CHAPTER - 4

DATA ANALYSIS AND INTERPRETATION

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4.1 INTRODUCTION

In the previous chapter, a complete account of the approach to study the main theme of the present investigation was elucidated. Both, the process of data collection and the methods to be applied in analysing and interpreting the data collected through the various research tools were described and discussed at length. The present chapter is devoted to the analysis and interpretation of the data according to the seven hypotheses as formulated in the previous chapter.

The major concern of the present investigation, as described in the previous chapter, is to study the effectiveness of the implementation of a creativity programme on the creativity level of the PSTTs in relation to its components; and other variables like caste - category and academic stream of the PSTTs. To measure the creativity level of the PSTTs, a creativity test was constructed and standardized. Further by adopting ' Pre-test Post-test design' as an experimental method, before and after the treatment, the creativity level of the PSTTs was measured with the help of the creativity test. And on the basis of the collected data in terms of scores on creativity and its components, the effectiveness of the CP was studied with the above mentioned variables. These facets of the present investigation were organised under certain hypotheses.

Out of the seven hypotheses, the first five hypotheses are tested by using Analysis of Co-variance (ANCOVA) and the remaining two are tested by using Analysis of Variance (ANOVA). For this, the analysis was done with the help of

SPSS computer package. It can be referred from the Appendix-X.

4.2 SIGNIFICANCE AND RELEVANCE OF USING ANCOVA AND ANOVA IN THE PRESENT STUDY

To test the first five hypotheses, the most reliable and suitable technique ANCOVA was applied, by taking the pre-test score of the respective variable as a co-variate.

It has been noted that criteria of a good and efficient experimental design are Maximization of experimental (treatment) variance, Minimization of error variance and Control of extraneous variance (Max-Min - Con principle). A good design takes care of experimental control and a good useful statistical technique takes care of statistical control, both of which together takes care of this Max - Min - Con principle, resulting in more useful and accurate information about the role of the independent variables studied, reduction of error and control of any extraneous factors influencing the outcome dependent variable, all these being achieved through the use of a good design as well as careful randomization process,while collecting data and then subjecting such data to statistical analysis by appropriate statistical technique. The statistical technique of Analysis of Covariance provides a very common, handy yet useful and refind technique for statistical control in a day - to - day experimental research, an experiment being a scientifically controlled observation and not an uncontrolled observation as in a survey of a field method.

Usually whenever, one undertakes an experiment to find out the effect of any one or more treatments, methods or training or therapy procedures or drugs, one administers that the treatment or treatments (Independent variable) to a subject or a group of subjects and observes or measures the change (dependent

variable), and then after analysing the data of responses or changes, one draws inferences. If the change is greater or better, one concludes that the treatment is comparatively or relatively more useful. But, it is neither true experiment nor a correct generalization drawn regarding absolute effectiveness, without comparing with some base at the beginning level before giving the treatment or the test. In other words, one must know the basic level before giving the test or treatment- a level which serves as a base or control, and then one must measure the level of change after the test or treatment, and then surmise the effect (+ or –) on the strength of difference between the two levels. In an experiment based on 'Before - After design', the data of pre-test and post - test performances can be statistically analysed more effectively by the technique of Analysis of Covariance (ANCOVA) , on the original data of pre - test performance (base) and post - test performance (change), instead of using ANOVA technique on difference scores. Analysis of Covariance is a good instance of better statistial control.

It should be recollected that there are two general procedures for controlling variability due to experimental error, viz. (i) Direct way through use of adequate experimental design, e.g. matching experimental group on some associated co-existent variable (co-variate), likely to influence the measure of dependent variable , as in a randomized block design or factorial design where other influencing factors are included in the same study, serving as controls or comparable groups, and (ii) Statistical procedure of adjustment of final effect of experimental variable in relation to the effect of a co-variate, e.g. use of technique of analysis of co-variance, that takes into account the differences in the initial and the final performances of experimental groups respectively before and after the treatment (i.e., takes into account the influence of any co-variate) and then would

adjust the final performance of same groups after the experimental treatment in relation to the initial performance or effect of a co-variate (instead of inferring simply and absolutely from post-test performance only). This technique of ANCOVA is more used in 'Before - After designs' to study both the absolute influence of one treatment or therapy or training or propagenda effect, measuring pre and post performances as well as to study even the relative efficacy or more treatments or methods by measuring pre-post performances of groups under each treatment.

