Chapter Four

A_N_A_L_Y_S_I_S O_F D_A_T_A

The analysis for interpretation of data was undertaken in an effort to draw logical inference converning the tenability of the given hypotheses with a view to gauging what contribution the study makes in the scientific development of the area of teaching behaviour. The rejection or non-rejection of the hypotheses of the present study will help in determining the nature and extent of such contribution.

The analysis of the data, in the present study, includes a comparison of the outcomes of the various treatments on the mean performance scores of the women student teachers of the population of the present study drawn from the Dev Samaj College of Education for Women Ferozepur, Panjab.

The data relevant to each hypothesis has been assembled and tested to determine whether or not there is significant difference in the results obtained from the six treatment groups. The analysis later develops as a comparison between the groups.

The principal method of analysis adopted was a repeated measure design for the analysis of variance: F-ratios were determined to study the treatment differences ' Between Subjects' and ' Within Subjects.' Having demonstrated the existence of significant differences between subjects and within subjects, Tukey-Method was adopted to find out which population means of underlying treatment populations differ from which other population means.

The statistical techniques employed have been planned with a view to making valid comparisons for purposes of inference. The data on the above pattern has been analysed for all the twenty-one dependent variables of the study and presented in this section of the present inquiry.

1. CATEGORY 2:

Table 1, given below summarises the calculations derived from the Table C.1, of the appendix.

TABLE I Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.016	47		
A (Treatments)	0.391	5	0.078	5.20*
Subjects within groups	0.625	42	0.015	
Within Subjects	1.167	240		
B (Trial Gains)	0.001	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.141	25	0.006	1.20
B x Subjects Within Groups	1.025	210	0.005	

* $F_{.99} = 3.49$ with 5, 42 d.f. Significant at .01 Level

For the treatment effect, $F = 5.20$ with 5, 42 d.f. and this value is significant at the .01 level.

Because the six treatment means A_1, A_2, A_3, A_4, A_5, and A_6, have been averaged over six trials, they correpond to a general overall measure of performance for each treatment and the test of significance indicates that the overall measure of performance for the six treatments differ significantly.

For the effect of factor B (Trial gains on six different occassions), we have $F = 0.00$ with 5, 210 d.f. The six trial mean gains B_1, B_2, B_3, B_4, B_5, and B_6 have been averaged over six treatments and it indicates that the overall measure of performance for the six trial gains effect do not differ.

Testing treatment x trial gains interaction, mean square for significance, $F = 1.20$ with 25, 210 d.f. and this value is not significant. This suggests that the learning curves of the six treatments are of the same form.

Having demonstrated the existence of significant differences between treatments, further steps are taken to establish the confidence intervals within which treatment differences are likely to lie. Accordingly the Tukey-Method, as suggested by Glass & Stanley (1970), has been adopted just to establish the confidence intervals for the differences between sample means and from there to identify those differences which have contributed to the overall significant treatment F-ratio. Applying it to the significance testing function of the T-Method, $\bar{X}_{.1} = 1.674$, $\bar{X}_{.2} = 1.666$, $\bar{X}_{.3} = 1.744$, $\bar{X}_{.4} = 1.732$, $\bar{X}_{.5} = 1.688$, $\bar{X}_{.6} = 1.638$, and $MS_W = 0.15$, $\sqrt{MS_W/n} = 0.02$ and $_{.95}q_{6,42} = 4.23$

To establish the confidence intervals around $n(n-1)/2 = 15$ possible differences between means, one adds and subtracts $(4.23)(0.02) = 0.085$ from each difference.

These calculations are performed in the Table I.I.

TABLE I.I. Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$X_{.j} - X_{.j}*$	$1 - q_{j,j(n-1)}(\sqrt{MS_w/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = .008$	.085	.008 ± .085 (.093, - .077)
$\bar{X}_{.1} - \bar{X}_{.3} = -.070$	.085	- .070 ± .085 (.015, - .155)
$\bar{X}_{.1} - \bar{X}_{.4} = -.058$	.085	- .058 ± .085 (.027, - .143)
$\bar{X}_{.1} - \bar{X}_{.5} = -.014$	.085	- .014 ± .085 (.071, - .099)
$\bar{X}_{.1} - \bar{X}_{.6} = .036$	.085	.036 ± .085 (.121, - .049)
$\bar{X}_{.2} - \bar{X}_{.3} = -.078$	.085	- .078 ± .085 (.007, - .163)
$\bar{X}_{.2} - \bar{X}_{.4} = -.066$	.085	- .066 ± .085 (.019, - .151)
$\bar{X}_{.2} - \bar{X}_{.5} = -.022$	.085	- .022 ± .085 (.063, - .107)
$\bar{X}_{.2} - \bar{X}_{.6} = .028$	.085	.028 ± .085 (.113, - .057)
$\bar{X}_{.3} - \bar{X}_{.4} = .012$	.085	.012 ± .085 (.097, - .073)
$\bar{X}_{.3} - \bar{X}_{.5} = .056$	.085	.056 ± .085 (.141, - .029)
$\bar{X}_{.3} - \bar{X}_{.6} = .106$	.085	.106 ± .085 (.191, .021)*
$\bar{X}_{.4} - \bar{X}_{.5} = .044$	.085	.044 ± .085 (.129, - .041)
$\bar{X}_{.4} - \bar{X}_{.6} = .094$	.085	.094 ± .085 (.179, .009)*
$\bar{X}_{.5} - \bar{X}_{.6} = .050$	.085	.050 ± .085 (.135, - .035)

* Significant at .05 Level

The results suggest that the mean performance on treatment A_6 is statistically different from the mean performance on treatments A_3 and A_4.

So it can be argued that the performance of the treatment groups that received feedback from (a) the college superviser, (b) the external observer, is statistically different from the performance of a control group (A_6), that was not taught interaction analysis, but taught learning theory.

No other differences are statistically significant at the .05 Level for the Tukey-Tests.

2. CATEGORY 3:

TABLE 2, given below summarises the calculations derived from the Table C.II, of the appendix.

TABLE 2 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.410	47		
A (Treatments)	0.380	5	0.076	3.16*
Subjects within groups	1.030	42	0.024	
Within Subjects	0.890	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.153	25	0.006	2.00**
B x Subjects Within Groups	0.737	210	0.003	

* $F_{.95}$ = 2.44 with 5, 42 d.f. Significant at .05 Level

** $F_{.99}$ = 1.87 with 25, 210 d.f. Significant at .01 Level

For the treatment effect (A), F = 3.16 with 5, 42 d.f. is a significant value at the .05 Level. The test of significance suggests that the overall measure of performance for the six treatments differ significantly at the .05 Level and that the hypothesis of significant differences between the mean scores of the treatment groups cannot be rejected.

For the effect of trial gains (B), F = 0.00 and this suggests that the hypothesis of significant differences between the six trial mean gains can be rejected.

Testing the A x B interaction, mean square for significance, an F = 2.00 with 25, 210 d.f. is a significant value at .01 Level. It can be argued that the learning curves of the six treatments are not of the same form.

Having demonstrated the existence of significant differences between treatment means, the Tukey-Method is applied to reveal the differences between the sample means to establish the confidence intervals within which treatment differences are likely to lie.

In the present analysis to illustrate the significance testing function of the T-Method, we have,

$\bar{X}_{.1} = 1.742$, $\bar{X}_{.2} = 1.658$, $\bar{X}_{.3} = 1.682$, $\bar{X}_{.4} = 1.736$, $\bar{X}_{.5} = 1.648$, $\bar{X}_{.6} = 1.677$, and $\sqrt{MS_W/n} = 0.02$ and ${}_{.95}q_{6,42} = 4.23$

To establish the confidence intervals around the fifteen possible pairs of mean scores, one adds and subtracts (4.23)(0.02) = 0.085 from each difference. These calculations are performed in the Table 2.1.

