CHAPTER FOUR

COLLECTION OF DATA AND ANALYSIS OF RESULTS

C H A P T E R IV

COLLECTION OF DATA AND ANALYSIS OF RESULTS

4.1.0 Introduction

The present study was an experimental one. It aimed at studying the effect of teaching geography through the Creative Teaching Method upon eighth graders. For this a multifactor covariance design having experimental and control groups was employed. The Kuppuswamy Socio Economic Status Scale Urban Form-A, the Madhookar Patel Intelligence Test, and the Passi Tests of Creativity (verbal) were used for getting the scores of the three covariates, namely, SES, intelligence and general creative thinking variables. The description of these tools, method and procedures adopted in this study were given in chapter II.

To measure the creative thinking in geography, a Geography Achievement Test on Structure of Intellect Model (GATSI) was constructed and standardised by the investigator. The split-half reliability and the concurrent validity were established for this test. The co-efficient of the concurrent validity and the split-half reliability were 0.57 and 0.92 respectively. To measure the student's achievement in geography, three Achievement Tests in Geography, viz., ACHA, ACHB, and ACHC were developed by the investigator. The details of the standardisation of GATSI and the development of the Achievement Tests in Geography have been given in chapter III. The Passi

Tests of Creativity were employed to measure the criterion variable of general creative thinking. This chapter presents the collection of data for testing the hypotheses and the analysis of results.

4.1.1 Collection of Data

There were three controlled variables in the study. They were socio economic status (SES), intelligence and general creative thinking (CYPT). The treatment variable was the method of teaching geography through Creative Teaching Method. The criterion variables were general creative thinking (CYAT), creative thinking in geography and achievement in geography. The general creative thinking consists of three sub-parts, such as, Seeing Problems, Unusual Uses, and Consequences tests. The creative thinking in geography represents 30 variables beginning from cognition of semantic units (CMU) and ends with evaluation of semantic implication (EMI). The details of the variables have been discussed under caption 3.2.3.

The data related to these variables were collected from two groups of eighth grade English medium students of Vellore town (Table 2.10). All the eighth grade English medium students of Voohrees High School formed one group and all the eighth grade English medium students of Krishna Swamy Mudaliar High School formed another group. The former group was then randomly designated as control group and the latter one as experimental group. It is to be stated here that both are

urban schools of the same town 'Vellore' of Tamilnadu. Both are non-fee levying, privately managed schools, following the same syllabus and having English medium sections. The pre-treatment data for SES, intelligence, and general creative thinking variables were collected from both the groups by administering Kuppuswamy Socio Economic Status Scale, Form-A, the Madhookar Patel Intelligence Test, and the Passi Tests of Creativity (verbal), respectively. The investigator with the assistance of the subject teachers, administered these tests and collected the data from the experimental and control groups.

The experiment started in the last week of August 1975 and came to an end during the last week of December 1975. It was made sure that during the period of experiment the courses covered in both the schools were the same and the rate of speed of teaching was also kept similar. This was possible for the investigator by consulting the subject teacher of the control group. The experimental group was taught the geography units through the Creative Teaching Method. This treatment continued for four months with two periods per week. In total 33 lessons were given by the investigator for the experimental group, out of that, eight were Morphological analysis, 10 were Brainstorming and 15, traditional lessons. As discussed in chapter II, traditional method also was used along with Morphological and Brainstorming techniques, wherever necessary. After the 11th lesson was over, Achievement Test I in Geography (ACHA) was administered and the data were collected from both

the groups. At the end of 22nd lesson Achievement Test II in Geography (ACHB) was administered and the data collected from both the groups. At the conclusion of the experiment, the post treatment testings by Creativity Tests (PTC), Geography Achievement Test on Structure of Intellect Model (GATSI) and Achievement Test III in Geography (ACHC) were done to both the groups. Leaving aside the absentees for some of the tests, final data from 36 students from control group and 35 students from experimental group were collected for all the variables under this study. This data were analysed by employing different statistical techniques.

4.2.0 Analysis of the data

As discussed earlier under caption 2.3.0. Multifactor Covariance Design having Experimental and Control groups was employed to test the following hypotheses.

H-I There is no significant difference in general creative thinking ability between the group taught through the Creative Teaching Method and the group taught through the traditional method.

H-II There is no significant difference in cognitive abilities in geography between the group taught through the Creative Teaching Method and the group taught through traditional method.

H-III There is no significant difference in memory abilities in geography between the group taught through Creative Teaching Method and the group taught through traditional method.

H-IV There is no significant difference in divergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through traditional method.

H-V There is no significant difference in convergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through traditional method.

H-VI There is no significant difference in evaluation abilities in geography between the group taught through the Creative Teaching Method and the group taught through traditonal method.

H-VII There is no significant difference in creative thinking in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method.

H-VIII There is no significant difference in achievement in geography between the group taught through the Creative Teaching Method and the group taught through traditional method.

To test the above eight hypotheses, the collected data were mainly analysed by applying the multiple analysis of covariance technique (Snedecor and Cochran 1956). The covariates in this study were socio economic status (SES), intelligence, and general creative thinking pretest (CYPT). Another technique used for analysis was t-test. It has been used to

compare the mean subscores of general creative thinking, creative thinking in geography and achievement in geography, for the two groups seperately. Even though analysis of covariance is the proper technique for doing this analysis, considering the large amount of statistical work involved in employing the ANCOVA for the subparts of the criterion variables, it was decided to do the ANCOVA, only for the main criterion variables and to do the t-test for the sub-parts. Levels of significant at 0.05 have been accepted for making decisions about rejecting or not rejecting the hypotheses.

