"History records that many great ideas come from those devoid of specialized training in the problem involved. The telegraph was worked out by Morse, a professional painter of portraits. The steam boat was thought up by Fulton, likewise and artist. A school teacher, Eli Whitney, devised the cotter gin.

-Alex Osborn
CHAPTER VI
DATA ANALYSIS

6.0 INTRODUCTION

6.1 PROCEDURE OF ANALYSIS

6.2 HOMOGENEITY OF VARIANCE TEST

6.3 ANALYSIS OF VARIANCE

6.3.1 ANOVA Model
6.3.2 Primary ANOVA
6.3.3 Orthogonal Matrix for ANOVA
6.3.4 Detailed ANOVA

6.4 TESTING OF HYPOTHESIS : MAIN EFFECTS

Study-1 Treatment v/s Creativity
Study-2 Trend across Treatments
Study-3 Initial Creativity v/s Acquired Creativity
Study-4 Intelligence v/s Creativity

6.5 TESTING OF HYPOTHESIS :
INTERACTION EFFECTS

6.5.1 First Order Interaction Effect

Study-5 Interaction between Treatment and Initial Creativity
Study-6 Interaction between Treatment and Intelligence
Study-7 Interaction between Initial Creativity and Intelligence

6.5.2 Second Order Interaction Effect

Study-8 Treatment x Initial Creativity x Intelligence

6.6 CI BLOCK STUDY

Study-9 Block v/s Creativity
Study-10 Trend Across Blocks

6.7 RESUME
6.0 **INTRODUCTION**

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

1. **Treatment**: three levels  
   PDB - PB - NP

2. **Initial Creative Levels**: two levels  
   High - Low

3. **Intelligence**: Two Levels  
   High - Low

The independent variable was creativity score obtained by pupils after taking creativity test developed by J.Z. Patel. 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.
Keeping in view 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 (Programmes)
- \( B \) = Effects due to Initial creativity
- \( C \) = Effects due to Intelligence
- \( E \) = Effects due to Errors

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

6.1 PROCEDURE OF ANALYSIS

The analysis of the data was done with the help of calculator in the order given as under:

1) The mean and variance of 3x2x2 factorial design was computed.

2) The tests 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, Newman-Keul's sequence Range test was given to arrive at appropriate relationship between means.

5) Trend test was also contemplated for the F.D. for treatment.

6.2 HOMOGENEITY OF VARIANCE TEST

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

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

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 and 6.2.

From the above table, Necessary Statistics for analysis were briefed and displayed in the following table 6.2.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FDB</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td>High IQ</td>
<td>X²</td>
</tr>
<tr>
<td>High CREATIVITY</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>VARI.</td>
</tr>
<tr>
<td>Low IQ</td>
<td>X</td>
</tr>
<tr>
<td>Low CREATIVITY</td>
<td>X²</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>VARI.</td>
</tr>
<tr>
<td>High IQ</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X²</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>VARI.</td>
</tr>
<tr>
<td>Low IQ</td>
<td>X</td>
</tr>
<tr>
<td>Low CREATIVITY</td>
<td>X²</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>VARI.</td>
</tr>
<tr>
<td>GRAND</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X²</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**TABLE 6.2**

SUMS, SUMS OF SQUARES, MEANS & VARIANCES
OF 3x2x2 FACTORIAL DESIGN (N = 96; n=8)
The statistics shown in this table could be easily used for analysis of variance in the next caption.

Hartley's \(^2\) F\(_{\text{max}}\) statistics for 3x2x2 Factorial Design can be used appropriately on the cell variance.

Thus,

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

\[
= \frac{4251.07}{1058.12}
\]

\[
= 4.01
\]

For \(K = 12\)

and \(df = 7\)

\(F = 8.41 \text{ at .05}\)

\(= 11.95 \text{ at .01}\)

Thus for 12 variances each based on 7 df, the value of \(F_{\text{max}}\) is 4.01 (8.41) which is nonsignificance 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.

