CHAPTER IV

ANALYSIS AND RESULTS

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4.0.0 Introduction

This chapter presents the results of the experiment,
the design of which has been given in Chapter III. The
first major objective of the experiment was to study the
effects of three teaching Strategies of classroom
teaching, that is, Lecturing and Questioning-Answering (S_1),
Lecturing and Questioning-Answering by using Behavioural
Objectives (S_2) and Discussion by using Instructional
Materials (S_3) upon the attainment of Instructional
Objectives in term of Knowledge, Comprehension, Application,
and Total Scores in Geography for Ninth grade student.
The second major objectives of the experiment was to study
the effects of three Strategies of teaching (as mentioned
above) upon the retention of Knowledge, Comprehension,
Application and Total Attainment in Geography of Ninth grade
students. Keeping in mind these objectives, null hypotheses
were formulated as given below.

Hypotheses Related to Post-achievement :

H_1 - There will be no significant difference in the mean
scores of the groups taught by using Strategy (S_1)
Lecturing and Questioning-Answering, Strategy (S_2)
Lecturing and Questioning-Answering by using
Behavioural Objectives and Strategy (S_3) Discussion
by using Instructional Materials in terms of pupils'
attainment of Instructional Objectives at Knowledge
level in Geography for students of Standard IX.

H_2 - There will be no significant difference in the mean
scores of the groups taught by using Strategy (S_1)
Lecturing and Questioning-Answering, Strategy (S_2)
Lecturing and Questioning-Answering by using
Behavioural Objectives, Strategy (S_3) Discussion by
using Instructional Materials in terms of pupils'
attainment of Instructional Objectives at Comprehesion
level.

H_3 - There will be no significant difference in the mean
scores of the groups taught by using Strategy (S_1)
Lecturing and Questioning-Answering, Strategy (S_2)
Lecturing and Questioning by using Behavioural
Objectives, Strategy (S_3) Discussion by using
Instructional Materials in terms of pupils' attainment
of Instructional Objectives at Application level.

H_4 - There will be no significant difference in the mean
scores of the groups taught/by using Strategy (S_1)
Lecturing and Questioning-Answering, Strategy (S_2)
Lecturing and Questioning-Answering by using
Behavioural Objectives, Strategy (S_3) Discussion by
using Instructional Materials in terms of pupils' Total
Achievement (Knowledge, Comprehension, Application
taken together).

Hypotheses Related to Retention Test :

H_5 - There will be no significant difference in the mean scores of the groups taught by using Strategy (S_1) Lecturing and Questioning-Answering, Strategy (S_2) Lecturing and Questioning-Answering by using Behavioural Objectives, and Strategy (S_3) Discussion by using Instructional Materials on retention of Pupils' attainment of Instructional Objectives at Knowledge level.

H_6 - There will be no significant difference in the mean scores of the groups taught by using Strategy (S_1) Lecturing and Questioning-Answering, Strategy (S_2) Lecturing and Questioning-Answering by using Behavioural Objectives and Strategy (S_3) Discussion by using Instructional Materials on retention of pupils' attainment of Instructional Objectives at Comprehension level.

H_7 - There will be no significant difference in the mean scores of the groups taught by using Strategy (S_1) Lecturing and Questioning-Answering, Strategy (S_2) Lecturing and Questioning-Answering by using Behavioural Objectives, and Strategy (S_3) Discussion by using Instructional Materials on retention of pupils' attainment at Application level.

H_8 - There will be no significant difference in the mean scores of the groups taught by using Strategy (S_1) Lecturing and Questioning-Answering, Strategy (S_2) Lecturing and Questioning-Answering by using Behavioural Objectives, Strategy (S_2) Discussion by using Instructional Materials on retention of pupils' Total Attainment (Knowledge, Comprehension, and Application taken together).

4.1.0. Results for Posttest Scores

Results for the Criterion variables of knowledge, comprehension, application and total achievement of posttest have been given in Tables 4.1.1 to 4.1.12.