TABLE 2.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$X_{.j} - X_{.j*}$	$1 - q_{j,j(n-1)}$ $(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} =$ .084	.085	.084 ± .085 (.169, - .001)
$\bar{X}_{.1} - \bar{X}_{.3} =$ .060	.085	.060 ± .085 (.145, - .025)
$\bar{X}_{.1} - \bar{X}_{.4} =$ .006	.085	.006 ± .085 (.091, - .079)
$\bar{X}_{.1} - \bar{X}_{.5} =$ .093	.085	.093 ± .085 (.178, .008)*
$\bar{X}_{.1} - \bar{X}_{.6} =$ .065	.085	.065 ± .085 (.150, - .020)
$\bar{X}_{.2} - \bar{X}_{.3} =$ - .024	.085	- .024 ± .085 (.061, - .109)
$\bar{X}_{.2} - \bar{X}_{.4} =$ - .078	.085	- .078 ± .085 (.007, - .163)
$\bar{X}_{.2} - \bar{X}_{.5} =$ .009	.085	.009 ± .085 (.094, - .076)
$\bar{X}_{.2} - \bar{X}_{.6} =$ - .019	.085	- .019 ± .085 (.066, - .104)
$\bar{X}_{.3} - \bar{X}_{.4} =$ - .054	.085	- .054 ± .085 (.031, - .139)
$\bar{X}_{.3} - \bar{X}_{.5} =$ .033	.085	.033 ± .085 (.118, - .052)
$\bar{X}_{.3} - \bar{X}_{.6} =$ .005	.085	.005 ± .085 (.090, - .080)
$\bar{X}_{.4} - \bar{X}_{.5} =$ .088	.085	.088 ± .085 (.173, .003)*
$\bar{X}_{.4} - \bar{X}_{.6} =$ .059	.085	.059 ± .085 (.144, - .026)
$\bar{X}_{.5} - \bar{X}_{.6} =$ - .028	.085	- .028 ± .085 (.057, - .113)

* Significant at .05 Level

It may be concluded that the mean performance on treatment A_5 is statistically different from the mean performance on treatments A_1 and A_4 . It suggests that the mean performance of the control group trained in the technique of interaction analysis is significantly different at .05 Level from the mean performance of the treatment groups that

(i) made self appraisal of their individual behaviour and had self directed feedback; and

(ii) received feedback from the external supervisor.

It can be argued that student teachers who made self appraisal of their individual behaviour and those who were observed by an external observer who presented objective information to the members of the group regarding their teaching behaviour and discussed steps for further improvement, attended more to the pupil ideas and integrated them into the class discussion through their own active response statements as compared to the control group of student teachers who were just trained in the use of interaction analysis.

3. CATEGORY 4:

Table 3, given below summarises the calculations derived from the Table C.III, of the appendix

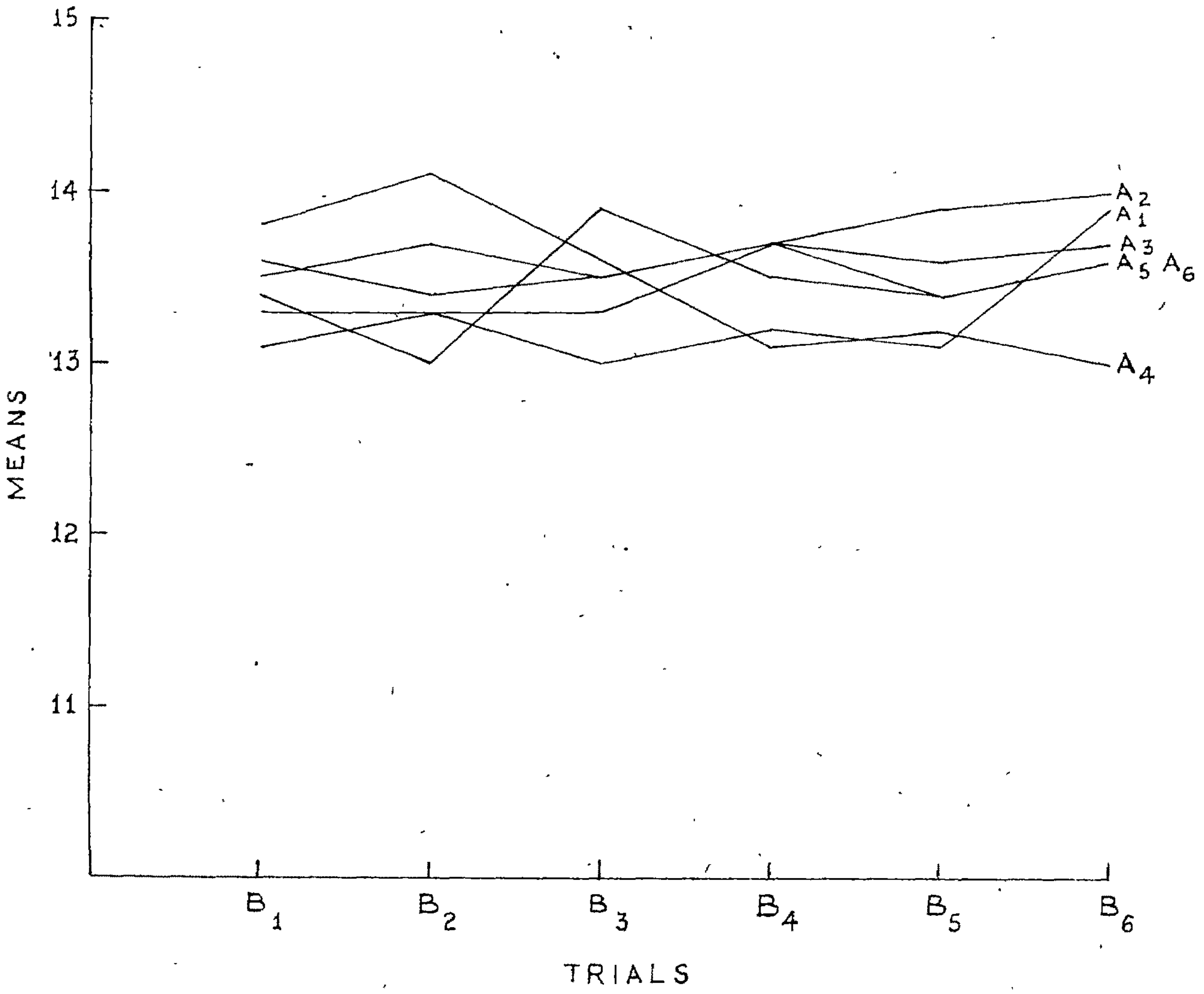
TABLE 3 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.045	47		
A (Treatments)	0.143	5	0.029	1.38
Subjects within groups	0.902	42	0.021	
Within Subjects	1.092	240		
B (Trial Gains)	0.002	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.251	25	0.010	2.50*
B x Subjects Within Groups	0.839	210	0.004	

* $F_{.99}$ = 1.88 with 25, 210 d.f. Significant at .01 Level

CATEGORY-4

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

For the treatment effect (A), F = 1.38 with 5, 42, d.f. and this is not a significant value. The test of significance indicates that the overall measure of performance for the six treatments do not differ significantly.

For the trial gains effect (B), F = 0.00. It indicates that the overall measure of performance for the six trial gains when averaged over the six treatments do not differ.

For the treatment x trial gains interaction, F = 2.50 with 25, 210, d.f. and this is a significant value. A significant A x B, mean square would suggest that the learning curves of the six treatments are not parallel. They are of the different form.

4. CATEGORY 5:

Table 4, given below summarises the calculations derived from the Table C.IV, of the appendix.

TABLE 4 Summary of the Analysis of Variance: Trial Means with Different Treatments

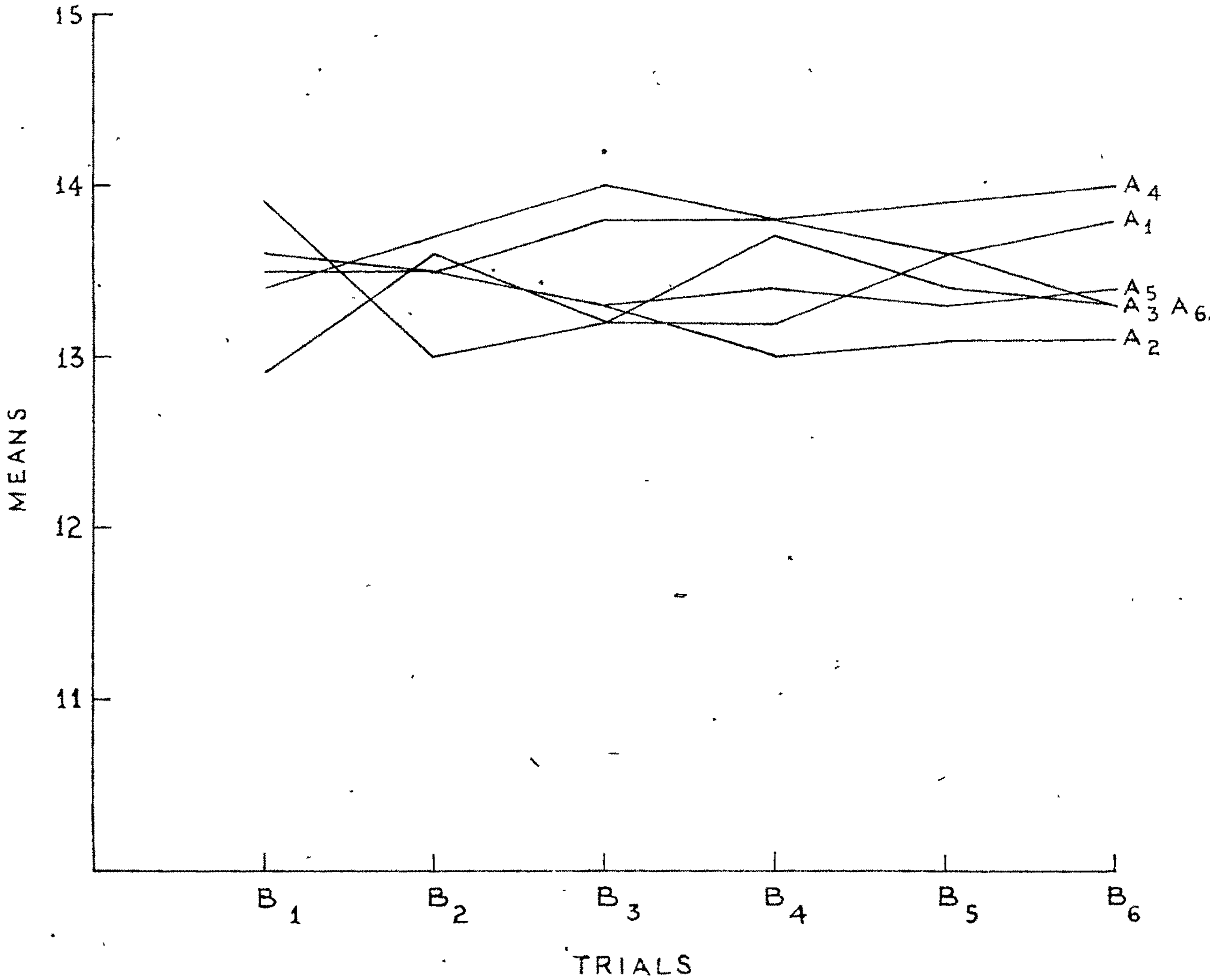
Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.143	47		
A (Treatments)	0.185	5	0.037	1.61
Subjects within groups	0.958	42	0.023	
Within Subjects	1.334	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.205	25	0.008	1.60*
B x Subjects Within Groups	1.129	210	0.005	