The results have been presented in the following pages in the order of sequence noted below. The results of the criterion varible of general creative thinking have been presented under caption 4.3.0, while the results of the creative thinking in geography under caption from 4.4.0 to 4.4.6 and the results of the achievement in geography under caption 4.5.0 to 4.5.3.

4.3.0 Covariance Results for General Creative Thinking

Results for the general creative thinking scores are reported in Tables 4.1 and 4.2. The summary of the analysis of covariance is given in Table 4.1.

TABLE 4.1 SUMMARY OF ANCOVA WITH THE THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF GENERAL CREATIVE THINKING (CYAT)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	45189.91	23.99	45165.92	23.99	654.58	2.53
YX_1	2366.90	67.25	2309.65	57.25	33.47	
YX_2	8829.63	-32.85	8862.48	-32.85	128.44	
YX_3	30136.68	110.37	30026.30	110.37	435.16	
X_1^2	2091.72	136.62	1955.10	136.62	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1724.79	263.39	1461.40	263.39	21.18	
X_2^2	12487.75	44.98	12442.77	44.98	180.33	
X_2X_3	7354.93	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.80	27726.79	507.80	401.84	

Y = General Creative Thinking (CYAT)
X_1 = SES
X_2 = Intelligence
X_3 = General Creative Thinking (CYPT)
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficent and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	0.4028	0.3159	1.2752
Intelligence	0.0841	0.1341	0.6268
General Creative Thinking	1.0389	0.0917	11.3276

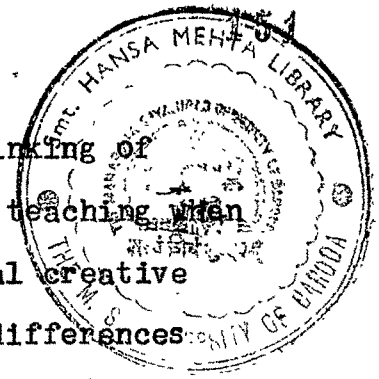
Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
0.04	(1, 69)	2.53	(1, 66)

Significance of Difference of Means between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	52.69	55.92	1.59
Experimental group	35	53.86	50.54	

From Table 4.1 it is observed that the F-ratio is 2.53 with df 1/69. It is not significant. The adjusted means for control and experimental groups for the general creative thinking are 55.92 and 50.54 respectively. Hence it may be said that the treatment of Creative Teaching Method has not produced



differential effects upon general creative thinking of eighth graders than the traditional method of teaching when the covariates of SES, intelligence and general creative thinking were used for adjusting the initial differences between the groups. Therefore the null hypothesis (H-I) that there is no significant difference in general creative thinking ability between the group taught through the Creative Teaching Method and the group taught through the traditonal method, is not rejected.

In order to know the analytical picture, the effect of the treatment was examined on the subparts of general creative thinking. For this, significance of difference between means of experimental and control groups for the three subparts under general creative thinking and the total of the three, that is general creative thimking has been calculated, which has been given in Table 4.2.

TABLE 4.2. SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF THE SUB SCORES OF GENERAL CREATIVE THINKING (CYAT) FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36 Mean	SD	Experimental gr N=35 Mean	SD	t-value
Seeing Problems After Test	SPAT	9.97	8.22	10.68	4.28	0.45
Unusual Uses After Test	UUAT	25.30	16.13	25.17	13.26	0.04
Consequences After Test	CTAT	17.41	10.63	18.02	7.74	0.27
General Creative Thinking (CYAT)	CYAT	52.69	29.92	53.85	20.17	0.19

Table 4.2 presents the t-values with mean and SDs of the three subparts and the general creative thinking (CYAT). It could be seen from Table 4.2 that the mean scores for all the subparts and the total of general creative thinking were not significant. This means that the treatment of Creative Teaching Method has not produced differential effects upon the subparts of the general creative thinking, such as, Seeing Problems, Unusual Uses and Consequences Tests and the general creative thinking in total, when compared with the traditional method of teaching geography to eighth graders.

4.4.0 Analysis of Covariance for Creative Thinking in Geography

Creative Thinking in Geography of the eighth graders was measured by the Geography Achievement Test on Structure of Intellect Model (GATSI). As discussed earlier under caption 3.2.3 , this test evaluates the mental abilities involving the five operations, viz., Cognition, Memory, Divergent Production, Convergent Production, and Evaluation in geography besides the total of all these abilities which form the creative thinking in geography. Analysis of these five operations will be first made separately under captions, ranging from 4.4.1 to 4.4.5 and the total of the creative thinking in geography will be presented after that under caption 4.4.6.

4.4.1 Covariance Results for Cognition Abilities in Geography (CMP)

The results for the cognition abilities in geography (CMP) have been reported in Tables 4.3 and 4.4. The summary of the analysis of covariance is given in Table 4.3.

