

CHAPTER SEVEN

RESULTS AND DISCUSSION

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CHAPTER SEVEN

RESULTS AND DISCUSSION

III - FOR EXPERIMENTAL No.1 AND EXPERIMENTAL No.2 GROUPS (E₁ and E₂ GROUPS)

In this chapter results and discussion related to Experimental No. 1 and Experimental No.2 groups (E₁ and E₂ groups) is presented.

7.1 COMPARISON OF DIFFERENCE IN VERBAL TEACHING BEHAVIOUR PATTERNS

To find out the direction and significance of difference in verbal teaching behaviour patterns between E₁ and E₂ groups of teachers, three comparisons were made. Results of these comparisons are now presented below :

1. Direction and significance of difference in all the 14 categories

The results given in this section deals with comparison of all the 14 categories, representing teaching behaviour patterns of E₁ and E₂ groups of teachers. Table 7.1 gives a comparative statement of percentage occurrence of these teaching behaviours and table 7.2 gives the results of median test applied to the data of table 7.1.

Table 7.1
 Percentage Occurrence of all the 14 Categories in E₁ and E₂ Groups of Teachers

Teachers	C A T E G O R I E S													
	1	2	3a	3b	4a	4b	4c	4d	5	6	7	8	9	10
1.	0.00	2.14	2.68	1.30	4.55	4.04	0.93	0.14	57.77	1.35	0.14	18.01	0.76	6.13
E ₁ 2.	0.00	2.75	4.09	0.74	8.89	1.45	0.63	0.00	48.86	0.81	0.03	22.55	0.70	8.48
3.	0.21	0.42	3.32	1.12	3.28	0.90	0.24	0.00	64.51	5.02	0.48	10.54	3.20	6.78
1.	0.40	4.88	11.12	4.09	7.37	4.55	2.92	2.03	25.84	0.65	0.00	29.91	1.41	4.77
E ₂ 2.	0.07	0.91	3.37	0.16	5.02	1.65	1.69	0.37	44.31	0.96	0.04	38.26	0.23	2.85
3.	0.48	1.35	5.36	1.05	6.07	2.60	2.38	0.81	44.06	0.62	0.02	33.16	0.97	1.00

Note: In the process of rounding off the values to two decimal places, small decimal values have either been lost or added to the total of 100%.

Median test was applied to the percentage occurrence of each of the above 14 categories given in the table above in order to find out the direction and significance of the difference in the occurrence of these categories between E_1 and E_2 groups of teachers. The results obtained are presented in the following table:

Table 7.2

Mean percentage occurrence of 14 categories, direction of difference and significance of difference in E_1 and E_2 groups of teachers.

Category	Teachers	Mean percentage occurrence of the category	Direction of difference	Significance of difference
1	2	3	4	5
1	E_1	.07	In 2 out of 3 E_1 group teachers this category was absent. In all the three E_2 teachers this category was present, though in small amount.	--
	E_2	.32		
2	E_1	1.77	In about 67% of the combined matrices category 2 was below common median in E_2 groups of teachers.	N.S.
	E_2	2.38		
3a	E_1	3.36	In about 67% of the combined matrices category 3a was above common median in E_2 group of teachers.	N.S.
	E_2	6.62		
3b	E_1	1.05	In about 67% of the combined matrices category 3b was below common median in E_2 group of teachers.	N.S.
	E_2	1.77		

1	2	3	4	5
4a	E ₁	5.57	In about 67% of the combined matrices category 4a was above common median in E ₂ group of teachers.	N.S.
	E ₂	6.15		
4b	E ₁	2.13	In about 67% of the combined matrices category 4b was above common median in E ₂ group of teachers.	N.S.
	E ₂	2.93		
4c	E ₁	0.60	In all the three combined matrices category 4c was above common median in E ₂ group of teachers	Sig.at .05 level
	E ₂	2.33		
4d	E ₁	0.05	In 2 out of 3 E ₁ teachers this category was absent. In all the three E ₂ teachers this category was present.	--
	E ₂	1.07		
5	E ₁	57.04	In all the three combined matrices category 5 was below common median in E ₂ group of teachers.	Sig.at .05 level
	E ₂	38.07		
6	E ₁	2.39	In about 67% of the combined matrices category 6 was below common median in E ₂ group of teachers.	N.S.
	E ₂	0.74		
7.	E ₁	0.22	In general occurrence of this category was rare. However, this was so more in E ₂ group of teachers.	--
	E ₂	0.02		
8	E ₁	17.03	In all the three combined matrices category 8 was above common median in E ₂ group of teachers.	Sig.at .05 level
	E ₂	33.78		
9.	E ₁	1.55	In about 67% of the combined matrices category 9 was above common median in E ₂ group of teachers.	N.S.
	E ₂	0.87		
10.	E ₁	7.13	In all the three combined matrices category 10 was below common median in E ₂ group of teachers.	Sig.at .05 level
	E ₂	2.87		

Note : (1) N.S. = Not significant.
(2) Sig. = Significant.