*$F_{.95}$ = 1.57 with 25, 210 d.f. Significant at .05 Level

For the treatment effect (A), F = 1.61 with 5, 42, d.f. and this is not a significant value. The test of significance indicates that the overall measure of performance for the six treatments do not differ significantly.

CATEGORY-5

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

For the trial gains effect (B), F = 0.00. It suggests that the hypothesis of significant differences between the mean scores of the trial gains can be rejected.

For the treatment x trial gains interaction, F = 1.60 with 25, 210, d.f. and this is a significant value at .05 Level. A significant treatment x trial gains interaction mean square suggests that the learning curves of the six treatments are not parallel.

5. CATEGORY 6:

Table 5, given below summarises the calculations derived from the Table C.V, of the appendix.

Table 5 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.320	47		
A (Treatments)	0.328	5	0.066	2.75*
Subjects Within Groups	0.992	42	0.024	
Within Subjects	1.050	240		
B (Trial Gains)	0.001	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.200	25	0.008	2.00**
B x Subjects Within Groups	0.849	210	0.004	

* $F_{.95}$ = 2.44 with 5, 42 d.f. Significant at .05 Level

**$F_{.99}$ = 1.88 with 25, 210 d.f. Significant at .01 Level

For the treatment effect (A), F = 2.75 with 5, 42 d.f. is a significant value .05 Level. It suggests that the overall measure of performance for the six treatments differ significantly.

For the trial gains effect (B), F = 0.00. It is not a significant value. The hypothesis of significant differences between trial mean gain scores can be rejected.

For the effect of treatment x trial gains interaction, F = 2.00 with 25, 210, d.f. and this is significant at .01 Level. This suggests that the learning curves of the six treatments are not of the same form.

Having demonstrated the existence of significant differences between treatments, further steps have been taken to identify the differences which have contributed to the overall significant treatment F-ratio. The mean scores for the different treatments are as follows:

$\bar{X}_{.1} = 1.661$, $\bar{X}_{.2} = 1.699$, $\bar{X}_{.3} = 1.671$, $\bar{X}_{.4} = 1.645$, $\bar{X}_{.5} = 1.730$, $\bar{X}_{.6} = 1.735$ and $\sqrt{MS_W/n} = 0.02$ & $_{.95}q_{6,42} = 4.23$

Confidence intervals around 15 possible differences between treatment means are given by $\pm (4.23)(0.02) = \pm 0.085$ from each difference. These calculations are performed in the Table 5.1.

TABLE 5.I Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$X_{.j} - X_{.j}*$	$1 - q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = -.038$	.085	$-.038 \pm .085$ (.047, - .123)
$\bar{X}_{.1} - \bar{X}_{.3} = -.010$	.085	$-.010 \pm .085$ (.075, - .095)
$\bar{X}_{.1} - \bar{X}_{.4} = .015$	.085	$.015 \pm .085$ (.100, - .070)
$\bar{X}_{.1} - \bar{X}_{.5} = -.070$	.085	$-.070 \pm .085$ (.015, - .155)
$\bar{X}_{.1} - \bar{X}_{.6} = -.073$	.085	$-.073 \pm .085$ (.012, - .158)
$\bar{X}_{.2} - \bar{X}_{.3} = .028$	.085	$.028 \pm .085$ (.113, - .057)
$\bar{X}_{.2} - \bar{X}_{.4} = .053$	.085	$.053 \pm .085$ (.138, - .032)
$\bar{X}_{.2} - \bar{X}_{5} = -.032$	.085	$-.032 \pm .085$ (.053, - .117)
$\bar{X}_{.2} - \bar{X}_{.6} = -.035$	.085	$-.035 \pm .085$ (.050, - .120)
$\bar{X}_{.3} - \bar{X}_{.4} = .025$	.085	$.025 \pm .085$ (.110, - .060)
$\bar{X}_{.3} - \bar{X}_{.5} = .060$	.085	$.060 \pm .085$ (.145, - .025)
$\bar{X}_{.3} - \bar{X}_{.6} = -.063$	.085	$-.063 \pm .085$ (.022, - .148)
$\bar{X}_{.4} - \bar{X}_{.5} = -.086$	.085	$-.086 \pm .085$ (-.001, - .171)*
$\bar{X}_{.4} - \bar{X}_{.6} = -.090$	.085	$-.090 \pm .085$ (-.005, - .175)*
$\bar{X}_{.5} - \bar{X}_{.6} = -.003$	.085	$-.003 \pm .085$ (.082, - .088)

*Significant at .05 Level

These results suggest that the population means for the treatments A_4 and A_5 & A_4 and A_6, differ significantly at .05 Level in their use of the category 6. It suggests that the population mean of the treatment group that received feedback from the external observer differs significantly in their use of category 6, from the population means of the two control groups of the present study.

This category is used for statements which are intended to produce compliance. A significant decrease in the use of this category indicates that the student teachers gave fewer directions to the pupil to do something. It shows that teacher initiation-pupil response pattern was not established by a group of student teachers who were observed by an external supervisor.

No other treatment differences are statistically significant at the .05 Level for the Tukey-tests.

6. CATEGORY 7:

Table 6, given below summarises the calculations derived from the Table C.VI, of the appendic.

TABLE 6 Summary of the Analysis of Variance: Trial Means with Different Treatments