TABLE 4.3 SUMMARY OF ANCOVA FOR THE THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF COGNITION ABILITIES IN GEOGRAPHY (CMP)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	879.718	0.003	879.715	0.003	12.749	0.12
YX_1	140.28	-0.66	140.94	-0.66	2.04	
YX_2	1318.76	0.38	1318.37	0.38	19.11	
YX_3	2097.21	-1.28	2098.49	-1.28	30.49	
X_1^2	2091.72	136.62	1955.10	136.62	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1724.79	263.39	1461.40	263.39	21.18	
X_2^2	12487.75	44.98	12442.77	44.98	180.33	
X_2X_3	7354.93	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.80	27726.79	507.80	401.84	

Y =Cognition Abilities in Geography (CMP)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-value of regression coefficient
SES	0.0298	0.0734	0.4062
Intelligence	0.0730	0.3012	2.3413
General Creative Thinking	0.0543	0.0213	2.5467

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
0.0008	(1, 69)	0.1185	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	7.53	7.65	0.34
Experimental group	35	7.51	7.38	

From Table 4.3 it can be seen that the F-ratio is 0.12 with df 1/69. It is not significant. The adjusted means for the control and experimental groups for the cognition abilities (CMP) are 7.65 and 7.38 respectively. Hence it may be said that the treatment of Creative Teaching Method had produced no differential effects upon the cognition abilities in geography of the eighth graders when compared with the traditional method of teaching geography, when the covariates of SES, intelligence, and general creative thinking were controlled. Therefore the null hypothesis (H-II) that there is no significant difference in cognition abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is not rejected.

To find the effect of the treatment in detail, the sub components under cognition abilities (CMP) were further examined. For this, significance of difference between means of experimental and control groups for the six products under cognition abilities in geography has been calculated which has been given in Table 4.4.

TABLE 4.4 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF COGNITION ABILITIES FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group. N=35		t-value
		Mean	SD	Mean	SD	
Cognition of semantic unit	CMU	0.16	0.44	0.85	0.97	3.85**
Cognition of semantic class	CMC	1.91	0.28	1.82	0.45	0.98
Cognition of semantic relations	CMR	1.30	0.78	1.74	0.56	2.69**
Cognition of semantic systems	CMS	1.72	1.59	1.34	1.66	0.98
Cognition of semantic transformation	CMT	1.77	1.82	1.14	1.51	1.59
Cognition of semantic implication	CMI	0.61	0.68	0.68	0.71	0.44

** significant at 0.01 level

Table 4.4 presents the t-values with means and SDs of the six components under cognition abilities in geography (CMP). It is seen from the table that mean scores for only two products, viz., cognition of semantic unit (CMU) and cognition of semantic relation (CMR) are significant at 0.01 level. The t-values are 3.85 and 2.69 respectively. The mean scores on CMU for the control and experimental groups are 0.16 and 0.85 respectivley. The mean scores on CMR for control and experimental groups are 1.30 and 1.74 respectively. Briefly, it means that the treatment of Creative Teaching Method given, to the experimental group produced higher mean scores than the traditional method of teaching geography for the mental abilities of cognition of semantic unit and cognition of semantic relation of eighth graders.

4.4.2 Covariance Results for Memory Abilities in Geography (MMP)

The results of the memory abilities in geography (MMP) have been reported in Tables 4.5 and 4.6. The Table 4.5 below shows the summary of the analysis of covariance.

TABLE 4.5 SUMMARY OF ANCOVA FOR THE THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF MEMORY ABILITIES IN GEOGRAPHY (MMP)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	357.55	12.11	345.44	12.11	5.01	1.42
YX_1	201.99	40.68	161.30	40.68	2.34	
YX_2	607.66	-23.34	631.00	-23.34	9.15	
YX_3	857.24	78.42	778.81	78.43	11.29	
X_1^2	2091.72	136.62	1955.10	136.62	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1724.79	263.39	1461.40	263.39	21.18	
X_2^2	12487.75	44.98	12442.77	44.98	180.33	
X_2X_3	7354.93	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.80	27726.79	507.80	401.84	

Y = Memory Abilities in Geography (MMP)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-value of regression coefficient
SES	0.0720	0.0490	1.4675
Intelligence	0.0427	0.0208	2.0522
General Creative Thinking	0.0127	0.0142	0.8915

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
2.4197	(1, 69)	1.4223	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	8.32	8.02	1.19
Experimental group	35	8.74	8.64	

From Table 4.5 it can be observed that the F-ratio is 1.42 with df 1/69. It is not significant. The adjusted means for the control and experimental groups for the memory abilities (MMP) are 8.02 and 8.64 respectively. Hence it may be said that the treatment of Creative Teaching Method

had not produced differential effects upon the memory abilities in geography of the eighth graders than the traditional method of teaching when the covariates of SES, intelligence and general creative thinking were used. Therefore the null hypothesis (H-III), that there is no significant difference in memory abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is not rejected.

In order to find out the effect of the treatment still further the components of memory abilities (MMP) were further examined. For this, significance of difference between means of experimental and control groups for the six products under memory abilities in geography has been calculated which has been given in Table 4.6.

TABLE 4.6 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF MEMORY ABILITIES FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group N=35		t-value
		Mean	SD	Mean	SD	
Memory for semantic unit	MMU	0.63	0.76	0.88	0.67	1.44
Memory for semantic class	MMC	1.38	0.72	1.34	0.68	0.27
Memory for semantic relation	MMR	0.94	0.63	1.05	0.72	0.70
Memory for semantic system	MMS	1.13	1.29	1.57	1.26	1.42
Memory for semantic transformation	MMT	1.88	0.31	1.60	0.77	2.06*
Memory for semantic implication	MMI	1.91	0.36	2.28	0.78	2.53*

* significant at 0.05 level

Table 4.6 presents the t-values with means and SDs of the six components under memory abilities in geography (MMP). It can be seen from the table that the mean scores for only two products, viz., memory for semantic transformation and memory for semantic implication are having significant differences at 0.05 level. The t-values are 2.06 and 2.53 respectively. The mean scores for memory for semantic transformation for the control and experimental groups are 1.88 and 1.60 respectively. This means that the traditional method has produced significant higher mean scores than the Creative Teaching Method for the mental ability of memory for semantic transformation in geography.

