CHAPTER FIVE

ANALYSIS OF THE DATA,

RESULTS AND DISCUSSION

I - FOR CONTROL AND EXPERIMENTAL

No.1 GROUPS (C AND $E_1$ GROUPS)

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I  -  FOR CONTROL AND EXPERIMENTAL No. 1,
       GROUPS  ( C AND $E_1$ GROUPS )

This and the next two chapters are devoted to the presentation of the results obtained in the present study which are followed by discussion thereon with a view to seeking interpretation as to why the results turned out to be what they are. In each of these three chapters results related to (I) C and $E_1$ groups, (II) C and $E_2$ groups and (III) $E_1$ and $E_2$ groups have been presented separately.

The present chapter, thus, is devoted to results and discussion related to Control and Experimental No.1 groups (C and $E_1$ groups). In this chapter, however, an additional attempt has been made to present a brief description of different statistical methods employed by the investigator to analyse the data.

5.1      <u>ANALYSIS OF THE DATA</u> :

In conformity with the design of the study, analyses of the data were carried on with regard to :

(a)      the direction and significance of difference in verbal teaching behaviour patterns experimentally manipulated between C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of teachers,

(b)      the extent and significance of difference in mean achievement at knowledge, understanding and application levels of cognitive operations between C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of students exposed to verbal teaching behaviour patterns of C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of teachers respectively.

A brief discussion of statistical analysis of data with respect to (a) and (b) above now follows :-

(a)      In order to estimate the direction and significance of difference in verbal teaching behaviour patterns in C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of teachers, the following statistical methods were adopted :

(i)      Following the procedure of matrix preparation, (Flanders, 1970), one master matrix based on 8 sequential lessons taught by a teacher was prepared for each teacher. Thus 9 master matrices were prepared in which 3 master matrices, representing verbal teaching behaviour patterns, belonged to each of the three groups of teachers. The tallies of teaching behaviour events obtained under each column in the matrices

were then converted into percentages for further computational purposes.

(ii)    The median test was used to test the hypotheses that C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of teachers would have the same median on each category or category pattern. In the use of this non-parametric statistics, the investigator was guided by the work reported by Pareek and Rao (1971) who used median test to "test the hypothesis that the experimental teachers before training (pretraining) and the control teachers (post training) would have the same median on each category." Since the total number of cases in both groups (e.g. C + $E_1$, C + $E_2$ and $E_1$ + $E_2$) was small ( 3 + 3 = 6 ), it was considered appropriate, following a suggestion by Siegel (1956), to apply Fisher exact probability test instead of chi-square test, to test the hypothesis of no true difference in medians of two groups, $H_0$.

(b)    In order to estimate the extent and significance of difference in mean achievement at knowledge, understanding and application levels between C and $E_1$, C and $E_2$, and $E_1$ and $E_2$ groups of students so as to test the different hypotheses laid down in chapter three, analysis of covariance was applied to the relevant data. "Analysis of covariance is a form of analysis of variance that tests the significance of the differences between means of final experimental data by taking into account and adjusting initial differences in the data," (Kerlinger,1964). "Analysis of covariance represents an extension of analysis of variance to allow for the correlation between initial and final scores. Covariance analysis is especially useful to

x experimental psychologists when for various reasons it is impossible or quite difficult to equate control and experimental groups at the start: a situation which often obtains in actual experiments. Through covariance analysis one is able to effect adjustments in final or terminal scores which will allow for differences in some initial variable," (Garrett, 1958).

In the present study, it was hypothesized that besides verbal teaching behaviour patterns, variables like previous knowledge and intelligence of the students were also related to students achievement. In order to adjust the final achievement scores for initial differences among students in previous knowledge and intelligence, it was considered appropriate to apply covariance analysis to the data. Thus in this study, previous knowledge (measured by PKT) and intelligence of the students (measured by intelligence test) were the two concomitant variables whose influence on the criterion variable (measured by achievement test) needed statistical control. This could be achieved by applying analysis of covariance. For applying this statistical method to the relevant data, the investigator followed the procedure suggested by Pesternack and Charen (1969) wherein they have discussed different computational steps of analysis of covariance involving two concomitant variables.

Analysis of covariance assumes some amount of correlation between a concomitant variable and a criterion variable. So, as a first step to the use of this method, it was decided

to estimate degree of relationship between previous knowledge and achievement at three levels as well as relationship between intelligence and achievement at three levels. This was achieved by computing coefficients of correlation by product-moment method (Garrett, 1958).

5.2      .COMPARISON OF DIFFERENCE IN VERBAL TEACHING
         BEHAVIOUR PATTERNS :

To find out the direction and significance of difference in teaching behaviours, the verbal teaching behaviour patterns of C and $E_1$ groups of teachers were compared. Results of various comparisons are presented in the tables 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 between C and $E_1$ groups of teachers. Table 5.1 contains a comparative statement of percentage occurrence of these categories and table 5.2 gives the results of median test applied to the data of table 5.1.

Table 5.1

Percentage occurrence of all the 14 categories in C and $E_1$ Groups of Teachers

| Teachers | | 1 | 2 | 3a | 3b | 4a | 4b | 4c | 4d | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | C A T E G O R I E S | | | | | | | |
| C | 1. | 0.00 | 0.87 | 1.46 | 1.74 | 6.26 | 3.96 | 1.02 | 0.00 | 48.56 | 2.16 | 0.55 | 23.80 | 0.50 | 9.12 |
| | 2. | 0.00 | 0.11 | 2.09 | 0.64 | 4.65 | 0.29 | 0.00 | 0.00 | 84.49 | 0.24 | 0.00 | 5.79 | 0.05 | 1.64 |
| | 3. | 0.00 | 0.44 | 2.61 | 1.48 | 2.93 | 1.10 | 0.44 | 0.00 | 67.33 | 2.62 | 0.23 | 7.75 | 1.68 | 11.29 |
| $E_1$ | 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 |
| | 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 | 3.31 | 1.12 | 3.28 | 0.90 | 0.24 | 0.00 | 64.51 | 5.02 | 0.48 | 10.54 | 3.20 | 6.78 |

Note : In the process of rounding off the values to two decimals 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 14 categories given in table 5.1 in order to test the direction of difference and significance of difference as a result of training $E_1$ group of teachers in the use of certain selected verbal teaching behaviours. The results obtained are given in the table below which are followed by explanation.