-------------------

6.3 ANALYSIS OF VARIANCE

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

6.3.1 ANOVA Model

The creativity was the dependent variables, while treatment, initial creativity and intelligence were the independent variables. Each of the independent variable was dichotomized into three and two levels respectively. According to Allen L. Edward:

"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, say.

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

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

6.3.2 Primary ANOVA

The sum of squares (SST) between sum of squares (SSB) and within the sum of squares (SSw) are to be computed for the significance of the mean square for observed data by the formula shown in table 6.3.

**TABLE 6.3**
COMPUTATION OF SUM OF SQUARES \( (N=96, \ n=8, \ k=12) \)

\[
\begin{align*}
SS_T &= (X_1)^2 + (X_2)^2 + \ldots + (X_{96})^2 - \frac{(\sum X)^2}{N} \\
&= 325377.90 \\
SS_B &= \frac{(\sum X^2)^2}{n} + \frac{(\sum X)^2}{2n} + \ldots - \frac{(\sum X)^2}{N} \\
&= 176945.01 \\
SS_w &= SS_T - SS_B \\
&= 148432.89
\end{align*}
\]
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 had \( k(n-1)=84 \) degree of freedom. This analysis is shown in Table 6.4.

**Table 6.4**

PRIMARY ANOVA 3x2x2 FACTORIAL DESIGN

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Sun of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Group</td>
<td>176945.01</td>
<td>11</td>
<td>16085.91</td>
<td>9.1</td>
</tr>
<tr>
<td>Within Group</td>
<td>148432.89</td>
<td>84</td>
<td>1767.06</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>325377.90</td>
<td>95</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ F_{11/84} = 1.91 \text{ at .05 }^4 \]
\[ = 2.48 \text{ at .01 }^{**} \]

From the above table, the F was found to be significant \( 11/84 \) degrees of freedom at .01 level.

Hence it was concluded that the group means differed significantly.

---

4. Ibid.
6.3.3 Orthogonal Matrix for ANOVA

The present 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 such 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 in short described in the following paragraphs.

A 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 variances. For samples of equal size, the following conditions define a set of orthogonal contrast.

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

(b) The sum of gross products of co-efficients for every pair of contrasts 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 the 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 \( 3 \times 2 \times 2 = 12 \). Thus under the phase, there might be \( 12-1 = 11 \) orthogonal contrast. The orthogonal matrix of \( 3 \times 2 \times 2 \) phase factorial design is given in table 6.5. (on the next page)

From the table 6.5, it can be seen that, from the orthogonal contrast matrix- the ANOVA summary for factorial design was extracted. The computation for error variance was made and entered into the ANOVA summary of \( 3 \times 2 \times 2 \) phase Factorial design. The ANOVA summary for Facrotial design is given in table 6.6.
### TABLE 6.5
ORTHOGONAL MATRICES OF 3x2x2 FACTORIAL DESIGN (n = 8)

<table>
<thead>
<tr>
<th></th>
<th>PP/B</th>
<th>PB</th>
<th>NP</th>
<th>Msd</th>
<th>MSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TREATMENT</td>
<td>HI</td>
<td>LO</td>
<td>CR</td>
<td>HI</td>
<td>LO</td>
</tr>
<tr>
<td>A₁</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>A₂</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>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>A₁B</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>A₁C</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>A₂B</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>A₂C</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>B₃C</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>A₁B₃C</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>A₂B₃C</td>
<td>1</td>
<td>-1</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>SUM</td>
<td>176944.85</td>
<td>176944.85</td>
<td>176944.85</td>
<td>176944.85</td>
<td>176944.85</td>
</tr>
</tbody>
</table>

On the basis of the statistics viz. Mean sum of Squares for each degree of freedom, the detailed ANOVA had been done.