The mean scores for memory for semantic implication (MMI) for the control and experimental groups are 1.91 and 2.28 respectively. This indicates that the treatment of Creative Teaching Method, given to the experimental group produced higher mean scores than the traditional method of teaching Geography for the mental ability of memory for semantic implication.

4.4.3 Covariance Results for Divergent Production Abilities in Geography (DMP)

The results of the divergent production in geography (DMP) have been reported in Tables 4.7 and 4.8. Table 4.7 shows the summary of the analysis if covariance.

TABLE 4.7 SUMMARY OF ANCOVA FOR THE THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABEE OF DIVERGENT PRODUCTION IN GEOGRAPHY (DMP)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	4027.09	141.19	3885.90	141.19	56.32	2.50
YX_1	239.16	138.88	100.28	138.88	1.45	
YX_2	2348.05	-79.69	2427.74	-79.69	35.18	
YX_3	5936.12	267.76	5668.36	267.76	82.15	
X_1^2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	43.63	-78.39	43.63	0.63	
X_1X_3	1724.78	263.39	1461.39	263.39	21.18	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7354.92	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.79	27726.79	507.79	401.84	

Y = Divergent Production Abilities in Geography (DMP)
X_1 = SES scores
X_2 = Intelligent scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	-0.0901	0.1462	0.6165
Intelligence	0.0827	0.0621	1.3320
General Creative Thinking	0.1867	0.0424	4.3989

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
2.50	(1, 69)	1.98	(1,66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	12.72	13.02	1.40
Experimental group	35	12.54	15.22	

From Table 4.7, it can be seen that the F-ratio is 2.50 with df 1/69. It is not significant. The adjusted means for the control and experimental groups for divergent production abilities (DMP) are 13.02 and 15.22 respectively. From this,

it may be said that the treatment of Creative Teaching Method has not produded differential effects upon the divergent production abilities in geography of the eighth graders than the traditional method of teaching, when the covariates are controlled. Therefore the null hypothesis(H-IV) that there is no significant difference in divergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is not rejected.

In order to find the analytical picture, the effect of the treatment was examined on the sub parts of divergent production abilities (DMP). For this significace of difference between means of control and experimental groups for the six products under divergent production abilities has been given in Table 4.8.

TABLE 4.8 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF DIVERGENT PRODUCTION ABILITIES FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group N=35		t-value
		Mean	SD	Mean	SD	
Divergent production of semantic unit	DMU	3.44	2.27	3.37	2.26	0.13
Divergent production of semantic class	DMC	3.44	1.62	3.45	1.31	0.03
Divergent production of semantic relation	DMR	0.55	1.05	1.05	1.58	1.57
Divergent production of semantic system	DMS	1.77	1.51	2.08	1.46	0.87
Divergent production of semantic transformation	DMT	1.80	1.67	2.05	1.28	0.71
Divergent production of semantic implication	DMI	1.69	2.09	3.51	2.97	2.98**

** significant at 0.01 level

Table 4.8 gives the t-values with means and SDs of the six products of divergent production abilities in geography. It is seen from Table 4.8 that mean scores of the control and experimental groups for the product, 'divergent production of semantic implication' (DMI) are having significant difference at 0.01 level. The t-value is 2.98. The mean scores on DMI for the control and experimental groups are 1.69 and 3.51 respectively. This implies that the treatment of Creative Teaching Method given to the experimental group, produced higher mean scores than the traditional method of teaching geography on the mental ability of divergent production of semantic implications of eighth graders.

4.4.4 Covariance Results for Convergent Production Abilities in Geography (NMP)

The results of the convergent production abilities in geography (NMP) have been presented in Tables 4.9 and 4.10. The summary of analysis of covariance is presented in Table 4.9.

TABLE 4.9 SUMMARY OF ANCOVA FOR THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF CONVERGENT PRODUCTION ABILITIES IN GEOGRAPHY (NMP)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	2029.18	140.00	1889.18	140.00	27.38	4.19*
YX_1	501.53	138.30	363.23	138.30	5.26	
YX_2	2142.84	-79.35	2222.20	-79.35	32.21	
YX_3	4611.90	266.63	4345.26	266.63	62.97	
X_1^2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
$X1X_3$	1724.39	263.39	1461.00	263.39	21.179	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7354.92	-151.13	7506.05	-151.13	108.78	
X_3^2	28234.59	507.79	27726.79	507.79	401.84	

* significant at 0.05 level

Y = Convergent production abilities in geography (NMP)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General creative thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares of error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	0.0908	0.0939	0.9669
Intelligence	0.1035	0.0399	2.5939
General Creative Thinking	0.1239	0.0272	4.5418

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
5.11	(1, 69)	4.19	(1, 66)

Significance of Difference of Means Between Experimental and Control groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	10.30	10.67	2.04
Experimental group	35	13.11	12.73	

From Table 4.9 it can be observed that the F-ratio is 4.19 with df 1/69. It is significant at 0.05 level. The adjusted means for the control and experimental groups for the convergent production abilities (NMP) are 10.67 and 12.73 respectively. Hence it may be said that the treatment of

Creative Teaching Method had developed the convergent production abilities in geography of eighth graders significantly more than the traditional method of teaching. Therefore the null hypothesis (H-V) that there is no significant difference in convergent production abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is rejected at 0.05 level of significance.