Table 5.2

Mean percentage occurrence of 14 categories, direction of difference and significance of difference in C and $E_1$ group of teachers.

| Category | Teachers | Mean percentage of occurrence of the category | Direction of difference | Significance of difference |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1. | C | 0.00 | Occurrence absent in C group and very small, 0.21% in one out of three teachers in $E_1$ group. | -- |
|  | $E_1$ | 0.07 | | |
| 2. | C | 0.47 | In about 67% of the combined matrices Cat.2 was above common median in $E_1$ group of teachers | N.S. |
|  | $E_1$ | 1.77 | | |
| 3a. | C | 2.05 | In 100% of the combined matrices Cat.3 was above common median in $E_1$ group of teachers. | Sig.at .05 level |
|  | $E_1$ | 3.36 | | |
| 3b. | C | 1.29 | In about 67% of the combined matrices Cat.3b was below common median in $E_1$ group of teachers. | N.S. |
|  | $E_1$ | 1.05 | | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 4a. | C | 4.61 | In about 67% of the combined matrices Cat. 4a was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 5.57 | | |
| 4b. | C | 1.78 | In about 67% of the combined matrices Cat. 4b was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 2.13 | | |
| 4c. | C | 0.49 | In about 67% of the combined matrices Cat. 4c was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 0.60 | | |
| 4d. | C | 0.00 | Occurrence absent in C group and very small, 0.14%, in one out of three teachers in $E_1$ group. | — |
| | $E_1$ | 0.05 | | |
| 5. | C | 66.79 | In about 67% of the combined matrices Cat. 5 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 57.04 | | |
| 6. | C | 1.67 | In about 67% of the combined matrices cat. 6 was below common median in $E_1$ group of teachers | N.S. |
| | $E_1$ | 2.39 | | |
| 7. | C | 0.26 | In about 67% of the combined matrices Cat.7 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 0.22 | | |
| 8. | C | 12.45 | In about 67% of the combined matrices Cat. 8 was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 17.03 | | |
| 9. | C | 0.74 | In about 67% of the combined matrices Cat.9 was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 1.55 | | |
| 10. | C | 7.35 | In about 67% of the combined matrices Cat. 10 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 7.13 | | |

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

In table 5.2 above, results of difference in all the 14 verbal interaction behaviours between C and $E_1$ groups of teachers are presented. The mean percentage of occurrence of each category gives an idea of average trend in occurrence of each category for the two groups of teachers. Direction of difference and the significance of difference in the next two columns give an idea of training effect and statistical significance of the training effect respectively between these two groups of teachers.

Category 1, accepting the feelings of the students, was found absent in the verbal teaching behaviour of C group of teachers whereas in $E_1$ group it was observed to the extent of 0.21% in the case of only one out of three teachers. It appears training had very small effect on $E_1$ group of teachers in using this category. Occurrence of category 2, praising or encouraging, was rare in C group of teachers whereas in $E_1$ group of teachers incidence of this category was higher. In 2 out of 3 $E_1$ group of teachers (about 67%) the incidence of this category was above the common median indicating training effect which was, however, found to be not significant. Category 3a, providing confirmatory feedback, was found to occur significantly more (.05 level of significance) in $E_1$ group of teachers. In all the three combined matrices category 3a was above common median in $E_1$ group of teachers indicating significant difference between C and $E_1$ groups/of teachers with regard to this teaching behaviour. Category 3b, providing corrective feedback, gives a somewhat different picture in the sense that the incidence of this category in 2 out of the 3 combined matrices of $E_1$ group of teachers

was below common median. Although this value was not signifi-
cant, training seems to have somewhat no effect on changing this
behaviour. So far as category 4a, asking cognitive memory
questions is concerned, in about 67% of the combined matrices
this category was found to be below common median in $E_1$ group
of teachers. Although the difference is not significant, it
indicates lesser use of this category by $E_1$ group teachers. With
regard to category 4b, asking convergent question, the direction
of difference was in favour of $E_1$ group of teachers because in
about 67% of the combined matrices this category was found above
common median in $E_1$ group of teachers. The difference, however,
was not significant. Incidence of category 4c, asking divergent
questions, had been quite low in both the groups. Within this
low incidence of occurrence of category 4c, in about 67% of the
combined matrices this category was found above common median
in $E_1$ group of teachers. Although the difference was not signi-
ficant, its direction indicates the effect of training in favour
of $E_1$ group of teachers. Category 4d, asking evaluative ques-
tions, was altogether absent in both the groups. This indicates
that training had no effect on $E_1$ group of teachers as far as
asking evaluative questions was concerned. The occurrence of
category 5, lecturing, was found to be less in $E_1$ group of
teachers as compared to C group of teachers. Although this
difference was not found to be statistically significant, in
about 67% of the combined matrices, category 5 was found to be
below common median in $E_1$ group of teachers. Similarly, though
the difference in the occurrence of category 6, giving direction,
in both the groups was not statistically significant, in about

67% of the combined matrices, this category was below common median in $E_1$ group of teachers indicating the use of this category by lesser number of $E_1$ group teachers as against C group of teachers. The occurrence of category 7, criticising or justifying authority, was quite low in both the groups which indicates that, in both the groups, the teachers used this category very rarely. The difference, though in favour of $E_1$ group of teachers, was not significant for this category. Occurrence of category 8, student-talk in response to teacher-talk, was found to be not significantly different in C and $E_1$ groups of teachers although in about 67% of the combined matrices, category 8 was found above common median in $E_1$ group of teachers which means that the number of classes in which students used this category and were taught by $E_1$ group of teachers were more than the number of classes taught by C group of teachers. Use of category 9, student initiating talk, was found in more classes taught by $E_1$ group of teachers as compared to classes taught by C group of teachers although the difference was not statistically significant. Also the occurrence of this category was nil in the case of one C group of teacher and quite low in the case of other two teachers of this group. The difference in the occurrence of category 10, silence or confusion, between C and $E_1$ groups of teachers was also found to be not significant, although, in about 67% of the combined matrices this category was below common median in $E_1$ group of teachers.

