} : \) There is a significant effect of problem solving approach with discussion on academic performance of secondary school pupils.

From table 6.6(b) it is observed that the F-value of this treatment is 0.03, which is not significant, hence the hypothesis is rejected and concluded that there is no effect of the treatment.

Study-2 Problem Solving Approach without discussion

\( (A_2) \) v/s Academic Performance
In order to know the effectiveness of problem solving approach without discussion on academic performance of secondary school pupils, the following hypothesis was formulated and put to F-test.

\[ H_{02} : \text{There is a significant effect of problem solving approach without discussion on academic performance of secondary school pupils.} \]

From the table 6.6(b) it is observed that the F value of this treatment is 0.02, which is not significant, hence the hypothesis is rejected and concluded that there is no effect of the treatment on academic performance of secondary school pupils.

Means of Academic Performance test scores of students for Experimental groups (i.e. Treatment groups) and control group have been shown in graph 5.

Study-3 Caste(B) v/s Academic Performance

To know the relationship of academic performance of and caste of secondary school pupils, the following hypothesis was formulated, and put to F-test.

\[ H_{03} : \text{There is no significant difference in academic performance of Backward caste and Non-Backward caste pupils of secondary} \]
Mean scores of academic performance levels of students of 3 treatments.

TREATMENTS

PSA WITH DISCUSSION
PSA WITHOUT DISCUSSION
NO PSA

GRAPH - 5
school, when problem solving approach is implemented or not.

From the table 6.6(b) it is observed that the F value of the effect is 27.82, which is highly significant at 0.01 level, hence the formulated hypothesis is rejected, and concluded that there is significant difference in academic performance of backward caste and non backward caste pupils of secondary school when problem solving approach is implemented or not.

This means the caste groups of pupils play an important role on the academic performance of the pupils. The Non B.C. pupils manifested more creative personality than their counterpart.

Means of Academic Performance test scores of students for the two levels Non-Backward and Backward caste have been shown in graph 6.

Study-4 Socio Economic Status v/s Academic performance

In order to know the relation between academic performance with high socio economic status and low socio-economic status pupils of secondary school, the following hypothesis was formulated and put to F-test.

$H_0$: There is no significant difference in
MEAN SCORES OF ACADEMIC PERFORMANCE SCORES
OF STUDENTS NON BACKWARD AND BACKWARD CASTE
Academic Performance of secondary school pupils of Std. IX of High Socio Economic Status and Low Socio Economic Status.

From the table 6.6(b) it is observed that the F value of this relation is 24.46, which is highly significant at 0.01 level, hence the hypothesis is rejected and concluded that there is a significant difference in academic performance of secondary school pupils of high and low socio economic status and it is in the favour of pupils having high SES.

Means of Academic Performance test scores of students for the two levels, high SES and low SES have been shown in graph.7.

6.6.2 Interactive Effects

For the studies about interactive effects viz. problem solving approach, caste and socio economic status on academic performance of secondary school pupils of Std. IX, the following hypotheses for first and second order are formulated and put to F-test as shown below :

6.6.2.1 First Order Interactive Effect

Study-5 Problem Solving Approach with discussion and Caste v/s Academic Performance.

To know the interactive effect of problem solving
MEAN SCORES OF AP

GRAPH-7

MEANS OF ACADEMIC PERFORMANCE SCORES OF STUDENTS OF HIGH AND LOW SOCIO ECONOMIC STATUS

SOCIO ECONOMIC STATUS

MEAN SCORES OF AP

HIGH SES

LOW SES
approach with discussion and caste on academic performance of secondary school pupils the following hypothesis was formulated and put to F-test.

\( H_{05} \): There is no first order interactive effect of problem solving approach with discussion and backward and non backward caste on academic performance of secondary school pupils.

From the table 6.6(b) it can be observed that the F value for \( A_1B \) is 0.32 which is not significant, hence the above null hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach with discussion and caste on academic performance of secondary school pupils.

Study-6  Problem Solving Approach with discussion and Socio economic status v/s Academic performance.

In order to know the interactive effect of problem solving approach with discussion and socio economic status on academic performance of secondary school pupils the following hypothesis was formulated and put to F-test.

\( H_{06} \): There is no first order interactive effect of problem solving approach with discussion and high and low socio economic status on
From the table 6.6(b) it can be observed that the F value for A\textsubscript{1}C is 0.02 which is not significant hence the hypothesis is accepted and it was concluded that there is no interactive effect of problem solving approach with discussion and socio economic status on academic performance of secondary school pupils.

Study-7 Problem Solving Approach without discussion and Caste v/s Academic Performance

In order to know the interactive effect of problem solving approach without discussion and caste on academic performance of secondary school pupils the following hypothesis was formulated and put to F-test.

H\textsubscript{07} : There is no first order interactive effect of problem solving approach without discussion and caste on academic performance of secondary school pupils.

From the table 6.6(b) it can be concluded that the F-value for A\textsubscript{2}B is 1.14, which is not significant, hence the hypothesis is accepted and it was concluded that there is no interactive effect of problem solving approach without discussion and caste on academic performance of secondary school pupils.
Study-8 Problem Solving Approach without discussion and Socio Economic Status v/s Academic Performance.