Table 7.2 reveals that so far as category 1, accepting feelings of the students, is concerned, in 2 out of 3 E_1 group teachers this category was absent. But all the three E_2 group of teachers were found to use this behaviour while interacting with their students. The direction of difference in the occurrence of this verbal teaching behaviour was in favour of E_2 group of teachers although its occurrence was rare. So far as category 2, encouraging or praising, is concerned in about 67% of the combined matrices this verbal teaching behaviour was below common median in E_2 group of teachers. This means that although the difference in the occurrence of category 2 between E_1 and E_2 groups of teachers was not significant, the direction of difference was in favour of E_1 group of teachers. As regards category 3a, providing confirmatory feedback, in about 67% of the combined matrices this verbal teaching behaviour was above common median in E_2 group of teachers. Although the difference in the occurrence of this behaviour between E_1 and E_2 groups of teachers was not significant, the direction of the difference was in favour of E_2 group of teachers which means that 2 out of 3 E_2 group of teachers provided confirmatory feedback to their students more often as compared to 1 out of 3 E_1 group of teachers. In the case of category 3b, providing corrective feedback, this trend was reversed. That is, the direction of difference in the occurrence of this category was in favour of E_1 group of teachers although the difference in the occurrence of this teaching behaviour between the two groups was not found significant. As regards category 4a, asking cognitive memory questions, in about 67% of the combined matrices this category

was above common median in E_2 group of teachers. That is, the difference in the occurrence of asking cognitive memory questions between E_1 and E_2 group of teachers, though not significant, was in favour of E_2 group of teachers meaning thereby that 2 out of 3 E_2 group of teachers used this behaviour more often as compared to 1 out of 3 E_1 group of teachers. About category 4b, asking convergent questions, a similar trend was observed. As regards category 4c, asking divergent questions, in all the three combined matrices this verbal teaching behaviour was found above common median in E_2 group of teachers. This means that the difference in the occurrence of asking divergent questions between E_1 and E_2 groups of teachers was significant at .05 level of significance and was in favour of E_2 group of teachers. About category 4d, asking evaluative questions, in 2 out of 3 E_1 group of teachers this teaching behaviour was found absent. On the other hand, asking evaluative question was observed in classroom interaction of E_2 group of teachers. Thus, the difference in the occurrence of this category between E_1 and E_2 group of teachers was found in favour of E_2 group of teachers. As regards category 5, lecturing, in all the three combined matrices this category was below common median in E_2 group of teachers. This means that the difference in the occurrence of lecturing behaviour between E_1 and E_2 groups of teachers was found statistically significant at .05 level of significance and that this difference was in favour of E_2 group of teacher meaning thereby that as expected as a result of training all these three teachers used lecturing behaviour less than all the 3 E_1 group of teachers. As regards category

6, giving direction and command, in about 67% of the combined matrices this behaviour was below common median in E_2 group of teachers. Thus, although, the difference in the occurrence of category 6 between E_1 and E_2 groups of teachers was not found significant, 2 out of 3 E_2 group of teachers used this teaching behaviour less often than 1 out of 3 E_1 group of teachers. About category 7, criticising and justifying authority, this teaching behaviour was in general rare in both the groups but this was so more in the case of E_2 group of teachers. As regards category 8, student talking in response to teacher-talk, in all the three combined matrices this student response behaviour was above common median in E_2 group of teachers. That is, the difference in the occurrence of this behaviour between E_1 and E_2 groups of teachers was statistically significant (at .05 level of significance) and was in the direction of E_2 group of teachers. As regards category 9, students initiating talk, in about 67% of the combined matrices, this student-talk behaviour was above common median in E_2 group of teachers which means that although the difference in the occurrence of this classroom behaviour between the two groups of students was not significant, the direction of the difference was in favour of E_2 group. As regards category 10, silence or confusion during classroom interaction, in all the three combined matrices this category was below common median in E_2 group of teachers. That is, the difference in the occurrence of this category between E_1 and E_2 groups of teacher was found significant at .05 level of significance which means that in the case of all the three E_2 group of teachers there was less amount of silence or

confusion in the class thereby indicating more of teacher-student talk.

The above results are summarised as (i) significant difference at .05 level of significance in favour of E_2 group of teachers was found in respect of such teaching behaviours as asking divergent question and lecturing (Cat. 4c and 5) and also classroom interaction characterized by student responding to teacher talk (Cat. 8) and silence or confusion (Cat. 10), (ii) accepting student's feeling (Cat.1), though present in small amount, was observed in the case of all the E_2 group of teachers as against only 1 out of 3 E_1 group of teachers, (iii) Category 4d, asking evaluative questions, was absent in 2 out of 3 E_1 group of teachers whereas all the three E_2 group of teachers asked evaluative questions while teaching, (iv) the direction of the difference of occurrence of such classroom interaction behaviour as providing confirmatory feedback (3a), asking cognitive memory questions (4a), asking convergent questions (4b), student-initiated talk (9) and teacher giving direction and command(6) was found to be in favour of E_2 group of teachers although the difference was not significant. The direction of the difference of occurrence of category 3b, providing corrective feedback, was however, found to be in favour of E_1 group of teachers.

2. Direction and significance of difference in Teacher-talk categories :

The results presented here deals with comparison of different teacher-talk categories only between E_1 and E_2 groups of teachers. Table 7.3 contains a comparative statement of percentage occurrence of teacher-talk categories and table 7.4 gives the results of median test applied to the data of table 7.3.

Table 7.3

Percentage occurrence of 11 teacher-talk categories in E₁ and E₂ groups of teachers

Teachers	C A T · E G O R I E S										
	1	2	3a	3b	4a	4b	4c	4d	5	6	7
1.	0.00	2.86	3.57	1.73	6.06	5.38	1.24	0.18	76.94	1.80	0.18
E ₁ 2.	0.00	3.98	5.99	1.09	13.03	2.12	0.92	0.00	71.59	1.19	0.05
3.	0.26	0.50	4.16	1.47	4.13	1.14	0.30	0.00	81.11	6.31	0.57
1.	0.63	7.64	17.40	6.40	11.54	7.13	4.58	3.18	40.45	1.01	0.00
E ₂ 2.	0.12	1.56	5.75	0.28	8.56	2.81	2.89	0.64	75.62	1.65	0.08
3.	0.75	2.09	8.27	1.63	9.36	4.01	3.67	1.25	67.93	0.96	0.04

Note: In the process of rounding off the values to two decimal places, small decimal values have either been lost or added to the total of 100%.