To summarize the above results : (i) significant difference at .05 level of significance was found in category 3a only, (ii) difference in the intended direction amongst $E_1$ group of teachers was observed in categories 2, 4b, 4c, 5 and 6 although these differences were not found to be significant, (iii) occurrence of categories 1 and 4d was either nil or rare in these groups of teachers, (iv) occurrence of category 7 was also nil or rare in these groups of teachers, (v) differences were also observed in the predicted direction in the occurrence of categories 8, 9 and 10 although these differences were not significant, (vi) in the case of category 3b training did not change this behaviour in the predicted direction. In the combined matrices 2 out of 3 teachers of $E_1$ group, this category was found below common median.

2.    Direction and significance of difference
      in Teacher-Talk Categories

The results given in this section deals with comparison of teacher-talk categories only between C and $E_1$ groups of teachers. Table 5.3 contains a comparative statement of percentage occurrence of teacher-talk categories and table 5.4 gives the results of median test applied to the data of table 5.3.

Table 5.3

Percentage Occurrence of 11 Teacher-talk Categories in C and $E_1$ Groups of

Teachers

| Teachers | | 1 | 2 | 3a | 3b | 4a | 4b | 4c | 4d | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | 1. | 0.00 | 1.31 | 2.18 | 2.62 | 9.40 | 5.94 | 1.53 | 0.00 | 72.92 | 3.23 | 0.83 |
| | 2. | 0.00 | 0.11 | 2.26 | 0.68 | 5.02 | 0.31 | 0.00 | 0.00 | 91.33 | 0.25 | 0.00 |
| | 3. | 0.00 | 0.55 | 3.29 | 1.86 | 3.69 | 1.39 | 0.58 | 0.00 | 84.94 | 3.37 | 0.29 |
| $E_1$ | 1. | 0.00 | 2.86 | 3.57 | 1.73 | 6.06 | 5.38 | 1.24 | 0.18 | 76.94 | 1.80 | 0.18 |
| | 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 |

CATEGORIES

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 11 categories in order to test the direction and significance of difference as a result of training in the use of certain types of teaching behaviours. The results thus obtained are given in the table below :

Table 5.4

Mean percentage of occurrence of 11 teacher-talk categories, direction of difference and significance of difference in C and $E_1$ group of teachers

| Category | Teachers | Mean percentage of occurrence of the category | Direction of difference | Significance of difference |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1. | C | 0.00 | No occurrence in C group and 0.26% occurrence in only 1 out of 3 $E_1$ group of teachers. | — |
|  | $E_1$ | 0.09 | | |
| 2. | C | 0.66 | In about 67% of the combined matrices Cat. 2 was above common median in $E_1$ group of teachers. | N.S. |
|  | $E_1$ | 2.45 | | |
| 3a. | C | 2.58 | In 100% of the combined matrices Cat. 3a was above common median in $E_1$ group of teachers. | Sig.at .05 level |
|  | $E_1$ | 4.57 | | |
| 3b. | C | 1.72 | In about 67% of the combined matrices Cat. 3b was below common median in $E_1$ group of teachers. | N.S. |
|  | $E_1$ | 1.42 | | |
| 4a. | C | 6.04 | In about 67% of the combined matrices Cat. 4a was above common median in $E_1$ group of teachers. | N.S. |
|  | $E_1$ | 7.74 | | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 4b. | C | 2.55 | In about 67% of the combined matrices Cat. 4b was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 2.88 | | |
| 4c. | C | 0.70 | In about 67% of the combined matrices Cat. 4c was above common median in $E_1$ group of teachers | N.S. |
| | $E_1$ | 0.82 | | |
| 4d | C | 0.00 | No occurrence in C group and 0.18% of occurrence in only 1 out of 3 $E_1$ group of teachers. | — |
| | $E_1$ | 0.06 | | |
| 5. | C | 83.06 | In about 67% of the combined matrices Cat. 5 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 76.55 | | |
| 6. | C | 2.28 | In about 67% of the combined matrices Cat. 6 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 3.10 | | |
| 7. | C | .37 | Occurrence small although in about 67% of the combined matrices Cat. 7 was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | .27 | | |

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

The results obtained in table 5.4 above with respect to teacher talk categories revealed that, except for category 4a, the trend was the same as was observed when all the 14 categories were analysed. Significant difference was found in the case of category 3a only (providing confirmatory feedback). For category 3b, providing corrective feedback, 2 teachers in $E_1$ group as against 1 teacher in C group were below common median which indicates that despite training to use more of

category 3b behaviours, less number of $E_1$ group of teachers used this category as compared to C group of teachers, although, the difference was not significant. The results with respect to categories 2, 4b, 4c, 5, 6 and 7 were also the same as were obtained in the case of analyses of all the 14 categories given in table 5.2. However, in the case of category 4a, asking cognitive memory questions, the trend of direction of change was reversed. That is, whereas in 14 category analyses in about 67% of the combined matrices category 4a was below common median, in 11 category analyses in about 67% of the combined matrices this category was found above common median in $E_1$ group of teachers. This resulted from the percentages of category 4a, moving up in the case of one of the teachers in $E_1$ group when student-talk (8 and 9) and silence / confusion (10) categories were not considered.

3.　　Direction and Significance of Difference in Selected Verbal Teaching Behaviour Patterns :

As discussed in the procedure of the study, teachers in $E_1$ and $E_2$ groups were given varying degree of training in the theory and practice of interaction process analysis with a view to bringing about systematic difference amongst different groups of teachers in selected verbal teaching behaviour patterns such as general indirectedness, verbal feedback and questioning. The results obtained with respect to these selected verbal teaching behaviour patterns in C and $E_1$ groups of teachers are given in the table below :

Table 5.5

Percentage Occurrence of Selected Verbal Teaching Behaviour Patterns

in C and E₁ Groups of Teachers

| Teachers | | TRR | TIFbR-89 (Total) | TIFbR-89 (Con.) | TIFbR-89 (Cor.) | PATTERNS | | | | | CCR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | TQR (Total) | TQR (4a) | TQR (4b) | TQR (4c) | TQR (4d) | |
| C | 1. | 60.09 | 67.44 | 27.81 | 39.53 | 18.80 | 11.42 | 7.54 | 2.06 | 0.00 | 75.91 |
| | 2. | 92.34 | 97.14 | 75.24 | 21.90 | 5.52 | 5.21 | 0.34 | 0.00 | 0.00 | 97.08 |
| | 3. | 60.93 | 91.03 | 59.31 | 31.72 | 6.27 | 4.17 | 1.61 | 0.68 | 0.00 | 80.89 |
| Mean | | 71.12 | 85.20 | 54.12 | 31.05 | 10.20 | 6.93 | 3.16 | 0.91 | 0.00 | 84.63 |
| E₁ | 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 |