Table :4.1.1: Summary of ANCOVA with Posttest Scores on
Knowledge Objective

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
EY^2	2813.33	602.43	2210.91	301.21	15.04	7.56
EX_1^2	15266.67	1657.82	13608.86	828.91	92.58	
EX_2^2	997.33	118.32	879.02	59.16	5.98	
EYX_1	3596.47	997.52	2598.95	498.76	17.68	
EYX_2	696.33	259.20	437.13	129.60	2.97	
EX_1X_2	327.07	422.76	904.30	211.38	6.15	

Posttest   E stands for   '$\leq$'
Y   =   Scores on knowledge : X_1 = Intelligence
X_2 =   Pretest Knowledge : SS'B = Mean sum of squares
between groups
SS'W = Mean sum of squares error

Table :4.1.2: Testing of Unadjusted Means by F-test

Unadjusted F-test	df (Factor ERR)	Adjusted F-test	df (Factor ERR)
20.03	2/147	7.56**	2/145

** Significant at 0.01 level

Table :4.1.3: Significance of Difference of Adjusted Means
of Posttest Knowledge for Groups 1, 2 and 3

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	15.36	16.19 ⎤	3.90**
2	50	20.02	18.88 ⎦⎤	
3	45	16.53	16.79 ⎦⎤	2.88**
1	55	15.36	16.19 ⎦	0.84

** Significant at 0.01 level

Interpretation of Results : Posttest Knowledge

The summary of ANCOVA for posttest Knowledge is given in Table 4.1.1. The F-ratio is 7.56 (Vide Table 4.1.2). This is significant at 0.01 level with df 2/145. This shows that the three Strategies - S_1 (Lecturing and Questioning-Answering), S_2 (Lecturing and Questioning-Answering by using Behavioural Objectives) and S_3 (Discussion by using Instructional Materials) produced differential effects on Posttest Knowledge scores. The results of significance of difference between adjusted mean scores of the three groups hare given in Table 4.1.3. The adjusted mean scores for group 1, 2 and 3 are 16.19, 18.88 and 16.79 respectively. The f-value between groups 1 and 2 is 3.90 which is significant at 0.01 level with df equal to 103. The mean score on Knowledge of group taught under S_2 is significantly higher than the group taught under S_1. So, S_2 is more effective as compared to S_1. The t-value between group 2 and 3 is 2.88 with df 93. This is significant at 0.01 level. The mean score on Knowledge of group taught under S_2 is significantly higher than the group taught under S_3. Since the mean score of Knowledge for group 1 taught under S_1 does not differ significantly than group 3 taught under S_3, S_1 and S_3 are equally effective. It may be concluded that S_2 is more effective than S_1 and S_3. Thus, the null hypothesis 1 - there will be no significant difference in the mean scores of the groups taught by using Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing and Questioning-Answering by

using Behavioural Objectives) and Strategy S_3 (Discussion by using Instructional Materials) in terms of pupils' attainment of Instructional Objectives at Knowledge level in Geography for students of standard IX, is rejected.

Table :4.1.4: Summary of ANCOVA with Posttest Scores on Comprehension Objective

	SST	SS'B	SS'W	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
$E Y^2$	2446.67	523.81	1922.87	261.90	13.08	5.86
$E X_1^2$	15266.67	1657.82	13608.86	828.91	92.58	
$E X_2^2$	1494.83	298.72	1196.11	149.36	8.14	
$E Y X_1$	3162.99	931.79	2231.21	465.89	15.18	
$E Y X_2$	921.23	391.99	529.24	195.99	3.60	
$E X_1 X_2$	1083.43	698.56	1284.87	349.28	8.74	

E stands for ' $\leq$ '

Y = Posttest Comprehension : X_1 = Intelligence

X_2 = Pretest Comprehension : SS'B = Mean sum of squares between groups

SS'W = Mean sum of squares error

Table :4.1.5: Testing of Unadjusted Means by F-test

Unadjusted F-test	df(Factor ERR)	Adjusted F-test	df(Factor ERR)
20.02	2/147	5.86**	2/145

** Significant at 0.01 level

Table :4.1.6: Significance of Difference of Adjusted Means
of Posttest Comprehension for Groups 1, 2, 3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	10.31	11.13	3.36**
2	50	14.56	13.37	
				2.83**
3	45	11.07	11.39	
				0.37
1	55	10.31	11.13	