Median test was applied to the above percentage occurrence of each of the eleven categories representing teaching behaviours in order to test the direction and significance of difference between E_1 and E_2 group of teachers. The results are given in the following table :

Table 7.4

Mean percentage occurrence of 11 teacher-talk categories, direction of difference and significance of difference in E_1 and E_2 groups of teachers

Category	Teachers	Mean percentage occurrence of the category	Direction of difference	Significant of difference
1	2	3	4	5
1	E_1	.09	In 2 out of 3 E_1 group of teachers category 1 was absent whereas this category was present in all the three E_2 group of teachers. However, its occurrence was rare.	--
	E_2	.50		
2	E_1	2.45	In about 67% of the combined matrices category 2 was below common median in E_2 group of teachers.	N.S.
	E_2	3.76		
3a	E_1	4.57	In about 67% of the combined matrices category 3a was above common median in E_2 group of teachers.	N.S.
	E_2	10.47		
3b	E_1	1.42	In about 67% of the combined matrices category 3b was above common median in E_2 group of teachers.	N.S.
	E_2	2.77		

1	2	3	4	5
4a	E ₁	7.74	In about 67% of the combined matrices category 4a was above common median in E ₂ group of teachers.	N.S.
	E ₂	9.82		
4b	E ₁	2.88	In about 67% of the combined matrices category 4b was above common median in E ₂ group of teachers.	N.S.
	E ₂	4.65		
4c	E ₁	0.82	In all the three combined matrices category 4c was above common median in E ₂ group of teachers.	Sig. at .05 level
	E ₂	3.71		
4d	E ₁	0.06	In 2 out of 3 E ₁ group of teachers category 4d was absent whereas this category was found present above the minimum value of E ₁ teacher in all the three E ₂ group of teachers.	--
	E ₂	1.69		
5	E ₁	76.55	In about 67% of the combined matrices category 5 was below common median in E ₂ group of teachers.	N.S.
	E ₂	61.33		
6	E ₁	3.10	In about 67% of the combined matrices category 6 was below common median in E ₂ group of teachers.	N.S.
	E ₂	1.21		
7	E ₁	0.27	In general the occurrence of this category was rare. However, this was so more in E ₂ group of teachers.	--
	E ₂	0.04		

Note : (1) N.S. = Not significant
 (2) Sig. = Significant

When analysis of 11 teacher-talk categories only were considered, the results, as given in table 7.4, revealed that except for category 5, lecturing, and category 3b, providing corrective feedback, the trend was the same as when all the 14 categories had been considered (table 7.2). In the case of category 5, lecturing, the difference in the occurrence of this teaching

behaviour was not found significant for E_2 group of teachers although the direction of this difference was still in favour of this group of teachers. Again for category 3b, providing corrective feedback, it was observed that in about 67% of the combined matrices this teaching behaviour was above common median in E_2 group of teachers. These shifts resulted from the changes in percentage occurrence in one of the three teachers for both the categories when student-talk (8 and 9) and silence or confusion (10) categories were not considered for analysis.

As for other categories were concerned, significant difference at .05 level of significance between E_1 and E_2 group of teachers was observed with respect of category 4c, asking divergent questions. Direction of difference in occurrence of category 1, accepting feelings of the students, and category 7, criticising and justifying authority, was found in favour of E_2 group of teachers although the occurrence was rare for both the groups. Similarly category 4d, asking evaluative questions, was found to be present in all the three E_2 group of teachers. Again direction of difference in occurrence of category 3a, 4a, 4b and 6 was found in favour of E_2 group of teachers. However, in the case of category 2, praising and encouraging the students, the direction of difference in occurrence of this category was found, as in the case of 14 category analysis, in favour of E_1 group of teachers.

3. Direction and significance of difference
in selected verbal teaching behaviour
patterns

E_1 and E_2 groups of teachers had been given varying amount of training in the theory and practice of interaction process analysis with a view to achieving systematic differences between these two groups in using some selected verbal teaching behaviour patterns such as general indirection, providing confirmatory and corrective feedback and asking cognitive memory, convergent, divergent and evaluative questions. The results obtained with respect to these different selected verbal teaching behaviour patterns in E_1 and E_2 groups of teachers are given in the table below :

Table 7.5 on next page...

Table 7.5
Percentage occurrence of selected Verbal Teaching Behaviour Patterns in E₁ and
E₂ groups of teachers

Teachers	P A T T E R N S																			
	TRR	TIFbR -89 (total)	TIFbR -89 (Con.)	TIFbR -89 (Cor.)	TQR (total)	TQR (4a)	TQR (4b)	TQR (4c)	TQR (4d)	CCG										
E ₁																				
1.	80.39	60.45	37.85	22.60	14.34	7.30	6.54	1.58	0.24	81.08										
2.	89.82	76.22	64.02	12.19	18.34	15.40	2.88	1.28	0.00	73.50										
3.	58.87	83.25	61.93	21.32	6.42	4.85	1.39	0.37	0.00	78.80										
Mean	76.36	73.31	54.60	18.70	13.03	9.18	3.60	1.08	0.08	77.79										
E ₂																				
1.	96.92	83.10	60.45	22.64	39.53	22.20	14.99	10.18	7.29	61.56										
2.	81.70	88.68	84.27	4.40	16.47	10.17	3.58	3.68	0.84	60.49										
3.	92.70	92.51	77.53	14.97	21.23	12.11	5.57	5.13	1.81	71.26										
Mean	90.44	88.10	74.08	14.00	25.74	14.83	8.04	6.33	3.31	64.44										
Note :	TRR	Teacher Response Ratio	TIFbR-89(total)	Teacher Instantaneous Feedback Ratio(total)	TIFbR-89(Con.)	Teacher Instantaneous Feedback Ratio(Confirmatory)	TIFbR-89(Cor.)	Teacher Instantaneous Feedback Ratio(corrective)	TQR (total)	Teacher Question Ratio (total)	TQR (4a)	Teacher Question Ratio (Cognitive memory)	TQR (4b)	Teacher Question Ratio (Convergent)	TQR (4c)	Teacher Question Ratio (Divergent)	TQR (4d)	Teacher Question Ratio (Evaluative)	CCR	Content Cross Ratio