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 table 5.5 above to test the direction and significance of difference. The findings are given below :

Table 5.6

Mean percentage of occurrence of selected verbal teaching behaviour patterns, direction of difference and significance of difference in C and $E_1$ Groups of Teachers

| Patterns | Teachers | Mean percentage occurrence of Patterns | Direction of difference | Significance of difference |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| TRR | C | 71.12 | In about 67% of the combined matrices TRR was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 76.36 | | |
| TIFbR89 (Total) | C | 85.20 | In about 67% of the combined matrices TIFbR was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 73.31 | | |
| TIFbR89 (Con.) | C | 54.12 | In about 67% of the combined matrices TIFbR(Con.) was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 54.60 | | |
| TIFbR89 (Cor.) | C | 31.05 | In about 67% of the combined matrices TIFbR(Cor.) was below common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 18.70 | | |
| TQR(Total) | C | 10.20 | In about 67% of the combined matrices TQR(Total) was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 13.03 | | |
| TQR(4a) | C | 6.93 | In about 67% of the combined matrices TQR(4a) was above common median in $E_1$ group of teachers. | N.S. |
| | $E_1$ | 9.18 | | |

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| TQR(4b) | C | 3.16 | In about 67% of the combined matrices TQR(4b) was above | N.S. |
| | $E_1$ | 3.60 | common median in $E_1$ group of teachers. | |
| TQR(4c) | C | 0.91 | In about 67% of the combined matrices TQR(4c) was above | N.S. |
| | $E_1$ | 1.08 | the common median in $E_1$ group of teachers. | |
| TQR(4d) | C | 0.00 | Occurrence nil in C group of teachers and .24% in one out | — |
| | $E_1$ | 0.08 | of three $E_1$ group of teachers. | |
| CCR | C | 84.63 | In about 67% of the combined matrices CCR was below common | N.S. |
| | $E_1$ | 77.79 | median in $E_1$ group of teachers. | |

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

The values of ten different ratios given in the table 5.5 were calculated on the basis of the formulae suggested by Flanders (1970). However, for the calculation of some of these ratios the formulae had to be suitably modified. These ten ratios and the results of median test obtained in table 5.6 are explained as below :

(i)      The teacher response ratio (TRR) is an index which "corresponds to the teachers' tendency to react to the ideas and feelings of the pupils" and gives an estimate of general indirectedness in teaching behaviour. The TRR was calculated by adding category frequencies 1 + 2 + 3a + 3b, multiplying by 100, and dividing by the sum of 1 + 2 + 3a + 3b + 6 + 7. Looking at the table 5.6, it was found that in about 67% of the combined matrices, this ratio was above common median in the case of $E_1$ group of

teachers. That is, 2 out of 3 teachers in $E_1$ group showed general indirectedness in their teaching behaviour as compared to 1 out of 3 teachers in C group, although this difference was not found to be significant.

(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 the pupils stop talking. The TIFbR89 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 was below common median in $E_1$ group of teachers indicating that despite training to use more of verbal feedback only 1 out of 3 $E_1$ group of teachers used this behaviour more frequently as compared to 2 out of 3 teachers in C group. This difference was, however, not found to be significant.

(iii)      The teacher instantaneous confirmatory feedback ratio (TIFbR89-Confirmatory) in an index of the tendency of the teacher to provide confirmatory feedback to the pupils at the moment the pupils stop talking. The TIFbR89(Con.) was calculated by adding the 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, columns 1, 2, 3a, 3b, 6 and # 7. The result revealed that in about 67% of the combined matrices this ratio was above common median in $E_1$ group of teachers, that is, 2 out of 3 teachers of $E_1$ group showed confirmatory feedback behaviours more frequently as compared to 1 out of 3 teachers of

C group. The difference was, however, not found to be signifi-
cant.

(iv)      The teacher instantaneous corrective feedback ratio
(TIFbR89-Corrective) is an index of the tendency of the teacher
to provide corrective feedback in a non-threatening way to the
pupils at the moment the pupils 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 this ratio was below common median in $E_1$ group
indicating that 2 out of 3 teachers in C group showed this
behaviour more frequently as compared to 1 out of 3 $E_1$ group of
teachers. Though this difference was not found to be signifi-
cant, training did not have positive influence on $E_1$ group of
teachers.

(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
discussion." The TQR(total) was calculated by adding category
frequencies 4a, 4b, 4c, 4d, multiplying by 100, and dividing by
the sum of category frequencies 4a, 4b, 4c, 4d and 5. It was
found that in about 67% of the combined matrices this ratio was
above common median in $E_1$ group of teachers indicating that 2
out of 3 teachers of $E_1$ group used this category more as compared
to 1 out of 3 teachers of C group. However, the difference in
favour of $E_1$ group of teachers after training was not found
significant.

(vi)      The teacher question ratio, TQR(4a), is an index of the tendency of the teachers to ask cognitive memory questions. The TQR(4a) was calculated by multiplying cell frequencies in 4a by 100 and dividing this value by frequencies in cell 4a + 5. It was found that in about 67% of the combined matrices TQR (4a) was above common median in $E_1$ group of teachers. Training appears to have brought about more variation in asking cognitive memory questions in $E_1$ group of teachers, although this variation was not found to be significant.

(vii)     The teacher question ratio TQR(4b), is an index of the tendency of the teachers to ask convergent type of questions. The TQR(4b) was calculated by multiplying cell frequencies in 4b by 100 and dividing this value by frequencies in 4b and 5. The result revealed that in about 67% of the combined matrices this ratio was above common median in $E_1$ group of teachers. Training appears to have brought about more variation in asking convergent type questions in $E_1$ group of teachers, although, this variation was not found to be significant.

(viii)    The teacher question ratio, TQR(4c), is an index of the tendency of the teachers to ask divergent type of questions. The TQR (4c) was calculated by multiplying cell frequencies in 4c by 100 and dividing this value by frequencies in 4c and 5. The result revealed that the incidence of this behaviour was relatively small in both the groups of teachers. It was further found that in about 67% of the combined matrices this category was above common median in $E_1$ group of teachers although this difference as compared to C group of teacher was not found to be significant.