The above conceptual information of ANCOVA shows that this technique is more useful technique for more information and more accuracy, taking care of individual differences by using same subjects for groups before and after. That's why, the investigator has applied the technique of ANCOVA in the present study, to test the first five hypotheses.

Parekh and Dixit (1995) describe as, "Two - Way - ANOVA technique is used for simultaneous statistical analysis of the effect of any two independent variables on a dependent variable. This method is more advanced than one - way ANOVA technique. Two - way ANOVA method is used when the objective of any research is to study the interaction effect."

As in the present study, to test the remaining two hypotheses, the two variables namely; (i) Caste Category, and (ii) Academic Stream have to be considered, so two-way ANOVA technique was the most suitable one.

4.3 SIGNIFICANCE OF DIFFERENCE IN THE MEAN CREATIVITY SCORE OF THE EXPERIMENTAL AND CONTROL GROUPS

To study the significance of difference in the mean creativity score of the experimental and control groups, the following null hypothesis was formulated.

Ho 1: There will be no significant difference in the mean creativity score of the experimental group and the control group.

To test this hypothesis, the most reliable and suitable technique ANCOVA was applied, by taking the pre-test creativity score as a covariate.

The summary of ANCOVA for total creativity score, taking pre - test score in creativity as covariate, has been presented in the table no. 4.1.

TABLE No. 4.1

Summary of ANCOVA for Total Creativity score taking pre-test score in Creativity as covariate

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Covariates	1	77793.306	77793.306	216.188
Main effects group	1	168143.543	168143.543	467.272
Explained (Between Groups)	2	245936.849	122968.424	341.730*
Residual (Within Groups)	86	30946.342	359.841	
Total	88	276883.191	3146.400	

Expected F - value for df = 2/86 at 0.01 level is 4.85

*** Significant at 0.01 level**

As stated in the first hypothesis, the experimental group was not expected to differ significantly from the control group in respect of mean creativity score. Referring to table no. - 4.1, it is observed that the F - ratio of 341.730 is very highly significant indicating that the two groups do differ significantly.

The mean creativity score of the experimental and control groups are 205.80 and 112.42 respectively. The relatively higher mean score of the experimental group does indicate that the experimental group is at a higher level than the control group in respect of total creativity score. The programme has a

differential impact on the two groups. Therefore, the null hypothesis-1 (Ho-1) is rejected.

4.4 SIGNIFICANCE OF DIFFERENCE IN THE MEAN FLUENCY SCORE OF THE EXPERIMENTAL AND CONTROL GROUPS

To study the significance of difference in the mean fluency score of the experimental and control groups, the following null hypothesis was formulated.

Ho 2 : There will be no significant difference in the mean fluency score of the experimental group and the control group.

To test this hypothesis, the ANCOVA technique was applied. The summary of ANCOVA for fluency score, taking pre-test score in fluency as covariate, has been presented in the table no. 4.2.

TABLE No. 4.2

Summary of ANCOVA for Fluency score taking pre-test score in Fluency as covariate

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Covariates	1	8927.715	8927.715	150.080
Main effects group	1	9064.464	9064.464	152.378
Explained (Between Groups)	2	17992.179	8996.090	151.229*
Residual (Within Groups)	86	5115.843	59.487	
Total	88	23108.022	262.591	

Expected F - value for df = 2/86 at 0.01 level is 4.85

*** Significant at 0.01 level**

As stated in the second hypothesis, the experimental group was not expected to differ significantly from the control group in respect of mean fluency score. Referring to table no. - 4.2, it is observed that the F - ratio of 151.229 is very highly significant indicating that the two groups do differ significantly.

The mean fluency score of the exeperimental and control groups are 60.02 and 34.21 respectively. The relatively higher mean score of the experimental group does indicate that the experimental group is at a higher level than the control group in respect of fluency score. The programme has a differential impact on the two groups. Therefore the null hypothesis-2 (Ho2) is rejected.

4.5 SIGNIFICANCE OF DIFFERENCE IN THE MEAN FLEXIBILITY SCORE OF THE EXPERIMENTAL AND CONTROL GROUPS

To study the significance of difference in the mean flexibility score of the experimental and control groups, the following hypothesis was formulated.

Ho 3 : There will be no significant difference in the mean flexibility score of the experimental and the control group.

To test this hypothesis, the ANCOVA technique was applied. The summary of ANCOVA for flexibility score, taking pre-test score in flexibility as covariate, has been presented in the table no. - 4.3.