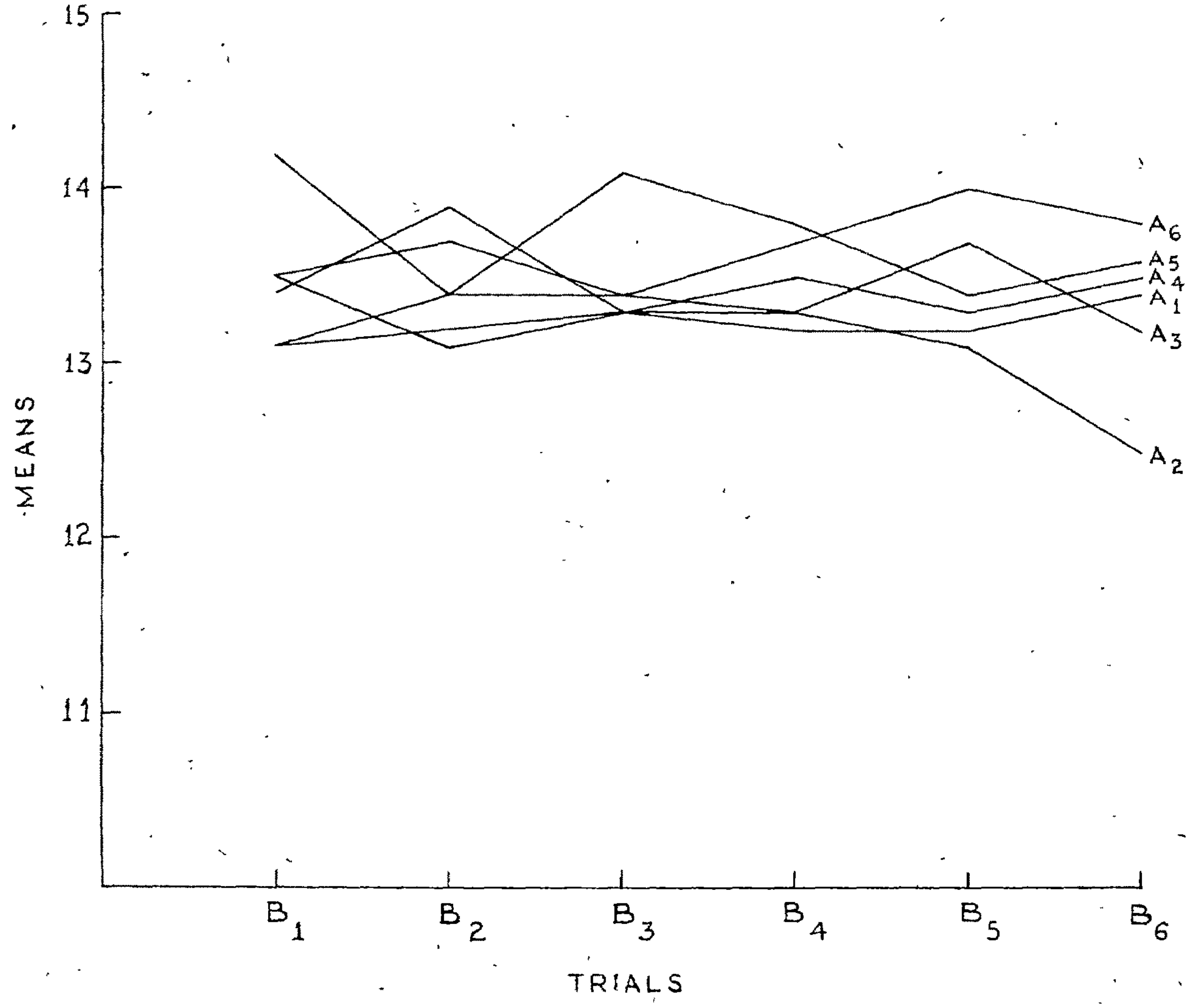
Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	2.421	47		
A (Treatments)	0.172	5	0.034	0.63
Subjects Within Groups	2.249	42	0.054	
Within Subjects	0.796	240		
B (Trial Gains)	0.003	5	0.001	0.50
A x B (Treatment x Trial Gains)	0.277	25	0.011	5.50*
B x Subjects Within Groups	0.516	210	0.002	

*$F_{.99}$ 1.87 with 25, 210 d.f. Significant at .01 Level

For the treatment effect (A), F = 0.63 with 5, 42, d.f. and this is not a significant value. Thus in the present analysis the hypothesis of significant differences between the mean scores of different treatments can be rejected.

CATEGORY-7

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

For the trial gains effect (B), F = 0.50 with 5, 210 d.f. and this is not a significant value; indicating that the trial mean gains when averaged over the six treatments do not differ significantly.

For the treatment x trial gain interaction, F = 5.50 with with 25, 210, d.f. and this is significant at .01 Level. A significant treatment x trial gain mean square would suggest that the learning curves for the six treatments are not of the same form.

7. <u>CATEGORY 8:</u>

Table 7, given below summarises the calculations derived from the Table C.VII, of the appendix.

TABLE 7 Summary of the Analysis of Variance:
Trial Means with Different Treatments

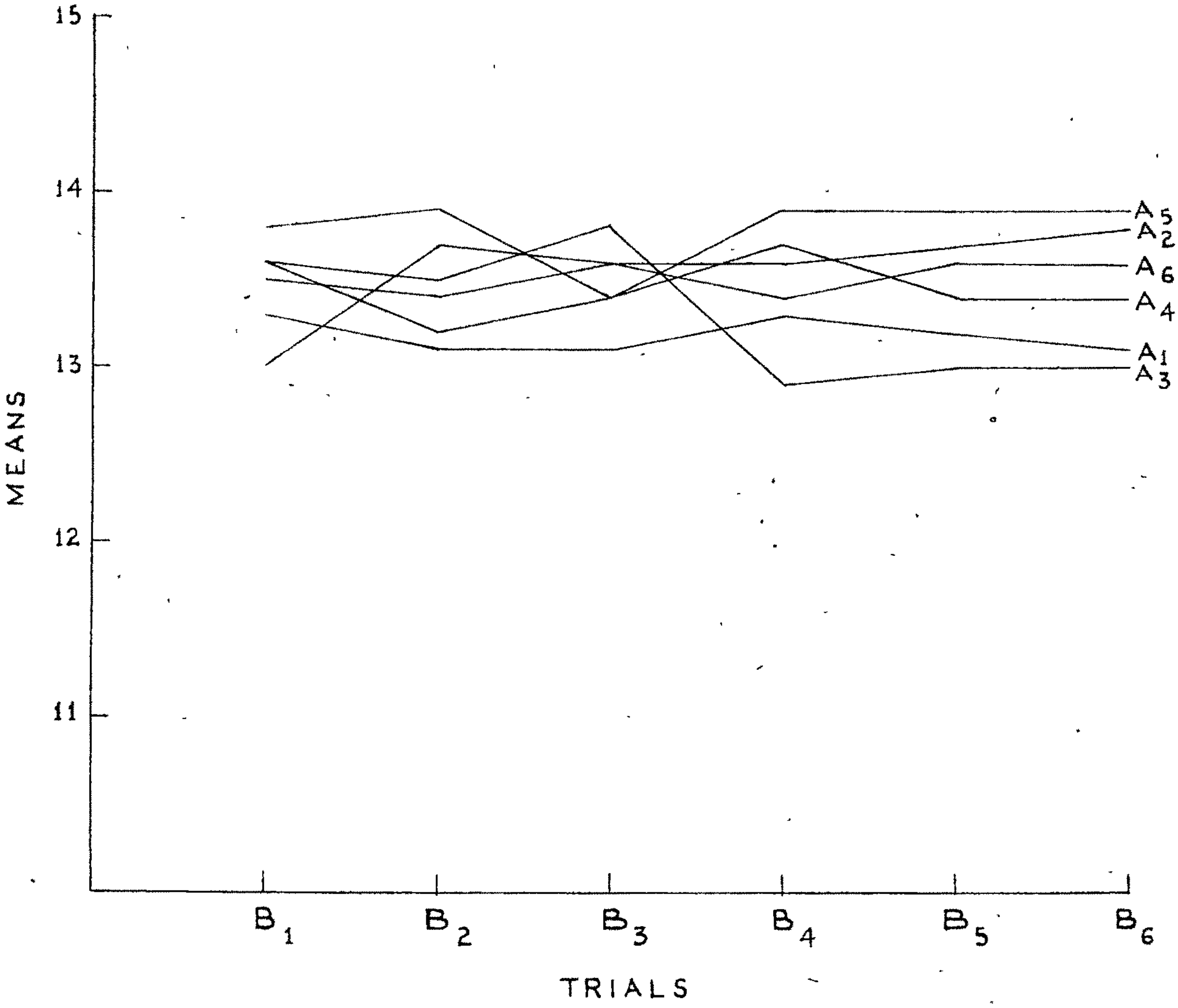
Source of Variation	Sum of Squares	d.f.	Mean Square	F
<u>Between Subjects</u>	<u>1.128</u>	<u>47</u>		
A (Treatments)	0.141	5	0.028	1.17
Subjects Within Groups	0.987	42	0.024	
<u>Within Subjects</u>	<u>1.009</u>	<u>240</u>		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.239	25	0.010	2.50*
B x Subjects Within Groups	0.770	210	0.004	

$*F_{.99}$ = 1.88 with 25, 210 d.f. Significant at .01 Level

For the effect of factor A, e.g. the treatment, F = 1.17 with 5, 42, d.f. and this is not significant. Thus the hypothesis of significant differences between the mean scores of the different treatments can be rejected.

CATEGORY-8

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

For the effect of trial gains (B), F = 0.00. This suggests that the hypothesis of significant differences between the trial mean gains can be rejected.

Testing the A x B interaction mean square for significance F = 2.50 with 25, 210, d.f. and this is a significant value with 25, 210, d.f. at .01 Level. It suggests that the learning curves of the six treatments are not parallel.

8. <u>CATEGORY 9:</u>

Table 8, given below summarises the calculations derived from the Table C.VIII, of the appendix.

TABLE 8 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
<u>Between Subjects</u>	<u>1.242</u>	<u>47</u>		
A (Treatments)	0.494	5	0.099	5.50*
Subjects Within Groups	0.748	42	0.018	
<u>Within Subjects</u>	<u>1.125</u>	<u>240</u>		
B (Grial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.186	25	0.007	1.75**
B x Subjects Within Groups	0.939	210	0.004	

* $F_{.99}$ = 3.49 with 5, 42 d.f. Significant at .01 Level

**$F_{.95}$ = 1.57 with 25, 210 d.f. Significant at .05 Level

For the treatment effect (A), F = 5.50 with 5, 42, d.f. and this is significant at .01 Level. It indicates that the overall measure of performance for the six treatments differ significantly.