** Significant at 0.01 level

Interpretation of Results : Posttest Comprehension

The summary of ANCOVA for Posttest Comprehension is
given in Table 4.1.4. The F-ratio is 5.86 (vide Table 4.1.5)
which is significant at 0.01 level with df 2/145. This
shows that the three Strategies S_1 (Lecturing and Questioning-
Answering), S_2 (Lecturing and Questioning-Answering by using
Behavioural Objectives), S_3 (Discussion by using Instructional
Materials) produced differential effects on Posttest
Comprehension scores. The results of significance of difference
between adjusted mean scores of the three groups have been
given in Table 4.1.6. The adjusted mean scores for groups 1,
2 and 3 are 11.13, 13.37 and 11.39 respectively. The t-value
between groups 1 and 2 is 3.36. This is significant at 0.01
level with df equal to 103. The mean score on comprehension
of group taught under Strategy S_2 is significantly higher than
the group taught under S_1. So S_2 is more effective as
compared to S_1. The t-value between groups 2 and 3 is 2.83

which is significant at 0.01 level with df equal to 93. The
mean score on comprehension of the group taught under
Strategy S_2 is significantly higher than the group taught under
Strategy S_3. Therefore S_2 is more effective than S_3. Since the
mean score of comprehension for group 1 taught under S_1, does
not differ significantly than group 3, S_1 and S_3 are equally
effective. From here it may be concluded that S_2 is more
effective than S_1 and S_3. Thus, the null hypothesis 2 - there
will be no significant difference in mean scores of the groups
taught by using Strategy S_1 (Lecturing and Questioning-
Answering), Strategy S_2 (Lecturing and Questioning-Answering
by using Behavioural Objectives), and Strategy S_3 (Discussion
by using Instructional Materials) in terms of pupils'
attainment of Instructional Objectives at Comprehension level
in Geography for students of standard IX, is rejected.

Table :4.1.7: Summary of ANCOVA with Posttest Scores on
Application Objective.

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
ΞY^2	3149.39	877.47	2271.93	438.73	15.46	15.51
ΞX_1^2	15266.67	1657.82	13608.86	828.90	92.58	
ΞX_2^2	352.83	33.99	318.84	16.996	2.17	
ΞYX_1	3656.31	1190.78	2465.53	595.39	16.77	
ΞYX_2	632.43	172.60	459.84	86.298	3.13	
$\Xi X_1 X_2$	1314.63	232.87	1081.76	116.44	7.36	

Ξ stands for '$\leqslant$'

Y = Posttest Application : X_1 = Intelligence
X_2 = Pretest Application : SSB = Mean Sum of Squares
between groups
SSW = Mean Sum of Squares error

Table :4.1.8: Testing of Unadjusted Means by
F-test

Unadjusted F-test	df(Factor ERR)	Adjusted F-test	df (Factor ERR)
28.39	2/147	15.51**	2/145

** Significant at 0.01 level

Table :4.1.9: Significance of Difference of Adjusted
Means of Posttest Application for Groups
1,2,3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	2.69	3.53	5.71**
2	50	8.42	7.29	3.46**
3	45	4.67	4.89	2.01*
1	55	2.69	3.53	

* Significant at 0.05 level   ** Significant at 0.01 level

Interpretation of Results : Posttest Application

The summary of ANCOVA is given in Table 4.1.7. The
F-ratio is 15.51 (vide Table 4.1.8). This is significant
at 0.01 level with df 2/145. This $_{\mathrm{M}}$ shows that the three
Strategies viz., S_1 (Lecturing and Questioning-Answering),
S_2 (Lecturing and Questioning-Answering using Behavioural
Objectives) and S_3 (Discussion by using Instructional
Materials) produced differential effects on Posttest
Application scores. The results of significance of difference

between adjusted mean scores of the three groups have been
given in Table 4.1.9. The adjusted mean scores for groups
1, 2 and 3 are 3.53, 7.29 and 4.89 respectively. The t-value
between groups 1 and 2 is 5.71. This is significant at
0.01 level with df equal to 103. The mean score on
Application of the group taught under Strategy S_2 is
significantly higher than the group taught under S_1. So, S_2
is more effective as compared to S_1. The t-value between
groups 2 and 3 is 3.46. This is significant at 0.01 level
with df equal to 93. The mean scores on Application of the
group taught under S_2 is significantly higher than the
group taught under Strategy S_3. The t-value between groups
1 and 3 is 2.01 which is significant at 0.05 level with
df equal to 98. This means that the mean score of
Application for group 3 taught under Strategy S_3 is significa-
ntly higher than the group taught under Secretary S_1.
Therefore, the Strategy S_3 is more effective than Strategy
S_1. It may be concluded that Strategy S_2 is more effective
than Strategy S_1 and S_3 and Strategy S_3 is more effective
than Strategy S_1. Thus, the null Hypothesis 3 - there will
be no significant difference in the mean scores of the
groups taught by using Strategy S_1 (Lecturing and Questioning-
Answering), Strategy S_2 (Lecturing and Questioning-Answering
by using Behavioural Objectives) and Strategy S_3 (Discussion
by using Instructional Materials) in terms of pupils'
attainments of Instructional Objectives at Applicational level
in Geography for students of standard IX, is rejected.