(ix)     The teacher question ratio, TQR(4d), is an index of
the tendency of the teachers to ask evaluative type of ~~qeu~~ ques-
tions. This ratio was calculated by multiplying cell frequencies
in 4d by 100 and dividing this value by frequencies in 4d and 5.
This category was absent in all the three C group of teachers
and/2 out of 3 $E_1$ group of teachers. Comparison, therefore,
appeared unwarranted.

(x)     The content cross ratio (CCR) gives an indication of
the focus of class discussion on subject matter. An exceptionally
high CCR reveals that the teacher took a "very active role in the
discussion, and that attention to motivation and discipline pro-
blem was at the minimum." CCR is calculated by adding all fre-
quencies in column and row of category 4 and 5, multiplying by
100, and dividing by sum of all the categories. The result
revealed that in about 67% of the combined matrices CCR was below
common median in $E_1$ group of teachers indicating that 2 out of
3 E group of trained teachers used this behaviour less as compared
to 1 out of 3 C group of teachers.

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

Now we take up the second part of the results obtained
on the basis of analysis of the data of students' achievement.
This part presents a comparison of mean achievement at knowledge
(K), understanding (U) and application (A) levels of C and $E_1$
groups of students exposed to verbal teaching behaviour patterns
of C and $E_1$ groups of teachers. Following the scheme of making
comparison between two groups of teachers at a time carried on

in 5.2, mean achievement at K, U and A levels of two correspond-ing groups of students were compared. Thus in all 3 comparisons were obtained.

Before results of the comparison of mean achievement is presented, it may be appropriate to get an idea about the direction and amount of relationship between the two concomitant variables and achievement. Similarly it may not be out of place to get an idea about the observed and adjusted mean differences in achievement between C and $E_1$ groups of students. The relevant results are, therefore, presented as below :

1.       Correlation between two concomitant variables
         and achievement at three levels :

In order to find out degree of relationship between previous knowledge and achievement and intelligence and achieve-ment, co-efficient of correlation was calculated by using the product-moment method,(Garrett, 1958, pp. 134-139). The obtained values of rs' are given in the following table :

Table 5.7

Product-moment correlation co-efficient(rs')
between concomitant variables and achievement

| Concomitant variables | C group students Achievement levels | | | $E_1$ group students Achievement levels | | | $E_2$ group students Achievement levels | | |
|---|---|---|---|---|---|---|---|---|---|
| | K | U | A | K | U | A | K | U | A |
| Previous knowledge | 0.38 | 0.27 | 0.37 | 0.43 | 0.15 | 0.24 | 0.09 | 0.18 | 0.24 |
| Intelli-gence | 0.19 | 0.13 | 0.21 | 0.25 | 0.24 | 0.11 | 0.17 | 0.17 | 0.18 |

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

The correlation coefficient values obtained indicate, the following trend :

(a)     all the values were positive indicating positive trend of relationships between (i) achievement (all the three levels) and previous knowledge and (ii) achievement (all the three levels) and intelligence.

(b)     the values of rs' between achievement and previous knowledge ranged from 0.09 to 0.43.

(c)     the values of rs' between achievement and intelligence ranged from 0.11 to 0.25.

2.     Observed and Adjusted Mean Differences in Achievement :

Observed mean differences between C and $E_1$ groups were computed to get an idea of the general trend in these mean differences with respect to all the three levels of achievement. Similarly the adjusted mean differences at three levels of achievement were obtained following the application of covariance analysis. These results are given in the following table in comparative perspective :

Table 5.8

Summary of the Observed and Adjusted Mean Differences in Achievement

| Achievement levels | Observed mean differences C and $E_1$ groups of students | | | Adjusted mean differences C and $E_1$ groups of students | | |
|---|---|---|---|---|---|---|
| | C | $E_1$ | Diff. | C | $E_1$ | Diff. |
| K | 11.315 | 10.935 | 0.380 | 11.391 | 10.802 | 0.589 |
| U | 4.632 | 4.624 | 0.008 | 4.628 | 4.605 | 0.023 |
| A | 5.232 | 4.850 | 0.382 | 5.209 | 4.946 | 0.263 |

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

3.        <u>Calculation of Significance of Difference</u>
          <u>between Mean Achievement at K, U and A</u>
          <u>levels in C and E₁ group of students</u>   :

          In order to determine the significance of the differ-
ence between mean achievement scores of two groups of students,
after adjusting for initial differences in previous knowledge
and intelligence, analysis of covariance technique was applied
(Pesternack and Charens, 1969). The stepwise summary of the
results obtained for calculating significance of difference in
$S$   mean achievement between C and $E_1$ group of students for each of
the K, U and A levels are presented below :

(a)       <u>Significance of difference at knowledge level (K)</u> :

          <u>Step (i)</u> -  <u>Sums of Squares</u>

| Variables | Source of variation | d.f.(degree of freedom) | S.S. Sum of squares |
|---|---|---|---|
| y = Achievement (K) | Between groups (treatments) | 1 | 6.794 |
| | Within groups (error) | 186 | 1610.142 |
| | Total (sum) | 187 | 1616.936 |
| $x^{(1)}$= Intelligence | Between groups (treatments) | 1 | 113.313 |
| | Within groups (error) | 186 | 14464.554 |
| | Total (sum) | 187 | 14577.867 |
| $x^{(2)}$= Previous Knowledge | Between groups (treatment) | 1 | 14.634 |
| | Within groups (error) | 186 | 601.217 |
| | Total (sum) | 187 | 615.851 |

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 sums of products are presented as below :

Sums of Products

| Product of two variables | Source of variation | Sum of Products |
|---|---|---|
| $yx^{(1)}$ Achievement x Intelligence (K) | Between groups | 27.752 |
| | Within groups | 1327.610 |
| | Total | 1355.362 |
| $yx^{(2)}$ Achievement x Previous (K) Knowledge | Between groups | - 10.009 |
| | Within groups | 366.350 |
| | Total | 356.341 |
| $x^{(1)}x^{(2)}$ Intelligence x Previous Knowledge | Between groups | - 40.869 |
| | Within groups | 318.273 |
| | Total | 277.404 |

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

Now between groups (treatments) sum of squares and sum of products matrix is presented as below :

$$T = \begin{pmatrix} Tyy & Tyx^{(1)} & Tyx^{(2)} \\ Tx^{(1)}y & Tx^{(1)}x^{(1)} & Tx^{(1)}x^{(2)} \\ Tx^{(2)}y & Tx^{(2)}x^{(1)} & Tx^{(2)}x^{(2)} \end{pmatrix} = \begin{pmatrix} 6.794 & 27.752 & -10.009 \\ 27.752 & 113.313 & -40.869 \\ -10.009 & -40.869 & 14.634 \end{pmatrix}$$