#### 6.3.4 Detailed ANOVA

The sum of all the MSS for each degree of freedom is 176944.85 (table 6.5) which is nearly equal to the sum of square between 176945.01 (table 6.4). 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 below.
<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MSq</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁</td>
<td>1</td>
<td>1782.25</td>
<td>1782.25</td>
<td>10.09</td>
<td></td>
</tr>
<tr>
<td>A₂</td>
<td>1</td>
<td>33022.52</td>
<td>33022.52</td>
<td>18.69</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>99910.51</td>
<td>99910.51</td>
<td>56.64</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>17903.34</td>
<td>17903.34</td>
<td>10.13</td>
<td></td>
</tr>
<tr>
<td>A₁B</td>
<td>1</td>
<td>132.25</td>
<td>132.25</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>A₁C</td>
<td>1</td>
<td>0.56</td>
<td>0.56</td>
<td>0.0003</td>
<td></td>
</tr>
<tr>
<td>A₂B</td>
<td>1</td>
<td>1441.02</td>
<td>1441.02</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>A₂C</td>
<td>1</td>
<td>4332.00</td>
<td>4332.00</td>
<td>2.45</td>
<td></td>
</tr>
<tr>
<td>BC</td>
<td>1</td>
<td>82.51</td>
<td>82.51</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>A₁BC</td>
<td>1</td>
<td>217.56</td>
<td>217.56</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>A₂BC</td>
<td>1</td>
<td>2080.33</td>
<td>2080.33</td>
<td>1.18</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>84</td>
<td>148432.89</td>
<td>1767.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For df 1/84

\[ F = 3.96 \text{ at } .05 \]  \( ^5 \)
\[ = 6.96 \text{ at } .01 \]  \( ^* \)

NS = Non significant

The Means for the levels of the independent variable
under study are shown below in table 6.7.

5. Ibid.
### TABLE 6.7

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

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Variables</th>
<th>Mean for the Levels</th>
<th>Mean differences between the level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Treatments PDB</td>
<td>204.25</td>
<td>33.38 56.02</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>170.87</td>
<td>22.65</td>
</tr>
<tr>
<td></td>
<td>NP</td>
<td>148.22</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Initial Creativity</td>
<td>High 206.71</td>
<td>72.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low 142.19</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Intelligence</td>
<td>High 188.10</td>
<td>35.65</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low 160.79</td>
<td></td>
</tr>
</tbody>
</table>

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

1. **Main Effects**
2. **Interaction Effects**

Along with the testing hypothesis, the trend analysis study had been done in the next caption.
6.4 TESTING OF HYPOTHESIS : MAIN EFFECTS

The hypothesis of the main effects viz. Productive Thinking Programme in Geography (PTPG), Initial Creativity and General Ability (IQ) are tested as shown below:

Study-1 Treatment Versus Creativity

In order to know the effectiveness of the creative thinking programmes in Geography on the creativity of the students, the following alternative hypothesis was formulated and put to F test.

H0. Productive thinking programmes in Geography increase the level of creativity of the students.

From the table 6.6, it is observed that value of treatments is 18.69 which is significant at .01 level, i.e. the students of experimental group (To whom PTPG were tried and with and without discussion) and control group (to whom PTPG was not tried out) differed significantly in their creativity levels.

From table 6.6, it is also observed that value of treatments (three) is 10.09 which is significant at .01 level, i.e. three treatment groups differ significantly in their creativity scores.

To look at the significance of mean, the Newman-Keul
Sequential Range Test was employed. The relevant information for the test is given in the table 6.8.

**TABLE 6.8**

**SUMMARY OF EXACT DIFFERENCES BETWEEN THE PAIRS OF MEANS OF TREATMENT GROUPS.**

<table>
<thead>
<tr>
<th>SE</th>
<th>$\sqrt{\frac{1767}{32}} = 7.43$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>NP</td>
</tr>
<tr>
<td>$\bar{X}$</td>
<td>148.22</td>
</tr>
<tr>
<td>$\bar{X} - \bar{X}$</td>
<td>22.65$^+$</td>
</tr>
<tr>
<td>N.K. Value</td>
<td>M.D. $\frac{M.D.}{SE}$</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First mean difference (22.65) between PB and NP groups is significant at .05 level while the last two mean differences between PDB and NP, and PDB and PB groups are significant at .01 level. The relationship between these three treatment groups can be shown symbolically as below:

PDB > PB > NP

This result reveals in the Graph No.1 on page.