In order to know the analytical picture, the effect of the treatment was examined on the sub components of convergent production abilities (NMP). For this, significance of difference between means of experimental and control groups for the six products under convergent production abilities in geography has been calculated and given in Table 4.10.

TABLE 4.10 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF CONVERGENT PRODUCTION ABILITIES FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group N=35		t-value
		Mean	SD	Mean	SD	
Convergent production of semantic unit	NMU	0.86	0.89	1.34	0.83	2.33*
Convergent production of semantic class	NMC	1.88	2.06	3.08	2.70	2.09*
Convergent production of semantic relation	NMR	0.63	0.72	0.85	0.69	1.29
Convergent production of semantic system	NMS	4.75	1.77	5.37	1.45	1.60
Convergent production of semantic transformation	NMT	0.83	1.48	0.68	1.34	0.43
Convergent production of semantic implication	NMI	1.41	1.62	1.80	1.76	0.95

* significant at 0.05 level

Table 4.10 presents the t-values with means and SDs of the six products of convergent production abilities in geography. It is seen from the Table 4.10 that mean scores for only two products viz., convergent production of semantic unit(NMU), and convergent production of semantic class (NMC) are having significant differences at 0.05 level. The t-values are 2.33 and 2.09 respectively. The mean scores on NMU for the control and experimental groups are 0.86 and 1.34 respectively. The mean scores on NMC for the control and experimental groups are 1.88 and 3.08 respectively. This means that the treatment of Creative Teaching Method, given to the experimental group produced higher mean scores than the traditional method of teaching geography on the mental abilities of convergent production of semantic unit and convergent production of semantic class in geography of eighth graders.

4.4.5 Covariance Results for Evaluation Abilities in Geography (EMP)

The results of the evaluation Abilities in Geography (EMP) have been presented in Tables 4.11 and 4.12. Table 4.11 shows the summary of analysis of covariance for evaluation abilities in geography.

TABLE 4.11 SUMMARY OF ANCOVA FOR THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF EVALUATION ABILITIES IN GEOGRAPHY (EMP)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	795.49	8.17	787.32	8.17	11.47	0.23
YX_1	105.13	33.41	71.71	33.41	1.04	
YX_2	562.04	-19.17	581.21	-19.17	8.42	
YX_3	1888.85	64.42	1824.43	64.42	26.44	
X_1^2	2091.72	136.62	1955.10	136.62	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1724.78	263.39	1461.40	263.39	21.20	
X_2^2	12487.75	44.98	12442.77	44.98	180.33	
X_2X_3	7354.93	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.80	27726.79	507.80	401.84	

Y = Evaluation Aabilities in Geography (EMP)
X_1 = SES score
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	-0.0115	0.0735	0.1566
Intelligence	0.0079	0.0312	0.2560
General Creative Thinking	0.0642	0.0213	3.0089

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
0.7161	(1, 69)	0.2328	(1, 66)

Significance of Difference of Means Between Experimental and Control groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	9.75	9.90	0.48
Experimental group	35	10.43	10.28	

It can be seen from Table 4.11 that the F-ratio is 0.23 with df 1/69. It is not significant. The adjusted means for the control and experimental groups for the evaluation abilities (EMP) are 9.90 and 10.28 respectively. Therefore, it may be said that the Creative Teaching Method has not produced

differential effects upon the evaluation abilities in geography than the traditional method in eighth graders when the covariates of SES, intelligence and general creative thinking were controlled. Hence the null hypothesis (H-VI) that there is no significant difference in evaluation abilities in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is not rejected.

The effect of the treatment on the sub parts of evaluation abilities (EMP) was examined, in order to have the analytical picture. For this, significance of difference between means of control and experimental groups for the six products under evaluation abilities has been calculated and given in Table 4.12.

TABLE 4.12. SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF EVALUATION ABILITIES FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36 Mean	Control group N=36 SD	Experimental group N=35 Mean	Experimental group N=35 SD	t-value
Evaluation of semantic unit	EMU	1.63	0.79	1.65	0.63	0.10
Evaluation of semantic class	EMC	1.19	0.78	1.31	0.67	0.68
Evaluation of semantic relation	EMR	0.50	0.69	0.94	0.87	2.36*
Evaluation of semantic system	EMS	2.88	1.32	2.91	1.40	0.07
Evaluation of semantic transformation	EMT	1.88	0.31	1.65	0.68	1.89
Evaluation of semantic implication	EMI	1.61	1.77	1.94	1.71	0.80

* significant at 0.05 level

Table 4.12 shows the t-values with means and SDs of the six products of evaluation abilities in geography. It can be observed in the table that mean scores of control and experimental groups for the mental ability of evaluation of semantic relations (EMR) are having significant difference at 0.05 level. The t-value is 2.36. The mean scores of EMR for the control and experimental groups are 0.50 and 0.94 respectively. This means that the Creative Teaching Method introduced to the experimental group produced higher mean scores than the traditional method of teaching geography upon the mental ability of evaluation of semantic relations of eighth graders.