In order to know the interactive effect of problem solving approach without discussion and socio economic status on academic performance of secondary school pupils, the following hypothesis was formulated and put to F-test.

\[ H_0 \]: There is no first order interactive effect of problem solving approach and socio economic status on academic performance of secondary school pupils.

From the table 6.6(b) it can be observed that the F value of \( A_2C \) is 2.10 which is not significant hence the hypothesis was accepted and it was concluded that there is no interactive effect of problem solving approach and socio economic status on academic performance of secondary school pupils.

Study-9 Caste and Socio Economic Status v/s Academic Performance

In order to know the interactive effect of caste and SES on academic performance of secondary school pupils, the following hypothesis was formulated and put to F-test.

\[ H_0 \]: There is no first order interactive effect
of caste and SES on the academic performance of secondary school pupils.

From the table 6.6(b) it can be observed that the F value of BC is 4.20, which is significant at 0.01 level, hence the hypothesis is rejected and it was concluded that there is an interactive effect of caste and socio economic status on academic performance of secondary school pupils.

Means of Academic Performance test scores of students for the first order interactive effect of Caste and Socio economic status have been shown in graph.8.

6.6.2.2. Second Order Interactive Effect

Study-10 Problem Solving Approach with discussion, Caste and Socio economic status vis Academic Performance

In order to know the interactive effect of above study the following hypothesis was formulated and put to F-test.

$H_{010}$: There is no second order interactive effect of problem solving approach with discussion, caste and SES on academic performance of secondary school pupils.

From the table 6.6(b) it can be observed that the
CASTE AND SOCIO ECONOMIC STATUS

MEAN OF ACADEMIC PERFORMANCE SCORES
OF STUDENTS OF CASTE AND SOCIO ECONOMIC STATUS
P value of $\text{h}_1^\text{BC}$ is 3.24 which is significant at 0.05 level; hence the hypothesis was rejected and it was concluded that there is an interactive effect of problem solving approach, caste and socio economic status on academic performance of secondary school pupils.

Study II: Problem Solving Approach without discussion, Caste and Socio economic status v/s Academic performance.

In order to know the interactive effect of problem solving approach, caste and socio economic status on academic performance the following hypothesis was formulated and put to F-test.

$H_{011}$: There is no second order interactive effect of problem solving approach without discussion, caste and socio economic status on academic performance of secondary school pupils.

From the table 6.6(b) it can be observed that the F value of $A_2^1BC$ is 0.24, which is not significant, hence
the null hypothesis is accepted and it was concluded that there is no interactive effect of problem solving approach without discussion, caste and socio economic status on the academic performance of secondary school pupils.

6.7 TESTING OF MEAN DIFFERENCES BY t-test

The F-test in ANOVA discussed in the forgoing pages states whether the differences among means within different groups were significant or otherwise, but it does not clearly show the significance of the differences of means between the particular pairs of groups. For this reason, the verification of significance between different pairs of group-means becomes imperative. This can be achieved with the help of the t-test. The necessary values of the statistics computed for t-test at df=11 are given below.

6.7.1 Testing of mean differences by t-test for Creative Personality

\[
\begin{align*}
\text{df} & = 111 \\
\text{SDW} & = \sqrt{\text{MSSW}} \\
t_{0.05} & = 1.96 \\
t_{0.01} & = 2.58 \\
\end{align*}
\]

From table 6.3(1)

\[
\begin{align*}
\text{SSW} & = 597.5 \\
\text{MSEW} & = \frac{597.5}{108} = 5.53 \\
\text{SED} & = \text{SDW} \sqrt{\frac{1}{N_1} + \frac{1}{N_2}} \\
& = 2.35 \sqrt{\frac{1}{10} + \frac{1}{10}} \\
& = 5.53 \\
& = 2.35 \times 0.447 = 1.05
\end{align*}
\]
\[ D_{0.05} = (t \text{ value}) \times SED \]
\[ = 1.96 \times 1.05 \]
\[ = 2.05 \]
\[ D_{0.01} = 2.58 \times 1.05 \]
\[ = 2.70 \]

\[
\begin{array}{ll}
SDW &= 2.35 & D_{0.05} &= 2.05 \\
SED &= 1.05 & D_{0.01} &= 2.70
\end{array}
\]

The mean differences between two particular groups greater than 2.05 and 2.70 are significant at 0.05 and 0.01 levels. The following shows more details about the significance of groups. (Table 6.8(a)).