To see the trend across treatments, the trend test was also attempted.
Study-2 Trend Across Treatment

The functional relationship of creativity across the three given treatments viz. Programme with Discussion along with textbook, Programme along with textbook and No programme (only book) can be studied by employing trend test. The relevant data and the computation of trend are given in table 6.9.

**TABLE 6.9**

**TREND TEST ACROSS THREE TREATMENTS**

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>PDB</th>
<th>PB</th>
<th>NP (W.B.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMS</td>
<td>6536</td>
<td>5459</td>
<td>4743</td>
</tr>
<tr>
<td>TRENDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear</td>
<td>-1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Quadratic</td>
<td>1</td>
<td>-2</td>
<td>1</td>
</tr>
</tbody>
</table>

Linear component = \( \frac{(1793)^2}{8 \times 4 \times 2} \)

= 50232.02

\[ F_{\text{Linear}} = \frac{50232.02}{1767.06} \]

= 28.43 significant at .01 level

Quadratic Component = \( \frac{361^2}{8 \times 4 \times 6} \)

= 678.75
MEAN OF CREATIVITY SCORES OF STUDENTS OF 3 TREATMENT GROUPS
The trend of creativity developed by the three different treatments is seemed to be linear one. The trend across treatments can be read from the Graph 1, on Page 20%.

Study-3  Initial Creativity v/s Acquired Creativity

In order to know whether there is a relationship between the initial creativity of the students and the creativity acquired by them after the administration of PTPG, the following hypothesis is generated and put to F-Test.

H0  There is no significant mean difference in Initial (before PTPG) tried and Acquired creativity (after PTPG) of the students.

From table 6.6 it is observed that the F-value for initial creativity as one variable is 56.64 which is significant at .001 level. Hence the null hypothesis is not accepted. So it was concluded that the means of creativity scores before and after the administration of the PTPG differed significantly and the mean difference of 72.85 (Table 6.7) was in favour of the programme (PTPG) implementation. Signifying thereby that the productive thinking programmes

\[
F_{\text{Quadratic}} = \frac{678.75}{1767.06} = 0.384 \quad \text{Non Significant}
\]
INITIAL CREATIVITY

ACQUIRED MEAN CREATIVITY SCORES OF STUDENTS OF HIC & LIC GROUPS
in Geography was effective in enhancing the creativity level of the students.

This result reveals in the graph No. 2 on page 210.

Study-4 Intelligence v/s Creativity

In order to know whether there is a relationship between the intelligence of the students and their creativity, the following null hypothesis was generated and put to F-Test.

$H_0$ : There is no significant mean difference in the creativity scores of students having high and low intelligence.

From table 6.6, it is observed that the F-value for variable I.Q. (General Ability) is 10.13 which is significant at .01 level. Hence the null hypothesis was not acceptable. Therefore, it was concluded that there were significant difference of 35.65 (Table 6.7) between the creativity scores of the pupils of high (above 110 I.Q) and low intelligence (below 110 I.Q) and this difference was in favour of high level of I.Q. (above 110 I.Q). This difference of 35.65 can be perceived from the Graph drawn on page No.-211.
MEAN CREATIVITY SCORES OF STUDENTS OF HIQ & LIQ GROUPS

HIGH INTELLIGENCE

LOW INTELLIGENCE

MEAN SCORES OF CR.

GRAPH - 3
6.5 TESTING OF HYPOTHESES : INTERACTIVE EFFECT

The ANOVA Summary given in table 6.6 furnishes full detail as regards significant and non-significant interaction of independent variables. It can be seen from the table that no any significant effects of interaction effect (first or second order) of the independent variables on the creativity of the students, so the study for each inactive effect had been stated as below.

Study-5  Treatment x Initial Creativity (AxB)

In order to know whether treatments and initial creativity of the students interact with each other in the enhancement of creativity scores, the following null hypothesis was generated and put to F-test.

H0  There is no significant interaction effect of treatments and Initial creativity of students on their creativity scores.