4.4.6 Covariance Results for Creative Thinking in Geography (GATSI)

The separate analysis of the five operations of the creative thinking in geography, such as, Cognition, Memory, Divergent production, Convergent production and Evaluation have been made and the results have been presented in Tables from 4.3 to 4.12. The analysis for the total of all the above said operations, that is creative thinking in geography (GATSI) has been made and the results have been reported in Tables from 4.13 to 4.15. The summary of the analysis of covariance for GATSI is presented in Table 4.13

TABLE 4.13 SUMMARY OF ANCOVA FOR THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING, AND THE CRITERION VARIABLE OF CREATIVE THINKING IN GEOGRAPHY (GATSI)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	20975.23	893.20	20082.03	893.20	291.04	2.40
YX_1	1184.70	349.32	835.37	349.32	12.11	
YX_2	7071.90	-200.44	7272.34	-200.44	105.40	
YX_3	15499.02	673.47	14825.55	673.47	214.86	
X_1^2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1724.78	263.39	1461.39	263.39	21.18	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7354.92	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.79	27726.79	507.79	401.84	

Y = Creative Thinking in Geography(GATSI)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of scores between groups
SSW' = Mean sum of scores error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	0.0879	0.3004	0.2927
Intelligence	0.3160	0.1276	2.4761
General Creative Thinking	0.4445	0.0872	5.0962

Testing of Unadjusted and Adjusted Means by F-test

unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
3.06	(1, 69)	2.39	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between ajusted means
Control group	36	48.30	49.35	1.54
Experimental group	35	55.40	54.32	

From Table 4.13 it can be observed that the F-ratio is 2.40 with df 1/69. It is not significant. The adjusted means for the control and experimental groups for the creative thinking in geography (GATSI) are 49.35 and 54.32 respectively. Hence it may be said that the treatment of Creative Teaching Method has not produced differential effects upon the creative thinking in geography of eighth graders, compared to the traditional method of teaching geography when the covariates of SES, intelligence and general creative thinking were controlled. Therefore the null hypothesis (H-VII) that there is no significant difference in creative thinking in geography between the group taught through the Creative Teaching Method and the group taught through the traditional method is not rejected.

In order to have the total picture, significance of difference between means of the 30 products under the creative thinking in geography (GATSI) is given in Table 4.14.

TABLE 4.14 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF GEOGRAPHY ACHIEVEMENT TEST ON SI MODEL (GATSI) FOR THE CONTROL AND EXPERIMENTAL GROUPS

S.No	Variable	Code	Controlgroup group N=36		Experimental group N=35		t-value
			Mean	SD	Mean	SD	
1.	Cognition of semantic unit	CMU	.16	.44	.85	.97	3.85**
2.	Cognition of semantic class	CMC	1.91	.28	1.82	.45	.98
3.	Cognition of semantic relation	CMR	1.30	.78	1.74	.56	2.69**
4.	Cognition of semantic system	CMS	1.72	1.59	1.34	1.66	.98
5.	Cognition of semantic transformation	CMT	1.77	1.82	1.14	1.51	1.59
6.	Cognition of semantic implication	CMI	.61	.68	.68	.71	.44
7.	Memory for semantic unit	MMU	.63	.76	.88	.67	1.44
8.	Memory for semantic class	MMC	1.38	.72	1.34	.68	.27
9.	Memory for semantic relation	MMR	.94	.63	1.05	.72	.70
10.	Memory for semantic system	MMS	1.13	1.29	1.57	1.26	1.42
11.	Memory for semantic transformation	MMT	1.88	.31	1.60	.77	2.06*
12.	Memory for semantic implication	MMI	1.91	.36	2.28	.78	2.53*
13.	Divergent production of semantic unit	DMU	3.44	2.27	3.37	2.26	.13

S.No	Variable	Code	Control group N=36 Mean	SD	Experimental group N=35 Mean	SD	t-value
14.	Divergent production of semantic class	DMC	3.44	1.62	3.45	1.31	.03
15.	Divergent production of semantic relation	DMR	.55	1.05	1.05	1.58	1.57
16.	Divergnet production of semantic system	DMS	1.77	1.51	2.08	1.46	.87
17.	Divergent production of semantic transformation	DMT	1.80	1.67	2.05	1.28	.71
18.	Divergent production of semantic implication	DMI	1.69	2.09	3.51	2.97	2.98**
19.	Convergent production of semantic unit	NMU	.86	.89	1.34	.83	2.33*
20.	Convergent production of semantic class	NMC	1.88	2.06	3.08	2.70	2.09*
21.	Convergent production of semantic relation	NMR	.63	.72	.85	.69	1.29
22.	Convergent production of semantic system	NMS	4.75	1.77	5.37	1.45	1.60
23.	Convergent production of semantic transformation	NMT	.83	1.48	.68	1.34	.43
24.	Convergent production of semantic implication	NMI	1.41	1.62	1.80	1.76	.95
25.	Evaluation of semantic unit	EMU	1.63	.79	1.65	.63	.10
26.	Evaluation of semantic class	EMC	1.19	.78	1.31	.67	.68
27.	Evaluation of semantic relation	EMR	.50	.69	.94	.87	2.36*
28.	Evaluation of semantic system	EMS	2.88	1.32	2.91	1.40	.07
29.	Evaluation of semantic transformation	EMT	1.88	.31	1.65	.68	1.89
30.	Evaluation of semantic implication	EMI	1.61	1.77	1.94	1.71	.80