Median test was applied to the results obtained in the above table to test the direction and significance of difference in selected teaching behaviour patterns between E_1 and E_2 groups of teachers. These findings are given below :

Table 7.6

Mean percentage occurrence of selected verbal teaching behaviour patterns, direction of difference and significance of difference in E_1 and E_2 group of teachers

Patterns	Tea- chers	Mean per- centage occurrence of patterns	Direction of difference	Signi- ficance of diff- erence
1	2	3	4	5
TRR	E_1	76.36	In about 67% of the com- bined matrices TRR was above common median in E_2 group of teachers.	N.S.
	E_2	90.44		
TIFbR89 (total)	E_1	73.31	In about 67% of the combined matrices TIFbR89(total) was above common median in E_2 group of teachers.	N.S.
	E_2	88.10		
TIFbR89 (Con.)	E_1	54.60	In about 67% of the combined matrices TIFbR89(Confirma- tory) was above common median in E_2 group of teachers.	N.S.
	E_2	74.08		
TIFbR89 (Cor.)	E_1	18.70	In about 67% of the combined matrices TIFbR89(Corrective) was below common median in E_2 group of teachers.	N.S.
	E_2	14.00		

	1	2	3	4	5
TQR(total)	E ₁	13.03	In about 67% of the combined matrices TQR(total) was above common median in E ₂ group of teachers.		N.S.
	E ₂	25.74			
TQR(4a)	E ₁	9.18	In about 67% of the combined matrices TQR(4a) was above common median in E ₂ group of teachers.		N.S.
	E ₂	14.83			
TQR(4b)	E ₁	3.60	In about 67% of the combined matrices TQR(4b) was above common median in E ₂ group of teachers.		N.S.
	E ₂	8.04			
TQR(4c)	E ₁	1.08	In all the three combined matrices TQR(4c) was above common median in E ₂ group of teachers.		Sig.at .05 level
	E ₂	6.33			
TQR(4d)	E ₁	0.08	Only in 1 out of 3 E ₁ group of teachers TQR(4d) was observed in rare amount. In all the three combined matrices of E ₂ group of teachers this category was observed.		--
	E ₂	3.31			
CCR	E ₁	77.79	In all the three combined matrices CCR was below common median in E ₂ group of teachers		Sig.at .05 level
	E ₂	64.44			

Note : (1) N.S. = Not significant
(2) Sig. = Significant

The values of ten different ratios given in table 7.6 were obtained on the basis of the formulae suggested by Flanders (1970). However, some of the formulae had to be suitably modified for the calculation of some of these ratios. These ten ratios and the results of median test are explained as below :

(i) The teacher response ratio, (TRR), is an index which "corresponds to the teacher's tendency to react to ideas and feelings of the pupils." It gives an estimate of general indirectedness in teaching behaviour. TRR was calculated by adding category frequencies 1 + 2 + 3a + 3b, multiplying by 100, and dividing by the sum of category 1, 2, 3a, 3b, 6 and 7. The result revealed that in about 67% of the combined matrices TRR was above common median in E_2 group of teachers. This means that the difference in the occurrence of TRR between E_1 and E_2 groups of teachers was not significant although the direction of this difference was in favour of E_2 group of teachers. More E_2 group of teachers reacted to ideas and feelings of the pupils as compared to E_1 group of teachers.

(ii) The teacher instantaneous feedback ratio, (TIFbR89-total), is an index of the tendency of the teacher to provide confirmatory and corrective feedback to the students at the moment they stop talking. The value of TIFbR89(total) was calculated by adding the cell frequencies in rows 8 and 9, columns 3a and 3b, multiplying this sum by 100 and dividing the product by the total tallies in the cells of rows 8 and 9, columns, 1, 2, 3a, 3b, 6 and 7. The result revealed that in about 67% of the combined matrices, TIFbR89(total) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TIFbR89(total), though not significant, was in favour of E_2 group of teachers. 2 E_2 group of teachers as against 1 E_1 group of teachers provided more verbal feedback (total) to their pupils.

(iii) The teacher instantaneous feedback ratio, TIFbR89 (confirmatory), is an index of the tendency of the teacher to provide confirmatory feedback to the pupils at the moment they stop talking. The TIFbR89 (Cor.) was calculated by adding cell frequencies in rows 8 and 9, column 3a, multiplying this sum by 100, and dividing the product by the total tallies in the cells of rows 8 and 9, column 1, 2, 3a, 3b, 6 and 7. The result revealed that in about 67% of the combined matrices TIFbR89(Con.) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TIFbR89(Con.) between E_1 and E_2 group of teachers, though not significant, was in favour of E_2 group of teachers. 2 E_2 group of teachers as against 1 E_1 group of teachers provided more confirmatory feedback to their pupils.

(iv) The teacher instantaneous feedback ratio TIFbR89(Cor.), is an index of the tendency of the teacher to provide corrective feedback in a nonthreatening way to the pupils at the moment they stop talking. The TIFbR89(Cor.) was calculated by adding the cell frequencies in rows 8 and 9, column 3b, multiplying this sum by 100, and dividing the product by the total tallies in the cells of rows 8 and 9, columns 1, 2, 3a, 3b, 6 and 7. The result revealed that in about 67% of the combined matrices, TIFbR89(Cor.) was below common median in E_2 group of teachers. This means that the difference in the occurrence of TIFbR89(Cor.) between E_1 and E_2 groups of teachers, though not significant, was in favour of E_1 group of teachers. 2 E_1 group of teachers as against 1 E_2 group of teachers provided more corrective feedback to their pupils.