Similarly within groups (error) sum of squares and sum of products matrix is presented as below :

$$E = \begin{pmatrix} Eyy & Eyx^{(1)} & Eyx^{(2)} \\ Ex^{(1)}y & Ex^{(1)}x^{(1)} & Ex^{(1)}x^{(2)} \\ Ex^{(2)}y & Ex^{(2)}x^{(1)} & Ex^{(2)}x^{(2)} \end{pmatrix} = \begin{pmatrix} 1610.142 & 1326.610 & 366.350 \\ 1327.610 & 14464.554 & 318.273 \\ 366.350 & 318.273 & 601.217 \end{pmatrix}$$

Step (iv)   –   <u>Regression Coefficients and Adjusted Means</u>

| Source of Variation | Regression Coefficients | | | | Adjusted means | |
|---|---|---|---|---|---|---|
| | $b_1$ | $b_2$ | $\widehat{b}_1$ | $\widehat{b}_2$ | $\overline{y}_1A$ | $\overline{y}_2A$ |
| Between Groups (treatments) | – | – | .081441 | .569789 | – | – |
| Within Groups (Error) | .079560 | .581747 | – | – | 11.391 | 10.802 |

Step (v)   –   <u>Adjusted Sum of Squares, Degrees of Freedom, Adjusted Mean Squares and F-Ratio</u>

| Source of variation | Adjusted S.S. | d.f. | Adjusted Mean Squares | F-Ratio |
|---|---|---|---|---|
| Between Groups (Treatments) | 12.240 | 1 | 12.240 | |
| | | | | 1.75 |
| Within Groups (Error) | 1285.5768 | 184 | 6.986 | |

From table F(Garrett 1958,pp.451-454)
d.f.   1/184
F at .05 level   =   3.89

Since the obtained value of F, 1.75, is less than the table value of 3.89 at .05 level of significance, the hypothesis (1.1) that there is no significant difference in achievement at Knowledge level between students exposed to verbal teaching behaviour patterns of C and $E_1$ 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. |
|---|---|---|---|
| | Between groups | 1 | 0.003 |
| y = Achievement (U) | Within groups | 186 | 699.933 |
| | Total | 187 | 699.936 |
| | Between groups | 1 | 113.313 |
| $x^{(1)}$ = Intelligence | Within groups | 186 | 14464.554 |
| | Total | 187 | 14577.867 |
| | Between groups | 1 | 14.634 |
| $x^{(2)}$ = Previous Knowledge | Within groups | 186 | 601.217 |
| | Total | 187 | 615.851 |

Step (ii) - Sums of Products

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

Sums of Products

| Product of two variables | Source of variation | Sum of products |
|---|---|---|
| $yx^{(1)}$ <br> Achievement(U) x Intelligence | Between groups | 0.578 |
| | Within groups | 1027.284 |
| | Total | 1027.862 |
| $yx^{(2)}$ <br> Achievement(U) x Previous knowledge | Between groups | - 0.210 |
| | Within groups | 148.550 |
| | Total | 148.340 |
| $x^{(1)}x^{(2)}$ <br> Intelligence x Previous knowledge | Between groups | - 40.869 |
| | Within groups | 318.273 |
| | Total | 277.404 |

<u>Step (iii)</u> - <u>Sum of Squares and Sum of Products Matrix</u>

Now between groups (treatments) sum of squares and sum of products matrix is presented as below :

$$
T = \begin{pmatrix} T_{yy} & T_{yx}^{(1)} & T_{yx}^{(2)} \\ T_{x}^{(1)}{}_{y} & T_{x}^{(1)}{}_{x}^{(1)} & T_{x}^{(1)}{}_{x}^{(2)} \\ T_{x}^{(2)}{}_{y} & T_{x}^{(2)}{}_{x}^{(1)} & T_{x}^{(2)}{}_{x}^{(2)} \end{pmatrix} = \begin{pmatrix} .003 & .578 & -0.210 \\ .578 & 113.313 & -40.869 \\ -.210 & -40.869 & 14.634 \end{pmatrix}
$$

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

$$
E = \left\{
\begin{array}{ccc}
Eyy & Eyx^{(1)} & Eyx^{(2)} \\
Ex^{(1)}y & Ex^{(1)}x^{(1)} & Ex^{(1)}x^{(2)} \\
Ex^{(2)}y & Ex^{(2)}x^{(1)} & Ex^{(2)}x^{(2)}
\end{array}
\right\}
= \left\{
\begin{array}{ccc}
699.933 & 1027.284 & 148.550 \\
1027.284 & 14464.554 & 318.273 \\
148.550 & 318.273 & 601.217
\end{array}
\right\}
$$

Step (iv) — <u>Regression Coefficients and Adjusted Means</u>

| Source of variation | Regression Coefficients | | | | Adjusted Means | |
|---|---|---|---|---|---|---|
| | $b_1$ | $b_2$ | $\widehat{b_1}$ | $\widehat{b_2}$ | $\bar{y}_1 A$ | $\bar{y}_2 A$ |
| Between Groups (Treatments) | – | – | .065808 | .207092 | – | – |
| Within Groups (Error) | .066844 | .210987 | – | – | 4.628 | 4.605 |

Step (v) — <u>Adjusted Sum of Squares, Degrees of Freedom, Adjusted Mean Squares and F-Ratio</u>

| Source of variation | Adjusted S.S. | d.f. | Adjusted Mean Squares | F-Ratio |
|---|---|---|---|---|
| Between Groups (Treatments) | 1.651 | 1 | 1.651 | |
| | | | | .507 |
| Within Groups (Error) | 599.923 | 184 | 3.256 | |

From the table d.f. 1/184
F at .05 level = 3.89

Since the obtained value of F, .507, is less than the table value of 3.89 at .05 level of significance the hypothesis (2.1) that there is no significant difference in achievement at Understanding level between students exposed to verbal teaching behaviour patterns of C and $E_1$ groups of teachers is retained.