For the trial gains effect, F = 0.00. It demonstrates that the overall measure of performance for the six trial gains when averaged over the six treatments do not differ.

Testing the treatment x trial gains interaction mean square for significance, F = 1.75 with 25, 210, d.f. and this is significant at .05 Level. This suggests that the learning curves of the six treatment are not of the same form.

Having demonstrated the existence of significant differences between treatments, we establish the confidence intervals within which treatment differences are likely to lie. The mean scores for the six different treatments are:
$\bar{X}_{.1} = 1.776$, $\bar{X}_{.2} = 1.666$, $\bar{X}_{.3} = 1.646$, $\bar{X}_{.4} = 1.695$, $\bar{X}_{.5} = 1.683$, $\bar{X}_{.6} = 1.672$.
and $\sqrt{MS_W/n} = 0.02$ and ${}_{.95}q_{6,42} = 4.23$
Confidence intervals around fifteen possible pairs of different treatment means are given by $\pm (4.23)(0.02) = \pm .085$ from each treatment mean difference. These calculations are performed in the Table 9.1

TABLE 8.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$X_{.j} - X_{.j}$*	$1 - p_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2}$ = .110	.085	.110 ± .085 (.195, .025)*
$\bar{X}_{.1} - \bar{X}_{.3}$ = .130	.085	.130 ± .085 (.215, .045)*
$\bar{X}_{.1} - \bar{X}_{.4}$ = .081	.085	.081 ± .085 (.166,- .004)
$\bar{X}_{.1} - \bar{X}_{.5}$ = .093	.085	.093 ± .085 (.178, .008)*
$\bar{X}_{.1} - \bar{X}_{.6}$ = .104	.085	.104 ± .085 (.189, .019)*
$\bar{X}_{.2} - \bar{X}_{.3}$ = .020	.085	.020 ± .085 (.105,- .065)
$\bar{X}_{.2} - \bar{X}_{.4}$ = -.029	.085	-.029 ± .085 (.056,- .114)
$\bar{X}_{.2} - \bar{X}_{.5}$ = -.017	.085	-.017 ± .085 (.068,- .102)
$\bar{X}_{.2} - \bar{X}_{.6}$ = -.006	.085	-.006 ± .085 (.079,- .091)
$\bar{X}_{.3} - \bar{X}_{.4}$ = -.039	.085	-.039 ± .085 (.046,- .124)
$\bar{X}_{.3} - \bar{X}_{.5}$ = -.037	.085	-.037 ± .085 (.048,- .122)
$\bar{X}_{.3} - \bar{X}_{.6}$ = -.026	.085	-.026 ± .085 (.059,- .111)
$\bar{X}_{.4} - \bar{X}_{.5}$ = .012	.085	.012 ± .085 (.097,- .073)
$\bar{X}_{.4} - \bar{X}_{.6}$ = .023	.085	.023 ± .085 (.108,- .062)
$\bar{X}_{.5} - \bar{X}_{.6}$ = .011	.085	.011 ± .085 (.096,- .074)

*Significant at .05 Level

It suggests that the mean performance on treatment A_1 is statistically different from the mean performance on the treatments A_2, A_3, A_5, and A_6 at .05 Level for the Tukey-tests.

These findings suggests that to increase the frequency of occurance of category 9, self appraisal of teaching behaviour and self directed feedback is significantly superior to

(a) the feedback provided by the peer group;

(b) the feedback provided by the college supervisor;

(c) control group having been taught the technique of interaction analysis;

(d) control group having not been taught the technique of interaction analysis, but taught learning theory.

9. VARIABLE i/d:

Table 9, given below summarises the calculations derived from the Table C.IX, of the appendix.

TABLE 9 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.545	47		
A (Treatments)	0.694	5	0.139	6.95*
Subjects Within Groups	0.851	42	0.020	
Within Subjects	0.740	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.142	25	0.006	2.00**
B x Subjects Within Groups	0.598	210	0.003	

* $F_{.99}$ = 3.49 with 5, 42 d.f. Significant at .01 Level

**$F_{.99}$ = 1.88 with 25, 210 d.f. Significant at .01 Level

For the treatment effect, (A), F = 6.95 with 5, 42, d.f. and is significant at .01 Level. The test of significant indicates that the overall measure of performance for the six treatments differ significantly.

For the trial gains (B), effect, F = 0.00 and is not a significant value, indicating thereby that the overall measure of performance for the six trial gains when averaged over the six treatments do not differ.

Testing the A x B interaction mean square for significance, F = 2.00 with 25, 210 d.f. and this is a significant value at .01 Level. It indicates that the learning curves of the six treatments are not of the same form.

In the present variable to illustrate the significance testing function of the T - Method, $\bar{X}_{.1} = 1.712$, $\bar{X}_{.2} = 1.667$, $\bar{X}_{.3} = 1.63$, $\bar{X}_{.4} = 1.731$, $\bar{X}_{.5} = 1.642$, $\bar{X}_{.6} = 1.625$, and $\sqrt{MS_W/n} = 0.021$ and ${}_{.95}q_{6,42} = 4.23$.

To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts (4.23)(0.021) = 0.089 from each difference. These calculations are performed in Table 9.1.

TABLE 9.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$X_{.j}$ $X_{.j^*}$	1 - $q_{j,j}$ $(n-1)(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = .045$	.089	.045 ± .089 (.134, - .044)
$\bar{X}_{.1} - \bar{X}_{.3} = -.051$	.089	-.051 ± .089 (.038, - .140)
$\bar{X}_{.1} - \bar{X}_{.4} = -.018$	.089	-.018 ± .089 (.071, - .107)
$\bar{X}_{.1} - \bar{X}_{.5} = .070$	.089	.070 ± .089 (.159, - .019)
$\bar{X}_{.1} - \bar{X}_{.6} = .087$	.089	.087 ± .089 (.176, - .002)
$\bar{X}_{.2} - \bar{X}_{.3} = -.096$	.089	-.096 ± .089 (-.007,- .185)*
$\bar{X}_{.2} - \bar{X}_{.4} = -.063$	.089	-.063 ± .089 (.026, - .152)
$\bar{X}_{.2} - \bar{X}_{.5} = .025$	.089	.025 ± .089 (.114, - .064)
$\bar{X}_{.2} - \bar{X}_{.6} = .042$	.089	.042 ± .089 (.131, - .047)
$\bar{X}_{.3} - \bar{X}_{.4} = .033$	.089	.033 ± .089 (.122, - .056)
$\bar{X}_{.3} - \bar{X}_{.5} = .121$	.089	.121 ± .089 (.210, - .032)*
$\bar{X}_{.3} - \bar{X}_{.6} = .138$	.089	.138 ± .089 (.227, .049)*
$\bar{X}_{.4} - \bar{X}_{.5} = .089$	.089	.089 ± .089 (.178, .000)*
$\bar{X}_{.4} - \bar{X}_{.6} = .106$	.089	.106 ± .089 (.195, .017)*
$\bar{X}_{.5} - \bar{X}_{.6} = .017$	.089	.017 ± .089 (.106, - .072)

*Significant at .05 Level

It may be concluded that the population means for the treatments A_2 & A_3, A_3 & A_5, A_3 & A_6, A_4 & A_5, and A_4 & A_6, differ significantly at the .05 Level for the Tukey-tests

These results suggest that (i) mean performance on the college supervisor treatment group is statistically different from the mean performance on the peer group and both the control groups; (ii) mean performance on the external observer treatment group is significantly different from the mean performance on both the control groups.

It can certainly be argued that to develop indirect - direct teacher talk ratio, feedback from the college supervisor and the external observer is effective.

10. VARIABLE I/D:

Table 10, given below summarises the calculations derived from the Table C.X of the appendix.