(v) The teacher question ratio, TQR(total), is an index of the tendency of the teacher to use four different types of questions when 'guiding the content oriented part of the class'. The TQR(total) was calculated by adding category frequencies 4a, 4b, 4c and 4d, multiplying by 100 and dividing by the sum of category frequencies 4a, 4b, 4c, 4d and 5. The result revealed that in about 67% of the combined matrices, TQR(total) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TQR(total) between E_1 and E_2 groups of teachers, though not significant, was in favour of E_2 group of teachers. 2 E_2 group of teachers as against 1 E_1 group of teachers asked more questions to their pupils.

(vi) The teacher question ratio, TQR(4a), is an index of the tendency of the teachers to ask cognitive memory questions. The value of TQR (4a) was calculated by multiplying cell frequencies in 4a by 100 and dividing this value by frequencies in cells 4a and 5. The result revealed that in about 67% of the combined matrices, TQR (4a) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TQR (4a) between E_1 and E_2 groups of teachers, though not significant, was in favour of E_2 group of teachers. 2 E_2 group of teachers as against 1 E_1 group of teachers asked more cognitive memory questions to their pupils.

(vii) The teacher question ratio, TQR(4b), is an index of the tendency of the teachers to ask convergent questions. The TQR (4b) was calculated by multiplying cell frequencies in 4b by 100 and dividing this value by frequencies in cells 4b and 5. The result revealed that in about 67% of the combined matrices,

TQR (4b) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TQR (4b) between E_1 and E_2 groups of teachers, though not significant, was in favour of E_2 group of teachers. 2 E_2 group of teachers as against 1 E_1 group of teachers asked more convergent questions to their pupils.

(viii) The teacher question ratio, TQR(4c), is an index of the tendency of the teachers to ask divergent questions. The TQR (4c) was calculated by multiplying cell frequencies in 4c by 100 and dividing this value by frequencies in cells 4c and 5. The result revealed that in all the three combined matrices, TQR(4c) was above common median in E_2 group of teachers. This means that the difference in the occurrence of TQR(4c) between E_1 and E_2 groups of teacher was significant at .05 level of significance. All the three E_2 group of teachers, as against none of the E_1 group of teachers, asked more divergent questions to their pupils.

(ix) The teacher question ratio, TQR(4d), is an index of the tendency of the teachers to ask evaluative questions. This ratio was calculated by multiplying cell frequencies in 4d by 100 and dividing this value by frequencies in 4d and 5. The result revealed that only 1 out of 3 E_1 group of teachers asked evaluative questions to their pupils and, even in this case, the occurrence of this type of question was rare. As against this, all the three E_2 group of teachers asked evaluative questions to their pupils more frequently than the 1 E_1 group of teachers. It appears training in the use of asking evaluative questions has brought about systematic variation in this teaching

behaviour in favour of E_2 group of teachers.

(x) The content cross ratio, CRR, gives an indication of the focus of classroom discussion on subject-matter. An exceptionally high CCR reveals that the teacher took active role in the class discussion. CCR is calculated by adding all frequencies in column and row of category 4a, 4b, 4c, 4d, and 5, multiplying by 100, and dividing by sum of all the categories. The result revealed that in all the three combined matrices TRR was below common median in E_2 group of teachers. This means that the difference in the occurrence of CRR between E_1 and E_2 groups of teacher was significant at .05 level of significance. All the three E_2 group of teachers as against none of the E_1 group of teachers took less active role in the class discussion.

With this the comparison of difference in verbal teaching behaviour patterns between E_1 and E_2 groups of teachers is complete.

7.2 COMPARISON OF DIFFERENCE IN MEAN ACHIEVEMENT AT KNOWLEDGE, UNDERSTANDING AND APPLICATION LEVELS :

First, the results related to observed and adjusted mean differences in achievement at three levels between E_1 and E_2 groups of students are given. This is followed by the results obtained on the basis of analysis of the data of students' achievement which provide a comparison of mean achievement at knowledge (K), understanding (U) and application (A) levels

between E_1 and E_2 groups of students exposed to verbal teaching behaviour patterns of E_1 and E_2 groups of teachers.

1. Observed and Adjusted Mean Differences in Achievement :

Observed and adjusted mean differences in achievement between E_1 and E_2 groups of students are presented here to get an idea about the general trend in these mean differences with respect to all the three levels of achievement. The results are given in the following table in a comparative perspective :

Table 7.7

Summary of the Observed and Adjusted Mean Differences in Achievement

Achievement	<u>Observed mean differences</u> E ₁ and E ₂ groups of students			<u>Adjusted mean differences</u> E ₁ and E ₂ groups of students		
	E ₁	E ₂	Diff.	E ₁	E ₂	Diff.
K	10.935	11.575	<u>0.640</u>	11.072	11.417	<u>0.345</u>
U	4.624	5.800	<u>1.176</u>	4.702	5.695	<u>0.993</u>
A	4.850	6.262	<u>1.412</u>	4.976	6.170	<u>1.194</u>

Note : K = Achievement at Knowledge level
 U = Achievement at Understanding level
 A = Achievement at Application level

2. Calculation of Significance of Difference between Mean Achievement at K, U and A levels in E_1 and E_2 Groups of students :