* significant at 0.05 level
** significant at 0.01 level

As seen from Table 4.14 the t-values are significant at 0.01 level for the three products of GATSI, viz., CMU CMR, and DMI. For five products of GATSI, such as, MMT, MMI NMU, NMC, and EMR, the mean scores are having significant differences at 0.05 level. Except the product MMT, for which the mean scores of control group is significantly higher than the experimental group, for all the above said seven products, the mean scores of the experimental group is higher than the control group. This implies that out of the 30 products, the treatment of Creative Teaching Method has produced higher mean scores for seven products, such as, cognition of semantic unit (CMU), cognition of semantic relation (CMR), memory for semantic implication (MMI), divergent production of semantic implication (DMI), convergent production of semantic unit (NMU), convergent production of semantic class (NMC), and evaluation of semantic relation(EMR). Traditional method produced higher mean scores for the product of memory for semantic transformation (MMT), compared to the Creative Teaching Method.

To have a consolidated picture of the significance of the difference between the means of five operations, such as, cognition, memory, divergent production, convergent production and evaluation of the control and experimental group, the results have been presented in Table 4.15

TABLE 4.15 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF GEOGRAPHY ACHIEVEMENT TEST ON SI MODEL (GATSI) (OPERATION WISE) FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group N=35		t-value
		Mean	SD	Mean	SD	
Cognition	CMP	7.52	3.62	7.51	3.50	0.02
Memory	MMP	7.91	2.19	8.74	2.28	1.55
Divergent production	DMP	12.72	7.46	15.54	7.54	1.58
Convergent production	NMP	10.30	3.58	13.11	5.07	2.26*
Evaluation	EMP	9.75	3.12	1042	3.61	0.84
Creative Thinking in Geography	GATSI	48.30	17.57	55.40	16.50	1.75

* significant at 0.05 level

From Table 4.15, it is observed that, when considering the five operations, the mean scores of convergent production abilities in geography of the experimental group is significantly higher than the control group. (significant at 0.05 level, df 69). Rest of the t-values are not significant. The mean scores on convergent production in geography of control and experimental groups are 10.30 and 13.11 respectively. This implies that out of the five operations the treatment of Creative Teaching Method had produced higher mean scores upon the convergent production abilities in geography of eighth graders.

4.5.0 Analysis of Covariance for Achievement Scores in Geography

As discussed earlier in chapter I, the third main objective of the study was to find out the effect of the treatment upon the achievement in geography of the eighth graders. Three achievement tests were developed for this purpose. They were, Achievement Test I in Geography, Achievement Test II in Geography and Achievement Test III in Geography. These tests were administered at three different times. Analysis in respect of each of these tests is being presented in the following pages one by one under caption 4.5.1 to 4.5.3.

4.5.1 Covariance Results for Achievement Test I in Geography (ACHA)

The summary of covariance results of the Achievement Test I in Geography are shown in Table 4.16.

TABLE 4.16 SUMMARY OF ANCOVA FOR THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF ACHIEVEMENT IN GEOGRAPHY (ACHA)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	27217.88	2633.14	24584.74	2633.14	356.30	5.16*
YX_1	2593.50	599.78	1993.72	599.78	28.89	
YX_2	6509.16	-344.15	6853.32	-344.15	99.32	
YX_3	13154.40	1119.27	12035.13	1119.27	175.33	
X_1^2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.39	0.63	
X_1X_3	1703.66	254.95	1448.71	254.95	21.18	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7273.88	-146.29	7420.17	-146.29	108.78	
X_3^2	28184.39	475.77	27708.62	475.77	401.84	

* significant at 0.05 level

Y = Achievement I in Geography (ACHA)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	0.7914	0.3704	2.1363
Intelligence	0.3704	0.1573	2.3542
General Creative Thinking	0.2943	0.1075	2.7366

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
7.39	(1, 69)	5.22	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	43.33	44.87	2.85 *
Experimental group	35	55.51	59.92	

It is seen from Table 4.16, that the F-ratio is 5.16 with df 1/69. It is significant at 0.05 level. The adjusted means for the control and experimental groups, for the scores on Achievement I in Geography are 44.87 and 59.92 respectively. Therefore it may be said that the treatment of Creative Teathing Method in geography has produced significant higher mean scores upon achievement I in geography of the experimental group when the covariates of SES, intelligence and general creative thinking were used for adjusting the initial differences between the groups.

4.5.2 Covariance Results for Achievement II in Geography (ACHB)

The summary of ANCOVA for achievement II in geography (ACHB) is reported in Table 4.17.