Table :4.1.10: Summary of ANCOVA with Posttest Scores on
Total Achievement

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
EY^2	18342.37	5906.85	12435.53	2953.42	84.60	10.28
EX_1^2	15266.67	1657.82	13608.86	828.91	92.58	
EX_2^2	4053.33	1147.95	3705.38	573.98	25.21	
EYX_1	10415.77	3120.08	7295.69	1560.04	49.63	
EYX_2	6928.13	2586.73	4341.40	1293.37	29.53	
EX_1X_2	4625.13	1354.19	3270.94	677.096	22.25	

E stands for '$\leq$'

Y = Posttest Total Achievement : X_1 = Intelligence
X_2 = Pretest Total Achievement
SS'B = Mean Sum of Squares between groups
SS'W = Mean Sum of Squares error

Table :4.1.11: Testing of Unadjusted Means by
F-test

Unadjusted F-test	df (Factor ERR)	Adjusted F-test)	df(Factor ERR)
34.91	2/147	10.28**	2/145

** Significant at 0.01 level

Table :4.1.12: Significance of Difference of Adjusted
Means of Posttest Total Achievement, For
Groups 1, 2, 3

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	28.36	31.92	
				4.60 **
2	50	43.00	38.27	
				3.51 **
3	45	32.26	33.17	
				0.88
1	55	28.36	31.92	

** Significant at 0.01 level

Interpretation of Results : Posttest Total Achievement

The summary of ANCOVA for Posttest Total Achievement is
given in Table 4.1.10. The F-ratio is 10.28 (vide Table
4.1.11). This is significant at 0.01 level with df 2/145.
This shows that the three Strategies, S_1 (Lecturing and
Questioning-Answering), S_2 (Lecturing and Questioning-
Answering by using Behavioural Objectives) and S_3 (Discussion by
using Instructional Materials) produced differential effects
on Posttest Total Achievement scores. The results of
significance of difference between adjusted mean scores of
the three groups have been given in Table 4.1.12. The adjusted
mean scores for groups 1, 2 and 3 are 31.92, 38.27 and 33.17
respectively. The t-value between groups 1 and 2 is 4.60. This
is significant at 0.01 level with df 103. The mean score on
Posttest Total Achievement of the group taught under Strategy S_2

is significantly higher than the group taught under S_1. So, S_2 is more effective as compared to S_1. The t-value between groups 2 and 3 is 3.51. This is significant at 0.01 level with df equal to 93. The mean scores on Posttest Total Achievement of group taught under S_2 is significantly higher than the group taught under S_3. Therefore, S_2 is more effective than S_3. Since the mean score of Posttest Total Achievement for group 1 taught under S_1 does not differ significantly from group 3 taught under S_3, S_1 and S_3 are equally effective. From here it may be concluded that S_2 is more effective than S_1 and S_3. Thus the null hypothesis 4 – there will be no significant difference in the mean scores of the groups taught under Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing-Answering by using Behavioural Objectives) and Strategy S_3 (Discussion by using Instructional Materials) in terms of pupils' Total Achievement (Knowledge, Comprehension and Applicational Ability taken together) in Geography for students of standard IX, is rejected.