In order to determine the significance of the difference between mean achievement scores of the two groups of students, after adjusting for initial differences in previous

knowledge and intelligence, analysis of covariance technique was applied. The stepwise summary of the results for each of the K, U and A levels are presented below :

(a) Significance of difference at knowledge level(K) :

Step (i) - Sums of Squares

Variables	Source of variation	d.f.	S.S.
y = Achievement (K)	Between groups	1	17.589
	Within groups	171	1572.163
	Total	172	1589.752
x ⁽¹⁾ = Intelligence	Between groups	1	56.436
	Within groups	171	11092.795
	Total	172	11149.231
x ⁽²⁾ = Previous Knowledge	Between groups	1	12.907
	Within groups	171	519.480
	Total	172	532.387

Step (ii) - Sums of Products

This involves obtaining all possible sums of products (two variables at a time) in a manner analogous to that by which the sums of squares were obtained. A summary of the results obtained is presented below :

Sums of Products

Product of two variables	Source of variation	Sums of Products
$\bar{y}_x^{(1)}$	Between groups	31.505
Achievement(K) x Intelligence	Within groups	1056.628
	Total	1088.133
$\bar{y}_x^{(2)}$	Between groups	15.068
Achievement(K) x Previous Knowledge	Within groups	226.713
	Total	241.781
$\bar{x}^{(1)}\bar{x}^{(2)}$	Between groups	26.990
Intelligence x Previous Knowledge	Within groups	446.802
	Total	473.792

Step (iii) - Sums of Squares and Sums of Products Matrix :

Now, between groups (treatment) sums of squares and sums of products matrix is presented below :

$$T = \begin{pmatrix} T_{yy} & T_{yx}^{(1)} & T_{yx}^{(2)} \\ T_x^{(1)}{}_y & T_x^{(1)}{}_x^{(1)} & T_x^{(1)}{}_x^{(2)} \\ T_x^{(2)}{}_y & T_x^{(2)}{}_x^{(1)} & T_x^{(2)}{}_x^{(2)} \end{pmatrix} = \begin{pmatrix} 17.589 & 31.505 & 15.068 \\ 31.505 & 56.436 & 26.990 \\ 15.068 & 26.990 & 12.907 \end{pmatrix}$$

Similarly, within groups (error) sums of squares and sums of products matrix is :

$$E = \begin{pmatrix} E_{yy} & E_{yx}^{(1)} & E_{yx}^{(2)} \\ E_x^{(1)}{}_y & E_x^{(1)}{}_x(1) & E_x^{(1)}{}_x(2) \\ E_x^{(2)}{}_y & E_x^{(2)}{}_x(1) & E_x^{(2)}{}_x(2) \end{pmatrix} = \begin{pmatrix} 1572.163 & 1056.628 & 226.713 \\ 1056.628 & 11092.795 & 446.802 \\ 226.713 & 446.802 & 519.480 \end{pmatrix}$$

Step (iv) - Regression Coefficients and Adjusted Means :

Source of variation	Regression Coefficients				Adjusted Means	
	b_1	b_2	\bar{b}_1	\bar{b}_2	$\bar{y}_1 A$	$\bar{y}_2 A$
Between groups (treatments)	-	-	.081376	.381726	-	-
Within Groups (Error)	.080462	.367217	-	-	11.072	11.417

Step (v) - Adjusted Sum of Squares, Degrees of Freedom, Adjusted Mean Squares and F-Ratio

Source of variation	Adjusted S.S.	d.f.	Adjusted M.S.	F-Ratio
Between Groups (Treatments)	5.019	1	5.019	.604
Within groups (Error)	1403.893	169	8.307	

From the table d.f. 1/169
F at .05 level = 3.90

Since the obtained value of F, .604, is less than the table value of 3.90 at .05 level of significance, the hypothesis (H_0 3.1) that there is no significance difference in ^{mean} achievement

at knowledge level between students exposed to verbal teaching. behaviour patterns of E_1 and E_2 groups of teachers is retained.

(b) Significance of difference at understanding level(U) :

Step (i) - Sums of Squares

Variables	Source of variation	d.f.	S.S.
y = Achievement(U)	Between groups	1	59.511
	Within groups	171	642.628
	Total	172	702.139
x ⁽¹⁾ = Intelligence	Between groups	1	56.436
	Within groups	171	11092.795
	Total	172	11149.231
x ⁽²⁾ = Previous Knowledge	Between groups	1	12.907
	Within groups	171	519.480
	Total	172	532.387

Step (ii) - Sums of Products

This involves obtaining all possible sums of products (two variables at a time) in a manner analogous to that by which the sums of squares were obtained. A summary of the results obtained is presented below :

Sums of Products

Product of two variables	Source of variation	Sum of Products
$y_x^{(1)}$	Between groups	57.953
Achievement(U) x Intelligence	Within groups	1041.168
	Total	1099.121
$y_x^{(2)}$	Between groups	2.716
Achievement(U) x Previous Knowledge	Within groups	127.475
	Total	130.191
$x^{(1)}_x^{(2)}$	Between groups	26.990
Intelligence x Previous Knowledge	Within groups	446.802
	Total	473.792

Step (iii) - Sums of Squares and Sums of Products Matrix

Now, between groups (treatments) sums of squares and sums of products matrix is presented below :

$$T = \begin{pmatrix} T_{yy} & T_{yx}^{(1)} & T_{yx}^{(2)} \\ T_x^{(1)}_y & T_x^{(1)}_x^{(1)} & T_x^{(1)}_x^{(2)} \\ T_x^{(2)}_y & T_x^{(2)}_x^{(1)} & T_x^{(2)}_x^{(2)} \end{pmatrix} = \begin{pmatrix} 59.511 & 57.953 & 2.716 \\ 57.953 & 56.436 & 26.990 \\ 2.716 & 26.990 & 12.907 \end{pmatrix}$$