TABLE 10 . Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.466	47		
A (Treatments)	0.165	5	0.033	1.06
Subjects Within Groups	1.301	42	0.031	
Within Subjects	1.318	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.264	25	0.011	2.04*
B x Subjects Within Groups	1.054	210	0.005	

*Significant at .01 Level

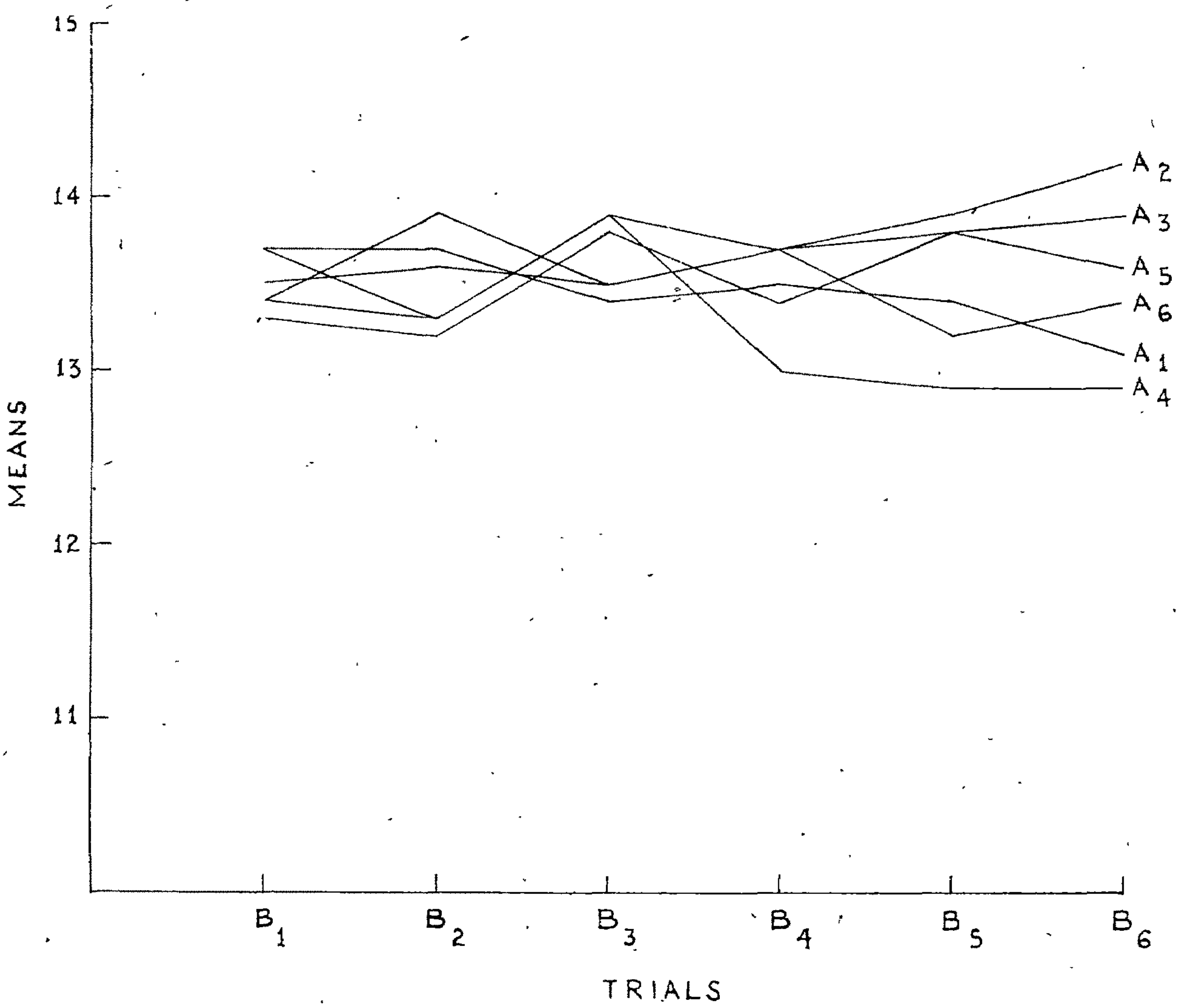
For the treatment effect, F = 1.06 with 5, 42 d.f. and this value is not significant. It suggests that the hypothesis of significant differences between the mean scores of the treatment groups can be rejected.

For the trial gains effect, F = 0.00. It suggests that the mean score of the six trial gains when averaged over the six treatments do not differ.

Testing A x B, mean square for significance, F = 2.04 with 25, 210 d.f. This is a significant value at .01 Level; and it suggests that the learning curves of the six treatments are of the different form.

$\frac{I}{D}$

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

11. VARIABLE S/T:

Table 11, given below summarises the calculations derived from the Table C.XI, of the appendix.

TABLE 11 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.514	47		
A (Treatments)	0.202	5	0.040	1.30
Subjects Within Groups	1.312	42	0.031	
Within Subjects	0.968	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.153	25	0.006	1.50
B x Subjects Within Groups	0.815	210	0.004	

For the treatment effect (A), F = 1.30 with 5, 42, d.f. and this value fails to reach significance. It suggests that the overall measure of performance for the six treatments do not differ and the hypothesis of significant differences between the mean scores of the treatments can be rejected.

For the trial gains effect (B), F = 0.00. It suggests that the six trial mean gains when averaged over the six treatments do not differ.

Testing the Treatment x Trial Gains interaction mean square for significance, F = 1.50 with 25, 210 d.f. and this value just misses to reach significance at .05 Level. This suggests that the learning curves of the six treatments are not significantly different from one another.

12. FLEXIBILITY:

Table 12, given below summarises the calculations derived from the Table C.XII, of the appendix.

TABLE 12 Summary of the Analysis of Variance: Trial Means with Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.103	47		
A x (Treatments)	0.153	5	0.003	1.50
Subjects Within Group	0.950	42	0.002	
Within Subjects	1.259	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.210	25	0.008	1.60*
B x Subjects Within Groups	1.049	210	0.005	

$*F_{.95} = 1.57$ with 25, 210 d.f. Significant at .05 Level

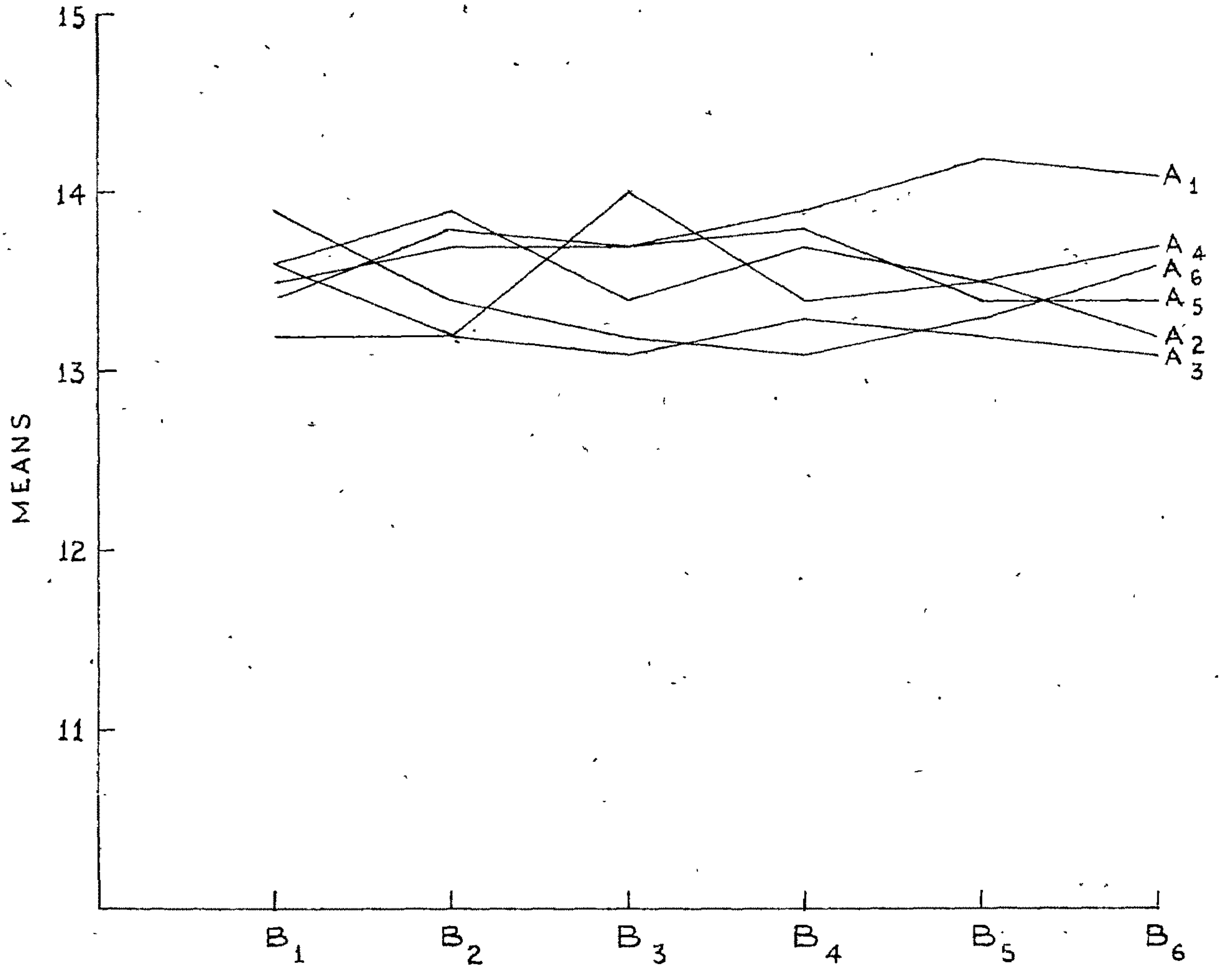
For the treatment effect (A), F = 1.50 with 5, 42, d.f. and this is not a significant value. It suggests that the overall measure of performance for the six treatments do not differ significantly and the hypothesis of significant differences between the mean scores of the treatments can be rejected.