TABLE 4.17 SUMMARY OF ANCOVA FOR THE THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF ACHIEVEMENT II IN GEOGRAPHY (ACHB)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	19879.91	2718.22	17161.68	2718.22	248.72	8.71**
YX_1	2065.90	609.39	1456.50	609.39	21.11	
YX_2	5027.63	-349.67	5377.30	-349.67	77.93	
YX_3	11465.28	1137.21	10328.06	1137.21	149.68	
X_1^2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	43.63	-78.39	43.63	0.63	
X_1X_3	1703.66	254.95	1448.71	254.95	20.99	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7273.88	-146.29	7420.17	-146.29	107.54	
X_3^2	28184.39	475.77	27708.62	475.77	401.57	

** significant at 0.01 level

Y = Achievement II in Geography (ACHB)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between group
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

Covariates	Regression coefficient	Standard error of regression coefficient	t-value of regression coefficient
SES	0.5366	0.3135	1.7116
Intelligence	0.2674	0.1329	2.0118
General Creative Thinking	0.2730	0.0908	3.0054

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
10.92	(1, 69)	8.70	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	41.16	42.38	2.95
Experimental group	35	53.54	52.28	

From Table 4.17 it is observed that the F-ratio is 8.71 with df 1/69. It is significant at 0.01 level. The adjusted mean scores for control and experimental groups on achievement II in geography (ACHB) are 42.38 and 52.28 respectively. It means that the treatment of Creative Teaching Method in geography has produced significant higher mean performance scores on achievement II in geography of the experimental group of eighth graders when the covariates of SES, intelligence and general creative thinking were adjusted.

4.5.3 Covariance Results for Achievement III in Geography (ACHC)

The results of ANCOVA for the achievement III in geography (ACHC) are presented in Table 4.18

TABLE 4.18 SUMMARY OF ANCOVA FOR THREE COVARIATES OF SES, INTELLIGENCE AND GENERAL CREATIVE THINKING AND THE CRITERION VARIABLE OF ACHIEVEMENT III IN GEOGRAPHY (ACHC)

	SST	SSB	SSW	SSB'	SSW'	F-ratio
df	70	1	69	1	69	
Y^2	17284.64	591.61	16693.03	591.61	241.93	1.06
YX_1	1637.39	284.29	1353.09	284.29	19.61	
YX_2	5057.46	-163.13	5220.59	-163.13	75.66	
YX_3	10310.29	548.10	9762.19	548.10	141.48	
X_1X_2	2091.71	136.61	1955.09	136.61	28.33	
X_1X_2	-34.76	-78.39	43.63	-78.38	0.63	
X_1X_3	1724.78	263.39	1461.39	263.39	21.20	
X_2^2	12487.74	44.98	12442.76	44.98	180.33	
X_2X_3	7554.92	-151.13	7506.06	-151.13	108.78	
X_3^2	28234.59	507.79	27726.79	507.79	401.84	

Y = Achievement III in Geography (ACHC)
X_1 = SES scores
X_2 = Intelligence scores
X_3 = General Creative Thinking scores
SSB' = Mean sum of squares between groups
SSW' = Mean sum of squares error

Regression Coefficient and Significance of Regression Coefficient of Covariates

SES Covariates	Regression coefficient	Standard error of regression coefficient	t-values of regression coefficient
SES	0.4960	0.3141	1.5788
Intelligence	0.2643	0.1334	1.9812
General Creative Thinking	0.2543	0.0912	2.7889

Testing of Unadjusted and Adjusted Means by F-test

Unadjusted F-test	df (factor ERR)	Adjusted F-test	df (factor ERR)
2.44	(1, 69)	1.05	(1, 66)

Significance of Difference of Means Between Experimental and Control Groups

Groups	N	Unadjusted Mean	Adjusted Mean	t-value between adjusted means
Control group	36	36.08	37.22	1.02
Experimental group	35	41.85	40.68	

From Table 4.18, it can be observed that the F-ratio is 1.06 with df 1/69. It is not significant. The adjusted means on achievement III in geography (ACHC) for control and experimental groups are 37.22 and 40.68 respectively. It means that the treatment of Creative Teaching Method has not produced differential effects upon achievement III in geography of eighth graders when the covariates of SES, intelligence and general creative thinking were adjusted for the initial differences.

In order to know the analytical picture, significance of differences of means for the achievement test I in geography, achievement test II in geography, and achievement test III in geography has been calculated seperately and reported in Table 4.19. To find the total effect of the treatment, upon achievement in geography of eighth graders, combined means for the three achievement tests in geography for the control and experimental groups were calculated and t-test was applied. The result has been shown in Table 4.19.

TABLE 4.19 SIGNIFICANCE OF DIFFERENCE BETWEEN MEAN SCORES OF ACHIEVEMENT TESTS IN GEOGRAPHY FOR THE CONTROL AND EXPERIMENTAL GROUPS

Variable	Code	Control group N=36		Experimental group N=35		t-value
		Mean	SD	Mean	SD	
Achievement Test I in Geography	ACHA	43.33	16.64	55.51	20.92	2.71**
Achievement Test II in Geography	ACHB	41.16	12.96	53.54	18.21	3.30**
Achievement Test III in Geography	ACHC	36.08	15.92	41.85	15.15	1.56
Combined Achievement in Geography		40.19	15.40	50.30	19.22	2.78**

** significant at 0.01 level

From Table 4.19, it is observed that the mean scores of experimental group for achievement I in geography and achievement II in geography are significantly higher than the control group. The t-values for ACHA and ACHB are 2.71 and 3.30 respectively, which are significant at 0.01 level. The t-value for

the mean performance for achievement III in geography for the two groups is not significant.

The t-value for the combined mean scores of achievement in geography for the control and experimental group is 2.78, which is significant at 0.01 level. The combined mean scores of achievement in geography of the control and experimental groups are 40.19 and 50.30 respectively. Hence, it is conveyed that the treatment has significant effect upon achievement in geography. Therefore the hypothesis (H-VIII), that there is no significant difference in achievement in geography, between the group taught through the Creative Teaching Method and the group taught through the traditional method is rejected at 0.01 level.