TABLE No. 4.3

Summary of ANCOVA for Flexibility score taking pre-test score in Flexibility as covariate

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Covariates	1	3635.549	3635.549	81.396
Main effects group	1	7046.408	7046.408	157.762
Explained (Between Groups)	2	10681.957	5340.978	119.579*
Residual (Within Groups)	86	3841.167	44.665	
Total	88	14523.124	165.035	

Expected F - value for df = 2/86 at 0.01 level is 4.85

*** Significant at 0.01 level**

As stated in the third hypothesis, the experimental group was not expected to differ significantly from the control group in respect of mean flexibility score. Referring to table no. 4.3, it is observed that the F - ratio of 119.579 is very highly significant indicating that the two groups do differ significantly.

The mean flexibility score of the experimental and control groups are 46.80 and 26.88 respectively. The relatively higher mean score of the experimental group does indicate that the experimental group is at a higher level than the control group in respect of flexibility score. The programme has a differential impact on the two groups. Therefore, the null hypothesis-3 (Ho-3) is rejected.

4.6 SIGNIFICANCE OF DIFFERENCE IN THE MEAN ORIGINALITY SCORE OF THE EXPERIMENTAL AND CONTROL GROUPS

To study the significance of difference in the mean originality score of the experimental and control groups, the following hypothesis was formulated.

Ho 4 : There will be no significant difference in the mean originality score of the experimental group and the control group.

To test this hypothesis, the ANCOVA technique was applied. The summary of ANCOVA for originality score, taking pre-test score in originality as covariate, has been presented in the table no. 4.4.

TABLE No. 4.4

Summary of ANCOVA for Originality score taking pre-test score in Originality as covariate

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Covariates	1	2608.545	2608.545	127.694
main effects group	1	15868.684	15868.684	776.807
Explained (Between Groups)	2	18477.229	9238.614	452.250*
Residual (Within Groups)	86	1756.816	20.428	
Total	88	20234.045	229.932	

Expected F - value for df = 2/86 at 0.01 level is 4.85

*** Significant at 0.01 level**

As stated in the fourth hypothesis , the experimental group was not expected to differ significantly from the control group in respect of mean originality score. Referring to table no. 4.4, it is observed that the F - ratio of 452.250 is very highly significant indicating that the two groups do differ significantly.

The mean originality score of the experimental and control groups are 37.67 and 11.93 respectively. The relatively higher mean score of the experimen-

tal group does indicate that the experimental group is at a higher level than the control group in respect of originality score. The programme has a differential impact on the two groups. Therefore, the null hypothesis-4 (Ho 4) is rejected.

4.7 SIGNIFICANCE OF DIFFERENCE IN THE MEAN ELABORATION SCORE OF THE EXPERIMENTAL AND CONTROL GROUPS

To study the significance of difference in the mean elaboration score of the experimental and control groups, the following hypothesis was formulated.

Ho 5 : There will be no significant difference in the mean elaboration score of the experimental group and the control group.

To test this hypothesis, the ANCOVA technique was applied. The summary of ANCOVA for elaboration score, taking pre-test score in elaboration as covariate, has been presented in the table no. 4.5.

TABLE No. - 4.5

Summary of ANCOVA for Elaboration score taking pre-test score in Elaboration as covariate

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Covariates	1	6831.966	6831.966	161.885
Main effects group	1	11781.652	11781.652	298.854
Explained (Between Groups)	2	18163.618	9081.809	230.370*
Residual (Within Groups)	86	3390.360	39.423	
Total	88	21553.978	244.932	

Expected F - value for df = 2/86 at 0.01 level is 4.85

*** Significant at 0.01 level**

As stated in the fifth hypothesis , the experimental group was not expected to differ significantly from the control group in respect of mean elaboration score. Referring to table no. 4.5, it is observed that the F - ratio of 230.370 is very highly significant indicating that the two groups do differ significantly.

The mean elaboration score of the experimental and control groups are 61.30 and 39.40 respectively. The relatively higher mean score of the experimental group does indicate that the experimental group is at a higher level than the control group in respect of elaboration score. The programme has a differential impact on the two groups. Therefore, the null hypothesis-5 (Ho-5) is rejected.

4.8 DIFFERENTIAL IMPACT OF THE CREATIVITY PROGRAMME ON PSTTs OF DIFFERENT CASTE CATEGORY AND ACADEMIC STREAM

To study the differential impact of the creativity programme on the PSTTs of different caste - category and academic stream in terms of mean creativity score, the following null hypotheses were formulated.

Ho 6 : There will not be any differential impact of the creativity programme on the PSTTs of different caste category in terms of mean creativity score.