Testing the trial gains mean square for significance, F = 0.00 and it suggests that the six trial mean gains when averaged over the six treatments do not differ.

For the treatment x trial gains interaction mean square for significance, F = 1.60 with 25, 210 d.f. and this value is significant at .05 Level. It suggests that the learning curves of the six treatment are not parallel.

FLEXIBILITY

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

13. 2-2 CELL:

Table 13, given below summarises the calculations derived from the Table C.XIII, of the appendix.

TABLE 13 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.067	47		
A (Treatments)	0.326	5	0.065	3.50*
Subjects Within Groups	0.741	42	0.018	
Within Subjects	1.033	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.185	25	0.007	1.75**
B x Subjects Within Groups	0.848	210	0.004	

* $F_{.99}$ = 3.49 with 5, 42 d.f. Significant at .01 Level

**$F_{.95}$ = 1.57 with 25, 210 d.f. Significant at .05 Level

For the treatment effect (A), F = 3.50 with 5, 42, d.f. and this is significant at .01 Level. Thus the hypothesis of significant differences between the mean scores of the various treatments cannot be rejected.

For the trial gains effect (B), F = 0.00. This suggests that the hypothesis of significant differences between the mean scores of the different treatments can be rejected.

For the treatment x trial gains interaction, F = 1.75 with 25, 210 d.f. and is significant at .05 Level. This suggests that the learning curves of the six treatments are of the different form.

Using the Tukey - Method, a set of simultaneous confidence intervals for the differences between sample means can be established. In the present analysis to illustrate the significance testing function of the T- Method, we have, $\bar{X}_{.1} = 1.712$, $\bar{X}_{.2} = 1.664$, $\bar{X}_{.3} = 1.728$, $\bar{X}_{.4} = 1.706$, $\bar{X}_{.5} = 1.629$, $\bar{X}_{.6} = 1.703$ and $\sqrt{MS_W/n} = .019$; ${}_{.95}q_{6,42} = 4.23$

To establish confidence intervals around the 15 possible differences between means, one adds and subtracts (4.23)(.019) = .080 from each difference. These calculations are performed in Table 13.1

TABLE 13.1 Establishing Confidence Intervals Around Differences Between 15 Sample Means Using The T - Method

$\bar{X}_{.j} - \bar{X}_{.j^*}$	$1 - q_{j,j,(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = .048$	.080	.048 ± .080 (.128, - .032)
$\bar{X}_{.1} - \bar{X}_{.3} = -.016$	.080	-.016 ± .080 (.064, - .096)
$\bar{X}_{.1} - \bar{X}_{.4} = .006$	.080	.006 ± .080 (.086, - .074)
$\bar{X}_{.1} - \bar{X}_{.5} = .083$	.080	.083 ± .080 (.163, .003)*
$\bar{X}_{.1} - \bar{X}_{.6} = .009$	.080	.009 ± .080 (.089, - .071)
$\bar{X}_{.2} - \bar{X}_{.3} = -.064$	.080	-.064 ± .080 (.016, - .144)
$\bar{X}_{.2} - \bar{X}_{.4} = -.042$	.080	-.042 ± .080 (.038, - .122)
$\bar{X}_{.2} - \bar{X}_{.5} = .065$	.080	.065 ± .080 (.145, - .015)
$\bar{X}_{.2} - \bar{X}_{.6} = -.039$	.080	-.039 ± .080 (.041, - .119)
$\bar{X}_{.3} - \bar{X}_{.4} = .022$	.080	.022 ± .080 (.102, - .058)
$\bar{X}_{.3} - \bar{X}_{.5} = .099$	.080	.099 ± .080 (.179, .019)*
$\bar{X}_{.3} - \bar{X}_{.6} = .025$	.080	.025 ± .080 (.105, - .055)
$\bar{X}_{.4} - \bar{X}_{.5} = .077$	.080	.077 ± .080 (.157, - .003)
$\bar{X}_{.4} - \bar{X}_{.6} = .003$	.080	.003 ± .080 (.083, - .077)
$\bar{X}_{.5} - \bar{X}_{.6} = -.074$	.080	-.074 ± .080 (.006, - .154)

*Significant at .05 Level

These results suggest that the mean performance on treatment A_5 is statistically significant (lower), from the mean performance on the treatments A_1 and A_3 at the .05 Level. It can be argued that the population means of the control group trained in the technique of interaction analysis is significantly lesser from the population means of the following two treatments:

(i) self appraisal and self directed feedback group;

(ii) college supervisor feedback group.

These findings suggest that student teachers who made a self appraisal of their individual teaching behaviour and those who received feedback from the college supervisor made significantly more use of the category 2 in an extended fashion as compared to a control group that was trained in the technique of interaction analysis.

14. 3-3 CELL:

Table 14, given below summarises the calculations derived from the Table C.XIV, of the appendix.

TABLE 14 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.349	47		
A (Treatments)	0.451	5	0.090	4.29*
Subjects Within Groups	0.898	42	0.021	
Within Subjects	1.068	240		
B (Trial Gains)	0.002	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.151	25	0.006	1.50
B x Subjects Within Groups	0.915	210	0.004	

$^*F_{.99} = 3.49$ with 5, 42 d.f. Significant at .01 Level

For the treatment effect (A), $F = 4.29$ with 5, 42 d.f. and this is significant. It suggests that the overall measure of performance for the six treatments differ significantly and that the hypothesis of significant differences between the treatment means cannot be rejected.

For the effect of (B) factor, $F = 0.00$ with 5, 25 d.f. It suggests that the hypothesis of significant differences between the mean scores of the trial gains can be rejected.

For the A x B interaction, we have $F = 1.50$ with 25, 210 d.f. This value just misses to reach significance at .05 Level. It indicates that the learning curves of the six treatments are not significantly of the different form.

Using the T - Method, a set of simultaneous confidence intervals for the differences between sample means can be established. In the present analysis to illustrate the significance testing function of the T - Method, we have $\bar{X}_{.1} = 1.736$, $\bar{X}_{.2} = 1.659$, $\bar{X}_{.3} = 1.716$, $\bar{X}_{.4} = 1.707$, $\bar{X}_{.5} = 1.617$, $\bar{X}_{.6} = 1.703$, and $\sqrt{MS_W/n} = 0.021$ and $_{.95}q_{6,42} = 4.23$.
To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts $(4.23)(0.021) = 0.089$ from each difference. These calculations are performed in Table 14.1.

TABLE 14.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using the T - Method

$\bar{X}_{.j} - \bar{X}_{.j}*$	$1 - q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = .077$	.089	.077 ± .089 (.166, - .012)
$\bar{X}_{.1} - \bar{X}_{.3} = .020$	.089	.020 ± .089 (.109, - .069)
$\bar{X}_{.1} - \bar{X}_{.4} = .030$	.089	.030 ± .089 (.119, - .059)
$\bar{X}_{.1} - \bar{X}_{.5} = .119$	.089	.119 ± .089 (.208, .030)*
$\bar{X}_{.1} - \bar{X}_{.6} = .033$	.089	.033 ± .089 (.122, - .056)
$\bar{X}_{.2} - \bar{X}_{.3} = -.057$	.089	-.057 ± .089 (.032, - .146)
$\bar{X}_{.2} - \bar{X}_{.4} = -.047$	.089	-.047 ± .089 (.042, - .136)
$\bar{X}_{.2} - \bar{X}_{.5} = .042$	.089	.042 ± .089 (.131, - .047)
$\bar{X}_{.2} - \bar{X}_{.6} = -.044$	.089	-.044 ± .089 (.045, - ,133)
$\bar{X}_{.3} - \bar{X}_{.4} = .010$	.089	.010 ± .089 (.099, - .079)
$\bar{X}_{.3} - \bar{X}_{.5} = .099$	.089	.099 ± .089 (.188, .010)*
$\bar{X}_{.3} - \bar{X}_{.6} = .013$	.089	.013 ± .089 (.102, - .076)
$\bar{X}_{.4} - \bar{X}_{.5} = .090$	.089	.090 ± .089 (.179, .001)*
$\bar{X}_{.4} - \bar{X}_{.6} = .003$	.089	.003 ± .089 (.092, - .086)
$\bar{X}_{.5} - \bar{X}_{.6} = -.084$	.089	-.084 ± .089 (.005, - .173)

*Significant at .05 Level

These results suggest that the mean performance on the treatments A_1, A_3 and A_4. is statistically different from the mean performance on the treatment A_5. It can be argued that the mean performance on the (a) self appraisal and self directed feedback group (b) college supervisor feedback group (c) external observer feedback group is statistically different from the mean performance of the control group trained in the technique of interaction analysis.

15. EXTENDED INDIRECT:

Table 15, given below summarises the calculations derived from the Table C.XV, of the appendix.