4.2.0 Results for Retention Scores

Results for the criterion variables of knowledge, comprehension, application and total achievement for retention test here been given in Tables 4.2.1 to 4.2.12

Table :4.2.1: Summary of ANCOVA with Scores on
Retention of Knowledge Objective

	SST	SSB	SSW	SS'B	SS'W	F-Ratio
df	149	2	147	2	145	
ΣY^2	2505.50	366.27	2139.23	183.14	14.55	4.59
ΣX_1^2	15266.67	1657.82	13608.86	828.91	92.58	
ΣX_2^2	997.33	118.32	879.02	59.16	5.98	
$\Sigma Y X_1$	2900.90	667.44	2233.46	333.72	15.19	
$\Sigma Y X_2$	704.00	202.22	501.78	101.11	3.41	
$\Sigma X_1 X_2$	1327.07	422.76	904.30	211.38	6.15	

Σ stands for 'Σ'

Y = Retention Test Knowledge : X_1 = Intelligence

X_2 = Pretest Knowledge   : SS'B = Mean Sum of Squares between groups

SS'W = Mean Sum of Squares error

Table :4.2.2: Testing of Unadjusted Means by F-test

Unadjusted F-test	df (Factor ERR)	Adjusted F-test	df (Factor ERR)
12.58	2/147	4.59*	2/145

* Significant at 0.05 level

Table :4.2.3: Significance of Difference of Adjusted Means of Retention-Knowledge £or Groups 1, 2, 3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	15.33	16.17	2.46 *
2	50	18.96	17.85	0.30
3	45	17.87	18.07	2.70 **
1	55	15.33	16.17	

* Significant at 0.05 level : ** Significant at 0.01 level

Interpretation of Results : Retention of Knowledge

The summary of ANCOVA for Test on Retention of Knowledge is given in Table 4.2.1. The F-ratio is 4.59 (vide Table 4.2.2). This is significant at 0.05 level with df 2/145. This shows that the three Strategies, S_1 (Lecturing and Questioning-Answering), S_2 (Lecturing and Questioning-Answering by using Behavioural Objectives) and S_3 (Discussion by using Instructional Materials) produced differential effects on Retention of Knowledge scores. The results of significance of difference between adjusted mean scores for groups 1, 2 and 3

are 16.17, 17.85 and 18.07 respectively. The t-value between groups 1 and 2 is 2.46. This is significant at 0.05 level with df equal to 103. The mean score of Test on Retention of Knowledge of group taught under Strategy S_2 is significantly higher than the group taught under Strategy S_1. So, S_2 is more effective as compared to S_1. Since the mean score of Retention Test on Knowledge for group 2 taught under Strategy S_2 and group 3 taught under Strategy S_3 do not differ significantly, S_2 and S_3 are equally effective. The t-value between groups 1 and 3 is 2.70 which is significant at 0.01 level with df equal to 98. The mean score on Retention Test of Knowledge of group 3 taught under Strategy S_3 is significantly higher than the group 1 taught under Strategy S_1. So the Strategy S_3 is more effective as compared to S_1. From here it may be concluded that Strategies S_2 and S_3 are more effective than Strategy S_1. Thus, the null hypothesis 5 - there will be no significant difference in the mean scores of the groups taught by using Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing and Questioning-Answering by using Behavioural Objectives) and Strategy S_3 (Discussion by using Instructional Materials) on retention of pupils' attainment of Instructional Objectives at Knowledge level in Geography for students of standard IX, is rejected.

Table :4.2.4: Summary of ANCOVA with Retention Scores on Comprehension Objective

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
EY^2	2453.74	296.01	2157.73	148.00	14.68	3.22
EX_1^2	15266.67	1657.82	13608.86	828.91	92.58	
EX_2^2	1494.83	298.72	1196.11	149.36	8.14	
EYX_1	3135.54	618.41	2517.13	309.21	17.12	
EYX_2	761.10	277.47	483.63	138.74	3.29	
EX_1X_2	1983.43	698.50	1284.87	349.28	8.74	

'E' stands for 'Σ'

Y = Retention Test Comprehension : X_1 = Intelligence

X_2 = Pretest Comprehension : SS'B = Mean Sum of Squares between groups

SS'W = Mean Sum of Squares error

Table :4.2.5: Testing of Unadjusted Means by F-test

Unadjusted F-test	df (Factor ERR)	Adjusted F-test	df (Factor ERR)
10.08	2/147	3.22*	2/145

E stands for ' '

Table :4.2.6:: Significance of Difference of Adjusted
Means of Retention Comprehension of Groups
1, 2, 3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	10.04	10.84	
				1.86
2	50	13.34	12.15	
				0.50
3	45	12.18	12.51	
				2.31 *
1	55	10.04	10.84	