Ho 7 : There will not be any differential impact of the creativity programme on the PSTTs of different academic stream in terms of mean creativity score.

To test the above hypotheses and also to study the interactions effect of caste - category and academic stream on mean creativity score, the two-way ANOVA technique was applied.

As, in the present study, there were four levels of caste category (SC, ST, SEBC and GEN) and two levels of academic stream (SCIENCE , GENERAL)

of PSTTs, a **4 X 2** Factorial design was prepared, showing various treatment combinations in the cells, as given below in the figure : 4.1.

Figure : 4.1 **" 4 X 2 Factorial Design "**

Variable-B (Academic Stream)	Variable-A (Caste-Category) A1 (Sc)	A2 (ST)	A3 (SEBC)	A4 (GEN)
B1 (Science)	A1B1	A2B1	A3B1	A4B1
B2 (General)	A1B2	A2B2	A3B2	A4B2

← Treatment Combinations →

The summary showing ANOVA results of mean creativity score in relation to variable - A (Caste - Category) and Variable - B (Academic Stream) has been presented in table no. 4.6.

TABLE No. 4.6

Summary showing ANOVA results of mean Creativity score in relation to Caste - Category and Academic Stream

Source of variation	df	Sum of squares (ss)	Mean square (mss)	F
Explained (Between Groups)	7	12979.511	1854.216	
Variable - A (Caste Category)	3	7997.015	2665.672	2.516*
Variable - B (Academic Stream)	1	805.874	805.874	0.761*
Variable : A X B (Interactions)	3	4176.622	1392.207	1.314*
Residual (Within Groups)	38	40257.728	1059.414	
Total	**45**	**53237.239**	**1183.050**	

Expected F - value for df = 3/38 at 0.01 level is 4.34

*** Not significant at 0.01 level**

From the analysis of data shown in the table no. 4.6, the results can be interpreted in respect of the significance of variable - A , variable - B and their interactions effect, as follows.

4.8.1 Significance of main effects of variable - A

It can be observed from the table no. 4.6 that the obtained F - value of 2.516 for the variable - A (Caste - Category), is less than the expected F - value at 0.01 level. So the F - value for the variable - A is not significant at 0.01 level. Hence the null hypothesis-6 (Ho 6) is accepted.

4.8.2 Significance of main effects of variable - B

It can be observed from the table no. - 4.6 that the obtained F - value of 0.761 for the variable - B (academic stream), is less than the expected F-value at 0.01 level. Thus, the F - value for the variable - B is not significant. Therefore, the null hypothesis - 7 (Ho 7) is accepted.

4.8.3 Significance of the interactions effect of variables - A and B

It can be observed from the table no. 4.6 that the obtainted F - value of 1.314 for the interactions of variables - A X B, is less than the expected F-value at 0.01 level. So the obtained F - value is not significant at 0.01 level. This indicates that the interactions effect of variables - A X B do not show any significant variation in mean creativity score of the PSTTs.

4.9 CONCLUSION

In the preceding section, the data yielded by the tool on the total creativity, fluency, flexibility, originality, and elaboration in respect of all the seven hyphotheses were analysed and interpreted. The results showed that some hypotheses could stand and some were rejected. These can be briefly stated as under.

TABLE No. 4.7

Overall results of the seven hypotheses

Hypothesis No.	Major Component of the study	Related variable	Whether accepted or rejected
1	Creativity	Total Creativity	Rejected
2	Creativity	Fluency	Rejected
3	Creativity	Flexibility	Rejected
4	Creativity	Originality	Rejected
5	Creativity	Elaboration	Rejected
6	Creativity	Caste Category	Accepted
7	Creativity	Academic Stream	Accepted

Thus, it has been observed that the present chapter is focussed on the analysis and interpretation of data obtained from the administration of the creativity test as pre and post tests on both the experimental and control groups during the experimentation. While analysing and interpreting data, the formulated hypotheses based on the objectives of the present study, were taken into consideration. Results of the analyses were presented in a tabular form. On the basis of the results, hypotheses were tested. The results of the analyses were also interpreted keeping in mind the objectives of the present study. Data related to the score on total creativity and its components, of both the groups were analysed and it was found that the experimental group was at a higher level than the control group in respect of the score of creativity and its components respectively. Also it was found that, there was not any significant variation in the mean creativity score of the experimental group as far as the caste category, academic stream and their interactions effect is concerned. As such these findings significantly do not convey specific meaning unless they are situated in a proper context. This is the subject matter of discussion in the chapter to follow.