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

Step (i) — Sums of Squares

| Variables | Source of variation | d.f. | S.S. |
|---|---|---|---|
| y<br>Achievement (A) | Between groups | 1 | 6.862 |
| | Within groups | 186 | 664.798 |
| | Total | 187 | 671.660 |
| $x^{(1)}$<br>Intelligence | Between groups | 1 | 113.313 |
| | Within groups | 186 | 14464.554 |
| | Total | 187 | 14577.867 |
| $x^{(2)}$<br>Previous Knowledge | Between groups | 1 | 14.634 |
| | Within groups | 186 | 601.217 |
| | Total | 187 | 615.851 |

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 sums of products are now presented as below :

Sums of Products

| Product of two variables | Source of Variation | Sum of Products |
|---|---|---|
| $yx^{(1)}$ | Between groups | 27.794 |
| Achievement(A)  x  Intelligence | Within groups | 818.993 |
| | Total | 846.787 |
| $yx^{(2)}$ | Between groups | -10.056 |
| Achievement(A)  x  Previous Knowledge | Within groups | 182.504 |
| | Total | 172.448 |
| $x^{(1)}x^{(2)}$ | Between groups | -40.869 |
| Intelligence  x  Previous Knowledge | Within groups | 318.273 |
| | Total | 277.404 |

<u>Step (iii)</u> — <u>Sums of Squares and Sums of Products Matrix</u>

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

$$T = \begin{pmatrix} T_{yy} & T_{yx}^{(1)} & T_{yx}^{(2)} \\ T_{x}^{(1)}{}_{y} & T_{x}^{(1)}{}_{x}^{(1)} & T_{x}^{(1)}{}_{x}^{(2)} \\ T_{x}^{(2)}{}_{y} & T_{x}^{(2)}{}_{x}^{(1)} & T_{x}^{(2)}{}_{x}^{(2)} \end{pmatrix} = \begin{pmatrix} 6.862 & 27.794 & -10.056 \\ 27.794 & 113.313 & -40.869 \\ -10.056 & -40.869 & 14.634 \end{pmatrix}$$

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

$$E = \begin{pmatrix} Eyy & Eyx^{(1)} & Eyx^{(2)} \\ Ex^{(1)}y & Ex^{(1)}x^{(1)} & Ex^{(1)}x^{(2)} \\ Ex^{(2)}y & Ex^{(2)}x^{(1)} & Ex^{(2)}x^{(2)} \end{pmatrix} = \begin{pmatrix} 664.798 & 818.993 & 182.504 \\ 818.993 & 14464.544 & 318.273 \\ 182.504 & 318.273 & 601.217 \end{pmatrix}$$

Step (iv) — Regression Coefficient and Adjusted Means

| Source of Variation | Regression Coefficients | | | | Adjusted Means | |
|---|---|---|---|---|---|---|
| | $b_1$ | $b_2$ | $\overset{\frown}{b}_1$ | $\overset{\frown}{b}_2$ | $\bar{y}_1A$ | $\bar{Y}_2A$ |
| Between Groups (Treatments) | – | – | .052646 | .251626 | – | – |
| Within Groups (Error) | .051019 | .275620 | – | – | 5.209 | 4.946 |

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

| Source of Varation | Adjusted S.S. | d.f. | Adjusted Mean Squares | F-Ratio |
|---|---|---|---|---|
| Between Groups (Treatments) | 10.975 | 1 | 10.975 | |
| | | | | 3.53 |
| Within Groups (Error) | 572.496 | 184 | 3.111 | |

From the table d.f. 1/184
F at .05 level = 3.89

Since the obtained value of F, 3.53, is less than the table value of 3.89 at .05 level of significance, the hypothesis (3.1) that there is no significance difference in achievement at application level between students exposed to verbal teaching behaviour patterns of C and $E_1$ group of teachers is retained.

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

Table 5.9

Summary of Results( Groups C and $E_1$ )

| | Achievement | Degree of Freedom | F | Level of Significance |
|---|---|---|---|---|
| (a) | Knowledge | 1/184 | 1.75 | Not Significant |
| (b) | Understanding | 1/184 | 0.507 | Not significant |
| (c) | Application | 1/184 | 3.53 | Not significant |

The results given in the table 5.9 above reveal that difference in mean achievement between C and $E_1$ groups of students was not significant at any of the three levels of achievement. In other words, these two groups of students did not differ significantly in mean achievement at knowledge, understanding and application levels.

5.4     <u>DISCUSSION</u> :

Major attempt will now be made on seeking interpretation as to why the above results turned out to be what they are. To achieve this purpose results of earlier related researches will often be considered. Such an attempt, however, needs a caution as already pointed out when related researches were being reviewed. Each study reported earlier was conducted within some implicit or explicit theoretical framework using constructs, observation systems, grades, subject matter and tools that often varied from investigator to investigator, thus, making it extremely difficult to compare the results. The discussion in this chapter may be understood with this caution in view.

Generally speaking, two sets of results emerged out of the design of the study (a) one set of results provided comparisons of verbal teaching behaviour patterns between C and $E_1$ groups of teachers. Within each comparison between two groups of teachers, results were obtained for (i) all the 14 classroom interaction categories (ii) only 11 teacher-talk categories and (iii) 10 different ratios indicating those tendencies in verbal teaching behaviour with which the present study is concerned, (b) the other set of results provided comparisons of achievement at knowledge, understanding and application levels between C and $E_1$ groups of students. Specifically speaking, inferential explanation will be sought between these two sets of results.

Three null hypotheses were laid down in Chapter Three for statistical testing. First the results of the testing of these hypotheses are presented and then the discussion follows:

$H_o$ 1.1
Retained

There is no significant difference in mean achievement at knowledge level of students exposed to verbal teaching behaviour patterns of C and $E_1$ groups of teacher.

The obtained value of F was 1.75. This value is not significant at .05 level of significance and, thus, the above hypothesis ($H_o$ 1.1) is retained. This means that there is no true difference in the mean achievement scores at knowledge level between C and $E_1$ groups of students and, that, whatever difference was obtained that could be expected by chance.

$H_o$ 1.2
Retained

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

The obtained value of F was 0.507. This value is not significant at .05 level of significance and, thus, the above hypothesis ($H_o$ 1.2) is retained. This means that there is no true difference in the mean achievement scores at understanding level between C and $E_1$ groups of students and, that, whatever difference was obtained that could be expected by chance.