Out of 66 particular group relations, in 15 relations the mean differences are found to be significant at 0.01 level, in 10 relations the mean differences are found to be significant at 0.05 level and the remaining 41 group relations the mean differences are observed to be not significant.
**TABLE 6.8(a)**

SIGNIFICANCE OF MEAN DIFFERENCES OF THE PARTICULAR GROUPS FOR 3x2x2 (PSAxCASTExSES) FACTORIAL DESIGN FOR CREATIVE PERSONALITY

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>223</th>
<th>123</th>
<th>222</th>
<th>213</th>
<th>113</th>
<th>331</th>
<th>212</th>
<th>211</th>
<th>322</th>
<th>112</th>
<th>121</th>
<th>111</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEANS</td>
<td>9.2</td>
<td>9.7</td>
<td>9.9</td>
<td>10.3</td>
<td>10.5</td>
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<td>11.5</td>
<td>11.6</td>
<td>11.8</td>
<td>12.6</td>
<td>12.8</td>
<td>14.9</td>
</tr>
</tbody>
</table>

| 123   | 0.5 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| 222   | 0.7 | 0.2 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| 213   | 1.1 | 0.6 | 0.4 | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| 113   | 1.3 | 0.8 | 0.6 | 0.2 | -   | -   | -   | -   | -   | -   | -   | -   |
| 221   | 1.9 | 1.4 | 1.2 | 0.8 | 0.6 | -   | -   | -   | -   | -   | -   | -   |
| 212   | 2.3 | 1.8 | 1.6 | 1.2 | 1.0 | 0.4 | -   | -   | -   | -   | -   | -   |
| 211   | 2.4 | 1.9 | 1.7 | 1.3 | 1.1 | 0.5 | 0.1 | -   | -   | -   | -   | -   |
| 122   | 2.6 | 2.1 | 1.9 | 1.5 | 1.3 | 0.7 | 0.3 | 0.2 | -   | -   | -   | -   |
| 112   | 3.4 | 2.9 | 2.7 | 2.3 | 2.1 | 1.5 | 1.1 | 1.0 | 0.8 | -   | -   | -   |
| 121   | 3.6 | 3.1 | 2.9 | 2.5 | 2.3 | 1.7 | 1.3 | 1.2 | 1.0 | 0.2 | -   | -   |
| 111   | 5.7 | 5.2 | 5.0 | 4.6 | 4.4 | 3.8 | 3.4 | 3.3 | 3.1 | 2.3 | 2.1 | -   |

* Significant at 0.05 level — greater than 2.05
** Significant at 0.01 level — greater than 2.70
6.7.2 Testing of mean differences by t-test for Academic Performance

\[ \text{df} = 111, \quad SDW = \sqrt{\frac{\text{MSSW}}{}}, \quad 1.96 \]

\[ t_{0.05} = 1.96, \quad t_{0.01} = 2.58 \]

From Table 6.3(2)

\[ \text{SSW} = 8512.1 \quad \text{SED} = SDW \sqrt{\frac{1}{N_1} + \frac{1}{N_2}} \]

\[ \text{MSSW} = \frac{8512.1}{108} \quad \text{SED} = 8.41 \times \sqrt{\frac{1}{10} + \frac{1}{10}} \]

\[ = 70.81 \quad = 8.41 \times \sqrt{0.2} \]

\[ = 8.41 \times 0.447 \]

\[ = 3.76 \]

\[ D_{0.05} = (t \text{ value}) \times SED \]

\[ = 1.96 \times 3.76 \]

\[ = 7.37 \]

\[ D_{0.01} = (t \text{ value}) \times SED \]

\[ = 2.58 \times 3.76 \]

\[ = 9.62 \]

\[ SDW = 8.41 \quad D_{0.05} = 7.37 \]

\[ SED = 3.76 \quad D_{0.01} = 9.62 \]

The mean difference between two particular groups is greater than 7.37 and 9.62, which is significant at 0.05 and 0.01 levels. The following table shows more details about the significance of groups.
### TABLE 6.8(b)

SIGNIFICANCE OF MEAN DIFFERENCES OF THE PARTICULAR GROUPS FOR 3x2x2 (PSAxCASTExSES) FACTORIAL DESIGN FOR ACADEMIC PERFORMANCES

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<th>222</th>
<th>212</th>
<th>123</th>
<th>122</th>
<th>211</th>
<th>121</th>
<th>213</th>
<th>111</th>
<th>113</th>
<th>112</th>
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<td>10.8</td>
<td>5.3</td>
<td>3.9</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level,

** Significant at 0.01 level.
Out of 66 particular group relations, in 24 relations the mean differences are found to be significant at 0.01 level, in 6 relations the mean differences are revealed to be significant at 0.05 level and the remaining 37 group relations the mean differences are observed to be non significant.

6.8 RESUME

In this chapter, the investigator has discussed in detail the main effects as well as interactive effects of the various independent variable on various levels of the students. Investigator had also deeply given the analysis and interpretation of various hypotheses. For this, homogeneity of variance, ANOVA model, orthogonal matrix for ANOVA and Detailed ANOVA was applied. Testing for significance by ANOVA investigator had used the t-test. Investigator had tried to find out the mean differences between two particular groups by t-test. Investigator had applied 3x2x2 factorial design in the study. The relations and effects in between problem solving approach, caste and socio economic status were found by detailed analysis and interpretation.

The investigator, in the next chapter intends to present the results of research study in terms of general observations, tentative conclusions arrived at and some suggestions for further researches.