Similarly within groups (error) sums of squares and sums of products matrix is :

$$E = \begin{pmatrix} E_{yy} & E_{yx}^{(1)} & E_{yx}^{(2)} \\ E_{xy}^{(1)} & E_{xx}^{(1)} & E_{xx}^{(2)} \\ E_{xy}^{(2)} & E_{xx}^{(1)} & E_{xx}^{(2)} \end{pmatrix} = \begin{pmatrix} 642.628 & 1041.168 & 127.475 \\ 1041.168 & 11092.795 & 446.802 \\ 127.475 & 446.802 & 519.480 \end{pmatrix}$$

Step (iv) - Regression Coefficients and Adjusted Means

Source of variation	Regression Coefficients				Adjusted Means	
	b_1	b_2	\bar{b}_1	\bar{b}_2	\bar{y}_1^A	\bar{y}_2^A
Between groups (treatments)	-	-	.091657	.162973	-	-
Within groups (Error)	.086990	.170571	-	-	4.702	5.695

Step (v) - Adjusted Sum of Squares, Degrees of Freedom, ^{adjusted} Mean Squares and F-Ratio

Source of variation	Adjusted S.S.	d.f.	Adjusted M.S.	F-Ratio
Between groups (Treatments)	49.866	1	49.866	15.89
Within groups (Error)	530.314	169	3.138	

From the table d.f. 1/169
F at .01 level = 6.81

Since the obtained value of F, 15.89, is more than the table value of 6.81 at .01 level of significance, the hypothesis (H_0 3.2) that there is no significant difference in

mean
 /achievement at understanding level between students exposed
 to verbal teaching behaviour patterns of E_1 and E_2 groups
 of teachers is rejected.

(c) Significance of difference at application
 level (A) :

Step (i) - Sums of Squares

Variables	Source of variation	d.f.	S.S.
y = Achievement (A)	Between groups	1	85.868
	Within groups	171	591.381
	Total	172	677.249
x ⁽¹⁾ = Intelligence	Between groups	1	56.436
	Within groups	171	11092.795
	Total	172	11149.231
x ⁽²⁾ = Previous Knowledge	Between groups	1	12.907
	Within groups	171	519.480
	Total	172	532.387

Step (ii) - Sums of Products

This involves obtaining all possible sums of products
 (two variables at a time) in a manner analogous to that by which
 the sums of squares were obtained. A summary of the results
 obtained is presented below :

Sums of Products

Product of two variables	Source of variation	Sum of Products
$y_x^{(1)}$	Between groups	69.612
Achievement (A) x Intelligence	Within groups	656.752
	Total	726.364
$y_x^{(2)}$	Between groups	33.292
Achievement (A) x Previous Knowledge	Within groups	148.280
	Total	181.572
$x^{(1)}_x^{(2)}$	Between groups	26.990
Intelligence x Previous Knowledge	Within groups	446.802
	Total	473.792

Step (iii) - Sums of Squares and Sums of Products Matrix

Now, between groups (treatment) sums of square and sums of products matrix is presented below :

$$T = \begin{pmatrix} T_{yy} & T_{yx}^{(1)} & T_{yx}^{(2)} \\ T_{x(1)y} & T_{x(1)x(1)} & T_{x(1)x(2)} \\ T_{x(2)y} & T_{x(2)x(1)} & T_{x(2)x(2)} \end{pmatrix} = \begin{pmatrix} 85.868 & 69.612 & 33.292 \\ 69.612 & 56.436 & 26.990 \\ 33.292 & 26.990 & 12.907 \end{pmatrix}$$

Similarly within groups (error) sums of squares and sums of products matrix is :

$$E = \begin{pmatrix} E_{yy} & E_{yx}^{(1)} & E_{yx}^{(2)} \\ E_{xy}^{(1)} & E_{xx}^{(1)} & E_{xx}^{(2)} \\ E_{xy}^{(2)} & E_{xx}^{(1)} & E_{xx}^{(2)} \end{pmatrix} = \begin{pmatrix} 591.381 & 656.752 & 148.280 \\ 656.752 & 11092.795 & 446.802 \\ 148.280 & 446.802 & 519.480 \end{pmatrix}$$

Step (iv) - Regression Coefficients and Adjusted Means

Source of variation	Regression Coefficients				Adjusted Means	
	b_1	b_2	\bar{b}_1	\bar{b}_2	\bar{y}_1A	\bar{y}_2A
Between Groups (Treatments)	-	-	.052647	.294199	-	-
Within Groups (Error)	.049420	.242933	-	-	4.976	6.170

Step (v) - Adjusted sum of Squares, Degrees of Freedom, Adjusted Mean Squares and F-Ratio

Source of variation	Adjusted S.S.	d.f.	Adjusted M.S.	F-Ratio
Between Groups (Treatments)	62.687	1	62.687	20.26
Within Groups (Error)	522.904	169	3.094	

From the table d.f. 1/169
F at .01 level = 6.81

Since the obtained value of F, 20.26, is more than the table value of 6.81 at .01 level of significance, the hypothesis (H_0 3.3) that there is no significant difference

mean in/achievement at application level between students exposed to verbal teaching behaviour patterns of E_1 and E_2 of teachers is rejected.

With the results given so far, the calculation of significance of difference between mean achievement scores at K, U and A levels in E_1 and E_2 groups of students is complete. A summary of the results is presented in the following table :

Table 7.8
Summary of Results (Groups E_1 and E_2)

Achievement	Degree of Freedom	F	Level of Significance
(a) Knowledge	1/169	.604	Not significant
(b) Understanding	1/169	15.89	Significant at .01 level
(c) Application	1/169	20.26	Significant at .01 level

The results given in the above table reveal that difference in mean achievement between E_1 and E_2 groups of students was not significant at knowledge level. However, significant difference, at .01 level of significance, was observed between these two groups of students both at the understanding and application levels of achievement meaning thereby that real difference existed in the mean achievement between E_1 and E_2 groups of students at these two levels of achievement.