$H_o$ 1.3

Retained

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

The obtained value of F was 3.53. This value is not significant at .05 level of significance and, thus, the above hypothesis ($H_o$ 1.3) is retained. This means that there is no true difference in the mean achievement scores at application level between C and $E_1$ groups of students, and, that whatever difference was obtained that could be expected by chance.

Since C and $E_1$ groups of students had been exposed to classroom instruction of C and $E_1$ groups of teachers, the results of the comparison of their verbal teaching behaviour patterns that present two treatments are discussed so as to draw an inference about the no true difference in the mean achievement at knowledge (K), understanding (U), and application (A) levels of achievement (table 5.9).

The 14-category comparison (table 5.2) had revealed significant difference at .05 level of significance in the mean percentage occurrence -for category 3a(providing confirmatory feedback) only. The direction of this significant difference was in favour of $E_1$ group of teachers. Also the same trend in result was observed for this category when only 11 teacher-talk categories were compared (table 5.4). However, when teacher response ratio (TRR), which is an index of indirect teaching,

was compared (table 5.6) no significant difference was found between C and $E_1$ groups of teachers. In the present study, providing confirmatory feedback (Cat. 3a) is operationally similar to Flanders accepting and using ideas of the students (Cat. 3). More use of accepting and using ideas of the students (or providing confirmatory feedback, Cat. 3a), providing corrective feedback (Cat. 3b), praising and encouraging (Cat.2) and accepting feelings of the students (Cat. 1) and less use of giving direction and command (Cat.6) and criticising (Cat. 7) is an index of indirect teaching and its value is represented by teacher response ratio (TRR).

Indirect teaching has been found to have positive and often significant relationship with achievement(Rosenshine, 1971). Also, significant difference in achievement of students exposed to more of indirect teaching has been reported by Lulla (1973) and Samph (1974) although the statistical significance of indirect/direct teaching between two groups of teachers was not reported by them.

The result of no true difference in mean achievement at K, U and A levels between C and $E_1$ groups of students, obtained in this study when viewed in terms of no significant difference in TRR appears understandable. Since C and $E_1$ groups of teachers were not found to differ significantly in their tendency to "react to ideas and feelings of the pupils", it appears students' achievement at these three levels was not affected differentially even though the direction of difference in this teaching behaviour was in favour of $E_1$ group of teachers.

When category 3a, viz., teacher providing confirmatory feedback, was considered for analysis as a part of TRR no significant difference had been observed. Taken separately, providing confirmatory feedback was the only verbal teaching behaviour in which significant difference at .05 level of significance was observed in favour of $E_1$ group of teachers. Rosenshine (1971) reported a small positive correlation of .18 between unsubscripted category 3 of FIACS with achievement predicting some relationship between accepting and using ideas of the student (or for the present study, providing confirmatory feedback) and achievement. However, despite the significant difference in the occurrence of category 3a found in favour of $E_1$ group of teachers the mean achievement difference at all the three levels between C and $E_1$ groups of teachers was not significantly indifferent. This may be either because the correlation between Cat. 3 and achievement reported by Rosenshine in a different study is too low to affect achievement significantly or, more truly, instead of considering this teaching behaviour separately when teacher instantaneous feedback ratio - confirmatory (TIFbR89), which is an index of the tendency of the teacher to provide confirmatory feedback at the moment the pupils stop talking, was compared no significant difference between the two groups of teachers was found.

Now about the direction of difference in those verbal teaching behaviours that were not found significant. Occurrence of accepting students' feelings (Cat.1), asking evaluative question (Cat. 4d) and criticising and justifying authority (Cat. 7) was rare and, hence, a discussion on their comparison

in relation to students' achievement is avoided. Pareek and
Rao (1971) also reported rare occurrence of category 1 in
preadolescent classes. Rare occurrence of category 4d may be
attributed to lack of sufficient skill in using evaluative
question whereas rare occurrence of category 7 is due to a
tendency on the part of the teacher not to criticise students.
In the 14-category comparison, the direction of difference in
the mean percentage occurrence of such verbal teaching behaviours
as praising and encouraging (Cat. 2), asking convergent ques-
tions (Cat. 4b), asking divergent questions (Cat. 4c), lecturing
(Cat. 5) and giving direction and command (Cat. 6), though not
significant, was in favour of $E_1$ group of teachers. In 11
teacher talk categories the same trend in result with respect
to the above teaching behaviours was observed. Even when verbal
teaching behaviour patterns in terms of certain ratios were
compared, it was found that the direction of difference with
respect to such teaching tendencies as providing confirmatory
feedback (TIFbR89-Con.), asking cognitive memory questions(TQR,
4a), asking convergent questions (TQR, 4b), asking divergent
questions (TQR, 4c) and taking active role in discussion (CCR),
though not significant, was in favour of $E_1$ group of teachers.
Results related to the criterion variable, on the other hand,
indicated that despite the use of the above verbal teaching
behaviour patterns by more number of $E_1$ group of teachers (not
significant), pupils' mean achievement at the three levels did
not differ significantly. It appears that the direction of
difference in the above treatment variables in favour of $E_1$
group of teachers was not sufficient for determining significant

difference in the mean achievement at K, U, and A levels of
$E_1$ group of students.

Before the discussion of results obtained for C and
$E_1$ groups are closed, one persistant question needs an answer.
No doubt, directional differences were observed for most of the
treatment variables in favour of $E_1$ group of teachers, but then,
despite training, no significant difference (except in the case
of category 3a) was found with respect to these treatment
variables. This question becomes more important because earlier
studies have consistently reported "programme effectiveness."
At least two reasons appear to be responsible for this not
significant result. First, the training provided to $E_1$ group
of teachers was limited to an introduction to the theory and
practice of interaction analysis with just two occasions provid-
ed to the teachers to get feedback of their teaching behaviour.
Secondly, the duration of the training lasted for about 12-13
hours spread over six days. This duration appears to be less
as compared to 6 hours training for 10 days (Pareek and Rao)
and 8 weeks training reported by Jangira (1972). Down(1972)
however, reported significant increase in the number of higher
level questions by providing instruction on question asking for
a duration of 5 fifty-five minute periods. Although providing
limited training in the theory and practice of interaction
process analysis was a part of the design of the present study,
it appears limited training of the type discussed above that
lasted for 12-13 hours does not result in "programme effective-
ness" when a number of categories are involved. If training
is limited to one or two teaching behaviours short duration may
be sufficient for significant change as reported by Down(1972).