From table 6.6, it can be observed that the F-values for $A_1B$ and $A_2B$ are 0.07 and 0.82, which are not significant hence the above null hypothesis was accepted and it was concluded that there was no significant interaction between the given treatments and the initial creativity scores. This can be read from the graphical data shown on the page 212.
INTERACTION EFFECT OF TREATMENT X INITIAL CREATIVITY ON CREATIVITY SCORES
**Study-6  Treatment and Intelligence (A x C)**

In order to know whether treatments and intelligence of the students interact with each other in the enhancing the creativity scores, the following null hypothesis was generated and put to F-test.

**H0** There is no significant interaction effect of the treatment and intelligence of the students on their creativity scores.

From the table 6.6, it can be seen that the F-value for $A_1C$ and $A_2C$ are 0.0003 and 2.45, which are not significant. Hence the above null hypothesis was accepted and it was concluded that there was no significant interactive effect of given treatments and intelligence of the students in developing their creativity ability. This can be easily read from the graphic data shown on the page 214.

**Study-7  Initial Creativity x Intelligence (B x C)**

In order to know whether initial creativity and intelligence of the students, on interactive effect in developing the creativity level of the students, the following null hypothesis was generated and put to F-test.

**H0** There is no significant interaction effect of
INTERACTION EFFECT OF TREATMENT X INTELLIGENCE ON CREATIVITY SCORES
initial creativity and intelligence of the
students on their creativity scores.

From table 6.6, it can be read that F values for BC
is 0.05, which is not significant. Hence the above null
hypothesis was accepted and it was concluded that there was
no significant interaction between the initial creativity
and intelligence of the students in enhancing their creative
levels. This can be perceptualized from the graphic data
shown on page 216.

Study-8 Treatment x Initial Creativity x Intelligence

To study the joint effect of all the three independent variables on the creativity of the students, the following null hypothesis was generated and put to F-test.

H0 There is no significant interaction effect of
treatment, initial creativity scores.

From table 6.6, it can be observed that the F-values
for A1BC and A2BC are 0.12 and 1.18, which are not signi-
ficant. Hence the above null hypothesis was accepted and
it was concluded that there was no significant interaction
effect of treatments, initial creativity and intelligence
in the enhancement of the creativity scores.
INTERACTION EFFECT OF INITIAL CREATIVITY X INTELLIGENCE ON CREATIVITY

INTELLIGENCE

INTERACTION EFFECT OF INITIAL CREATIVITY X INTELLIGENCE ON CREATIVITY

MEAN SCORES OF CR.

GRAPH-6

HIGH

LOW

B1

B2
6.6 CI BLOCK STUDY

It is found that the interactive effect of initial creativity and intelligence of the students was not significant on the acquired creativity of the students. As initial creativity and intelligence of the pupils are the creative correlates, the investigator had decided to construct the Creative Intelligence Blocks by dichotomized both the variables. They are as follows:

Block 1 : High Creativity & High Intelligence
Block 2 : High Creativity & Low Intelligence
Block 3 : Low Creativity & High Intelligence
Block 4 : Low Creativity & Low Intelligence

To see the significance of means of the four CI - Blocks, one study is undertaken and to test the trend across the Blocks, other study is undertaken in the caption follows

Study-9 CI - Blocks v/s Creativity

In order to know whether there is a relationship between the CI - Blocks and their creativity, the following hypothesis was generated.

H0 There is no significant mean difference in the Creativity scores of the students of different CI - Blocks.
To locate the significance of means, the Newman-Keul's sequential test was applied. The relevant information of the test is given in table 6.10 below:

**TABLE 6.10**

**SUMMARY OF EXACT DIFFERENCES BETWEEN PAIRS OF MEANS, OF 4 CI-BLOCKS (n = 24)**

<table>
<thead>
<tr>
<th>CI BLOCKS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LCLI</td>
<td>LCHI</td>
<td>HCLI</td>
<td>HCHI</td>
</tr>
<tr>
<td>Variance</td>
<td>1574.87</td>
<td>2857.38</td>
<td>1767.77</td>
<td>2820.91</td>
</tr>
<tr>
<td>(\bar{x} - \bar{x})</td>
<td>129.46</td>
<td>159.91</td>
<td>192.12</td>
<td>221.29</td>
</tr>
<tr>
<td>(\bar{x} - \bar{x})</td>
<td>-</td>
<td>25.45</td>
<td>62.66**</td>
<td>91.83**</td>
</tr>
<tr>
<td>(\bar{x} - \bar{x})</td>
<td>-</td>
<td>-</td>
<td>37.21**</td>
<td>66.38**</td>
</tr>
<tr>
<td>(\bar{x} - \bar{x})</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29.17*</td>
</tr>
<tr>
<td>N-K value</td>
<td>2.96</td>
<td>7.32</td>
<td>10.72</td>
<td>4.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.40</td>
</tr>
</tbody>
</table>