7.3 DISCUSSION :

Attempt will now be made to seek inferential interpretation of the results presented so far in this chapter with regard to comparisons of verbal teaching behaviour patterns (7.1) and achievement at K, U and A levels (7.2) between E_1 and E_2 groups. The approach of this discussion will be similar to that adopted in the two preceding chapters.

Three null hypotheses were laid down for statistical testing. First the results of the testing of these hypotheses are presented followed by discussion :

H_0 3.1 There is no significant difference in mean
Retained achievement at knowledge level of students
 exposed to verbal teaching behaviour patterns
 of E_1 and E_2 groups of teachers.

The obtained value of F was .604. This value is not significant at .05 level of significance and, thus, the above hypothesis (H_0 3.1) is retained. This means that there is no true difference in the mean achievement scores at knowledge level between E_1 and E_2 groups of students and, that, whatever difference was obtained, that could be expected by chance.

H_0 3.2 There is no significant difference in mean
Rejected achievement at understanding level of students
 exposed to verbal teaching behaviour patterns
 of E_1 and E_2 groups of teachers.

The obtained value of F was 15.89. This value is significant at .01 level of significance and, thus, the above hypothesis (H_0 3.2) is rejected. This means that there is a real difference in the mean achievement scores at understanding level between E_1 and E_2 groups of students.

H_0 3.3

Rejected

There is no significant difference in mean achievement at application level of students exposed to verbal teaching behaviour patterns of E_1 and E_2 groups of teachers.

The obtained value of F was 20.26. This value is significant at .01 level of significance and, thus, the above hypothesis (H_0 3.3) is rejected. This means that there is a real difference in the mean achievement scores at application level between E_1 and E_2 groups of students.

The results of the comparison of verbal teaching behaviour patterns of E_1 and E_2 groups of teachers are now discussed so as to draw an inference about no true difference in the mean achievement at knowledge level and real difference in the mean achievement at understanding and application levels between E_1 and E_2 groups of students (table 7.8). In 14-category comparison (table 7.2) significant difference at .05 level of significance was observed in favour of E_2 group of teachers for such teaching behaviours as asking divergent question (Cat. 4c) and lecturing (Cat. 5). It was further observed that asking evaluative questions (Cat. 4d), was used by all the E_2

group of teachers whereas in the case of 2 out of 3 E_1 group of teachers this teaching behaviour was absent and even in 1 E_1 group teacher occurrence of Cat. 4d was rare (0.14%). When only 11 teacher-talk categories were compared (table 7.4), the same trend in results was obtained for asking divergent questions (Cat. 4c) and evaluative questions (Cat. 4d). Even when verbal teaching behaviour pattern were considered in terms of ratios (table 7.6) the above trend in results was again observed for TQR (4c) and TQR (4d) that represent the tendency of the teachers to ask divergent and evaluative questions respectively. In addition to this, content cross ratio (CRR), that gives an indication of the role of the teacher in the class discussion, was found significant at .05 level of significance revealing that as compared to E_1 group of teachers all the E_2 group of teachers took less active role in the class discussion. This less active role of the teacher is understandable keeping in view significantly less of lecturing (Cat. 5) by them and significantly more of students' response (Cat. 8) following teacher talk (table 7.2).

As regards criterion variable, it was stated earlier that no true difference was observed in mean achievement at knowledge level between E_1 and E_2 groups of students whereas real difference between these two groups was observed in mean achievement at understanding and application levels. These results are similar to those observed with respect to C and E_2 groups of students. A closer look at the comparison of verbal teaching behaviour patterns of E_1 and E_2 groups of teachers and C and E_2 groups of teachers reveal interesting similarities

about verbal teaching behaviour patterns. For example, (i) tendency for asking divergent questions (Cat. 4c), was significant at .05 level of significance in favour of E_2 group of teachers in both the comparisons (ii) tendency to ask evaluative questions (Cat. 4d) was present in all the E_2 group of teachers whereas it was absent in all the C group of teachers or was present in a small degree in just 1 out of 3 E_1 group of teachers. Again, although E_2 group of teachers as compared to C group of teachers showed significant use of praising and encouraging pupils (Cat. 2) and providing confirmatory feedback (Cat. 3a) when 14 categories or 11 teacher-talk categories were compared yet when comparisons were made in terms of ratios it was found that (i) teacher tendency to react to ideas and feelings of the pupils (TRR) of which category 2 and category 3a are the components and (ii) teacher tendency to provide confirmatory feedback to the pupils at the moment they stop talking (TIFbR89-confirmatory) were not significant. These results about TRR and TIFbR89-confirmatory between C and E_2 group of teachers is again similar to those obtained between E_1 and E_2 groups of teachers. If it is accepted that significant teaching behaviour patterns in C and E_2 groups of teachers were similar to those between E_1 and E_2 groups of teachers it appears the similarities in achievement at K, U and A levels between E_1 and E_2 groups of students, attributable to verbal teaching behaviour patterns, can be interpreted in the same way as was done in the case of C and E_2 groups of teachers (Chapter six). More important than this, the similarities in results obtained between E_1 and E_2 groups further strengthen the interpretation presented with

respect to C and E₂ groups in the preceding chapter. Since, in terms of significance, asking divergent questions (Cat.4c) was common in both the patterns and also evaluative questions were frequently used by all the three E₂ groups of teachers, it appears these two teaching behaviours significantly affected pupil achievement at understanding and application levels.