* Significant at 0.05 level

Interpretation of Results : Retention of Comprehension

The summary of ANCOVA for Test on Retention of
Comprehension is given in Table 4.2.45. The F-ratio is
3.22 (vide Table 4.2.57). This is significant at 0.05
level with df equal to 2/145. This shows that the three
Strategies S_1 (Lecturing and Questioning-Answering),
S_2 (Lecturing and Questioning-Answering by using Behavioural
Objectives) and S_3 (Discussion by using Instructional
Materials) produced differential effects on Retention of
Comprehension Scores. The results of significance of
difference between the adjusted mean scores of the three
groups have been given in Table 4.2.63. The adjusted mean
scores for group 1, 2 and 3 are 10.84, 12.15 and 12.51
respectively. The t-value between groups 1 and 2 is 1.86
which is not significant. This means that the mean scores of
Test on Retention of Comprehension for Group 1 and Group 2

taught under Strategy S_1 and Strategy S_2 respectively do not differ significantly, therefore, the Strategies S_1 and S_2 are equally effective. Since the mean scores of Test on Retention of Comprehension for group 2 taught under Strategy S_2 do not differ significantly from group 3 taught under Strategy S_3, S_2 and S_3 are equally effective. The t-value between groups 3 and 1 is 2.31. This is significant at 0.05 level with df 98. The mean score on Retention Test of Comprehension of group taught under Strategy S_3 is significantly higher than the group taught under Strategy S_1. So, S_3 is more effective as compared to S_1. From here it may be concluded that Strategy S_3 is more effective than Strategy S_1. Thus, the null hypothesis 6 - there will be no significant difference in the mean scores of the groups taught by using Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing and Questioning-Answering) by using Behavioural Objectives) and Strategy S_3 (Discussion by using Instructional Materials) on retention of pupils' attainment of Instructional Objectives at Comprehension level in Geography for students of standard IX, is rejected.

Table :4.2.7: Summary of ANCOVA with Retention Test Scores on Application Objective

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	149	2	147	2	145	
ΣY^2	2570.67	693.43	1877.24	346.72	12.77	14.77
ΣX_1^2	15266.67	1657.82	13608.86	829.91	92.58	
ΣX_2^2	352.83	33.99	318.84	16.996	2.17	
ΣYX_1	4156.99	1039.09	3117.91	519.54	21.21	
ΣYX_2	620.03	153.31	466.72	76.66	3.17	
ΣX_1X_2	1314.63	282.87	1081.76	116.44	7.36	

E stands for 'Σ'

Y = Retention test Application
X_1 = Intelligence
X_2 = Pretest Application
SS'B = Mean Sum of Squares between groups
SS'W = Mean Sum of Squares error

Table :4.2.8: Testing of Unadjusted Means by F-test

Unadjusted F-test	df (Factor ERR)	Adjusted F-test	df (Factor ERR)
27.15	2/147	14.77 **	2/145

** Significant at 0.01 level

Table :4.2.9: Significance of Difference of Adjusted
Means of Retention Test Application
for Groups 1, 2, 3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	4.58	5.52	5.57 **
2	50	9.72	8.42	2.43 *
3	45	6.78	7.08	2.93 **
1	55	4.58	5.52	

* Significant at 0.05 level
** Significant at 0.01 level

Interpretation of Results : Retention Test Application

The summary of ANCOVA for Retention Test Application is
given in Table 4.2.7. The F-ratio is 14.77 (vide Table
4.2.8) which is significant at 0.01 level with df 2/145.
This shows that the three Strategies, Strategy S_1 (Lecturing
and Questioning-Answering) Strategy S_2 (Lecturing and
Questioning-Answering by using Behavioural Objectives)
Strategy S_3 (Discussion by using Instructional Materials)
produced differential effects on Retention of Application
scores. The results of significance of difference between
adjusted mean scores of the three groups have been given in
Table 4.2.9. The adjusted mean scores for groups 1, 2 and
3 are 5.52, 8.42 and 7.08 respectively. The t-value between
groups 1 and 2 is 5.57. This is significant at 0.01 level