The Newman-Keul's statistics have been calculated by applying the formula

\[
N.K. \text{ Value} = \frac{\text{Mean Difference}}{\sqrt{\text{Error variance}/n}}
\]

and shown in the above table 6.9. The significant level is decided from the steps between two means by using the
The mean difference (25.45) between LCLI and LCHI blocks was not significant while the mean difference (29.17) between HCLI and HCHI blocks was significant at .05 level. Other four Mean differences (62.66, 91.83, 37.21, 66.38) are found to be significant at .01 level.

The following relationships are established.

\[(HCHI) > (HCLI) > (LCHI = LCLI)\]

This relationship is revealed in the graph No. 7 on Page. 222.

From the above, it is evident that:

(i) Students possessing low creativity level but different intelligence level could not significantly gain the creativity scores.

(ii) Students possessing high creativity level but different intelligence level could significantly gain the creativity scores.

(iii) Students possessing high creativity level and low intelligence level could gain significantly the creativity scores.

To study the trend of the creativity across these four CI - Blocks, the Trend test is worth to apply.
The mean creativity scores of the students of different CI blocks

CI BLOCKS

LCLI  LCHI  HCLI  HCHI

MEAN SCORES OF CR.

THE MEAN CREATIVITY SCORES OF THE STUDENTS OF DIFFERENT CI BLOCKS
Study-10  Trend Test Across 4 CI-Blocks

The functional relationship of creativity across the four creative intelligence blocks can be studied by employing trend test. The relevant data and computation involved are given in Table 6.11 below:

**Table 6.11**

<table>
<thead>
<tr>
<th>BLOCKS</th>
<th>LCLI</th>
<th>LCHI</th>
<th>HCLI</th>
<th>HCHI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMS</td>
<td>3107</td>
<td>3718</td>
<td>4611</td>
<td>5311</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRENDS</th>
<th>Coeff²</th>
<th>contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINEAR</td>
<td>-3</td>
<td>-1</td>
</tr>
<tr>
<td>QUADRATIC</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>CUBIC</td>
<td>-1</td>
<td>3</td>
</tr>
</tbody>
</table>

Linear component = \( \frac{(7505)^2}{24 \times 20} \)

= 11734379

\( F_{lin} \) = \( \frac{11734379}{1767.06} \)

= 66.41

Quadratic component = \( \frac{(89)^2}{24 \times 4} \)

= 82.51

\( F_{Qued} \) = \( \frac{82.51}{1767.06} \)

= 0.047 NS
MEAN SCORES OF CR.

GRAPH-8

HCHI

HCLI

LCHI

LCLI

Cl BLOCKS W.R.T. TREATMENS

TREND OF CREATIVITY ACROSS CI BLOCKS W.R.T. TREATMENTS
Cubic component = \(\frac{(-475)^2}{24 \times 20}\)

= 470.05

\(F_{\text{cubic}} = \frac{470.05}{1761.06}\)

= 0.27 N S

From the above table, it is seen that only the linear trend is significant with respect to the different CI-Blocks while the quadratic and cubic trends are non-significant with respect to the different CI-Blocks.

This proves that the block has a linear concern with the creativity scores of the students in the blocks. The result can be read from the Graph-\(\delta\), with respect to the given three treatments.

6.7 RESUME

In this chapter, the investigator has discussed in detail the main effect as well as interactive effect of the various independent variables on the creativity level of the students. The trend test across treatments have been applied to study the functional relationship i.e. trend between students' creativity and the treatment given to them.

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