with df equal to 103. The mean score on Retention of Application of the group taught under Strategy S_2 is significantly higher than the group taught under Strategy S_1. So, S_2 is more effective as compared to S_1. The t-value between groups 2 and 3 is 2.43 which is significant at 0.05 level with df equal to 93. The mean score on Retention of Application of the group taught under Strategy S_2 is significantly higher than the group taught under Strategy S_3. The t-value between groups 1 and 3 is 2.93. This is significant at 0.01 level with df equal to 98. The mean score on Retention of Application of the group taught under Strategy S_3 is significantly higher than the group taught under the Strategy S_1. Therefore, S_3 is more effective than S_1. From here it may be concluded that S_2 is more effective than S_1 and S_3, and S_3 is more effective than S_1. Thus, the null Hypothesis 7 - there will be no significant difference in the mean scores of the groups taught under Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing and Questioning- Answering by using Behavioural Objectives) and Strategy S_3 Discussion by using Instructional Materials) on retention of pupils' attainment at Application level in Geography for students of standard IX, is rejected.

Table :4.2.10: Summary of ANCOVA with Retention Test Scores on Total Achievement

	SST	SSB	SSW	SS'B	SS'W	F-ratio
df	140	2	147	2	145	
EY^2	5768.83	3858.44	11910.39	1929.22	81.02	6.61
EX_1^2	15266.67	1657.82	13608.86	828.91	92.58	
EX_2^2	4853.33	1147.95	3705.38	573.98	25.21	
EYX_1	10193.43	2324.94	7868.50	1162.47	53.53	
EYX_2	6405.33	2057.18	4348.15	677.10	22.25	
EX_1X_2	4625.13	1354.19	3270.94	573.98	25.21	

E stands for 'Σ'

Y = Retention Test Total

X_1 = Intelligence

X_2 = Pretest total

SS'B = Mean Sum of Squares between groups

SS'W = Mean Sum of Squares error

Table :4.2.11: Testing of Unadjusted Means by F-test

Unadjusted F-test	df(Factor ERR)	Adjusted F-test	df(Factor ERR)
23.81	2/147	6.61**	2/145

Table :4.2.12: Significance of Difference of Adjusted
Means of Retention Test Total for
Groups 1, 2, 3.

Groups	N	Unadjusted Mean	Adjusted Mean	t-value
1	55	29.95	33.53	
				2.89**
2	50	42.02	37.21	
				0.43
3	45	36.82	37.78	
				3.25**
1	55	29.95	33.53	

** Significant at 0.01 level

Interpretation of Results : Retention of Total Achievement

The summary of ANCOVA for test on Retention of Total Achievement is given under Table 4.2.10. The f-ratio is 6.61 (vide Table 4.2.11). This is significant at 0.01 level with df 2/145. This shows that the three Strategies viz. S_1 (Lecturing and Questioning-Answering), S_2 (Lecturing and Questioning-Answering by using Behavioural Objectives) and S_3 (Discussion by using Instructional Materials) produced differential effects on scores for test of Retention of Total Achievement. The results of significance of difference between adjusted mean scores of the three groups have been given in Table 4.2.12. The adjusted mean scores for groups 1, 2 and 3 are 33.53, 37.21 and 37.78 respectively. The t-value between groups

1 and 2 is 2.89 which is significant at 0.01 level with df equal to 103. The mean score on test for Retention of Total Achievement of the group taught under Strategy S_2 is significantly higher than the group taught under Strategy S_1. So, S_2 is more effective as compared to S_1. Since the mean score of test on Retention of Total Achievement for group 2 taught under Strategy S_2 does not differ significantly from that of group 3 taught under Strategy S_3, S_2 and S_3 are equally effective. The t-value between groups 1 and 2 is 3.25 which is significant at 0.01 level with df equal to 98. The mean score of group 3 taught under Strategy S_3 is significantly higher than group 1 taught under Strategy S_1. Therefore, S_3 is more effective than S_1. It may be concluded that Strategy S_2 and Strategy S_3 are more effective than Strategy S_1. Thus, the null Hypothesis 8 – there will be no significant difference in the mean scores of the groups taught by using Strategy S_1 (Lecturing and Questioning-Answering), Strategy S_2 (Lecturing and Questioning-Answering by using Behavioural Objectives) and Strategy S_3 (Discussion by using Instructional Materials) on retention of pupils' total attainment (Knowledge, Comprehension and Applicational Ability taken together) in Geography for students of standard IX, is rejected.

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