TABLE 15 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.288	47		
A (Treatments)	0.292	5	0.058	2.42
Subjects Within Groups	0.996	42	0.024	
Within Subjects	1.025	240		
B (Trial Gains)	0.002	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.264	25	0.010	2.50*
B x Subjects Within Groups	0.759	210	0.004	

$*F_{.99}$ = 1.88 25, 210 d.f. Significant at .01 Level

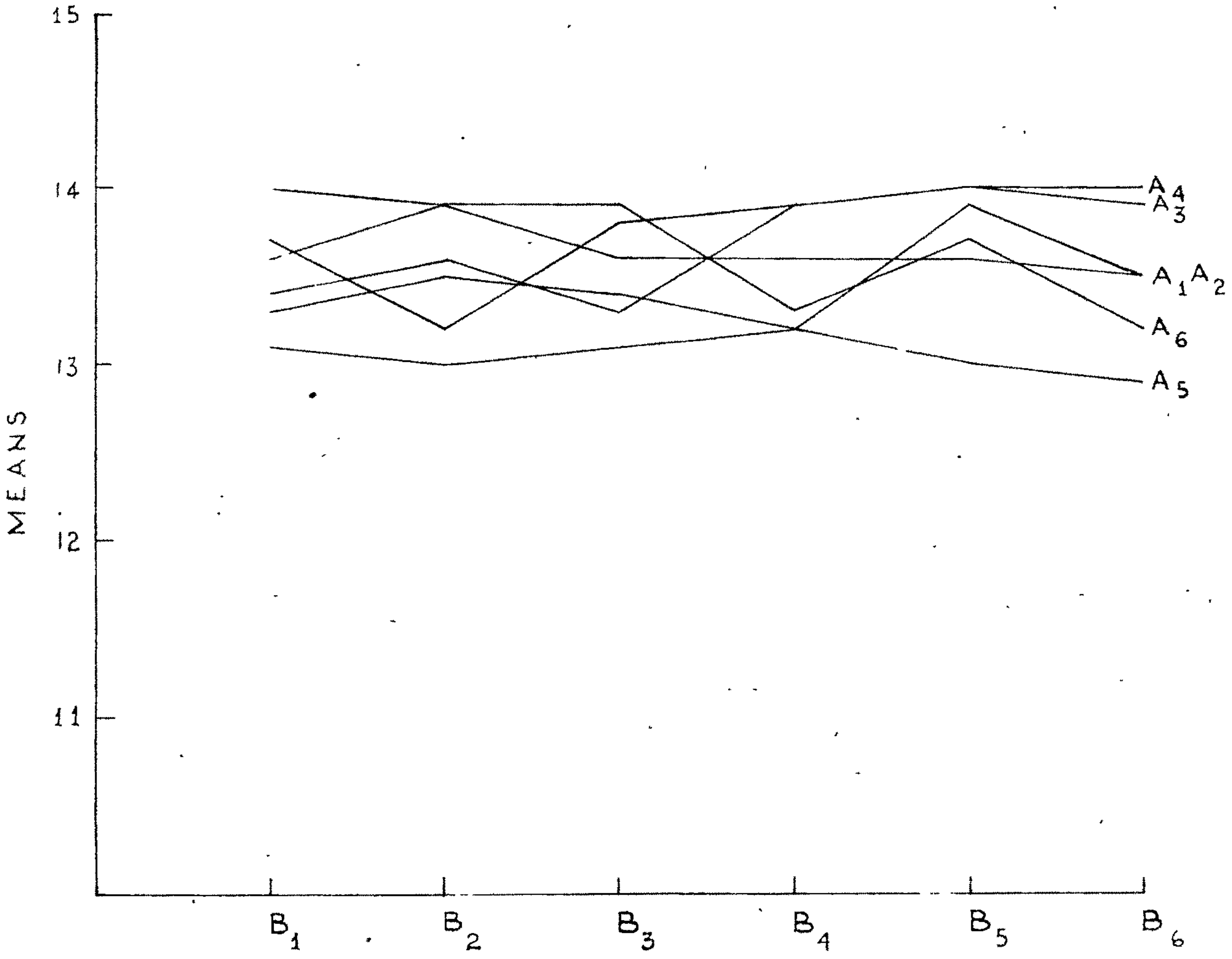
For the treatment effect (A) F = 2.42 with 5, 42 d.f. and this value just misses to reach significance at .05 Level. It suggests that the overall measure of performance for the six treatments do not differ significantly.

For the effect of Trial Gains (B), F = 0.00 and this suggests that the six trial gains when averaged over the six treatments do not differ.

Testing treatment x trial gain interaction mean square for significance, F = 2.50 with 25, 210 d.f. and this a a significant value at .01 Level. It indicates that the learning curves of the six treatments are not parallel; rather they are of the different form.

EXTENDED INDIRECT

TRENDS FOR THE SIX TREATMENT GROUPS



MEANS FOR LEVELS OF A AT EACH LEVEL OF B

16. EXTENDED DIRECT:

Table 16, given below summarises the calculations derived from the Table C.XVI, of the appendix.

TABLE 16 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	2.725	47		
A (Treatments)	0.665	5	0.133	2.71*
Subjects Within Groups	2.060	42	0.049	
Within Subjects	0.617	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.125	25	0.005	2.50**
B x Subjects Within Groups	0.492	210	0.002	

* $F_{.95}$ = 2.44 with 5, 42 d.f. Significant at .05 Level

**$F_{.99}$ = 1.88 with 25, 210 d.f. Significant at .01 Level

For the effect of factor (A), F = 2.71 with 5, 42 d.f. and this is a significant value at .05 Level. This suggests that the overall measure of performance for the six treatments differ significantly at .05 Level.

For the effect of factor B, F = 0.00 and it suggests that the six trial mean gains when averaged over the six treatments do not differ.

For the effect of interaction of treatments x trial gains, F = 2.50 with 25, 210 d.f. and this is a significant value at .01 Level. This indicates that the learning curves of the six treatments are not of the different form.

The mean scores of the different treatments are as follows: $\bar{X}_{.1} = 1.671$, $\bar{X}_{.2} = 1.738$, $\bar{X}_{.3} = 1.603$, $\bar{X}_{.4} = 1.715$, $\bar{X}_{.5} = 1.738$, $\bar{X}_{.6} = 1.662$. a

and $\sqrt{MS_W/n} = 0.03$ & $_{.95}q_{6,42} = 4.23$

To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts (4.23)(0.03) = 0.127 from each difference. These calculations are performed in the Table 16.1.

TABLE 16.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$\bar{X}_{.j} - \bar{X}_{.j^*}$	$1 - q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = -.067$	.127	−.067 ± .127 (.060, - .194)
$\bar{X}_{.1} - \bar{X}_{.3} = .068$	.127	.068 ± .127 (.195, - .059)
$\bar{X}_{.1} - \bar{X}_{.4} = .044$	.127	.044 ± .127 (.171, - .083)
$\bar{X}_{.1} - \bar{X}_{.5} = -.067$	.127	−.067 ± .127 (.060, - .194)
$\bar{X}_{.1} - \bar{X}_{.6} = .009$	.127	.009 ± .127 (.136, - .118)
$\bar{X}_{.2} - \bar{X}_{.3} = .135$	.127	.135 ± .127 (.262, - .008)*
$\bar{X}_{.2} - \bar{X}_{.4} = .023$	.127	.023 ± .127 (.150, - .104)
$\bar{X}_{.2} - \bar{X}_{.5} = .000$	.127	.000 ± .127 (.127, - ,127)
$\bar{X}_{.2} - \bar{X}_{.6} = .076$	.127	.076 ± .127 (.203, - .051)
$\bar{X}_{.3} - \bar{X}_{.4} = -.112$	.127	−.112 ± .127 (.015, - .239)
$\bar{X}_{.3} - \bar{X}_{.5} = -.135$	.127	−.135 ± .127 (−.008, - .262)*
$\bar{X}_{.3} - \bar{X}_{.6} = -.059$	.127	−.059 ± .127 (.068, - .186)
$\bar{X}_{.4} - \bar{X}_{.5} = -.023$	.127	−.023 ± .127 (.104, - .150)
$\bar{X}_{.4} - \bar{X}_{.6} = .053$	.127	.053 ± .127 (.180, - .074)
$\bar{X}_{.5} - \bar{X}_{.6} = .076$	.127	.076 ± .127 (.203, - .051)

*Significant at .05 Level

These findings suggest that the population means for the treatments A_2 and A_3 & A_3 and A_5 differ significantly. It can be argued that the feedback by the college supervisor is significantly different from (a) the peer; and (b) the control group having been taught interaction analysis.

The college supervisor feedback succeeded in its attempts to decrease the proportion of negative affective teacher talk or extended direct teacher talk. No other differences are statistically significant at the .05 Level for the Tukey tests.

17. INSTANTANEOUS TEACHER RESPONSE RATIO:

Table 17, given below summarises the calculations derived from the Table C.XVII, of the appendix.

TABLE 17 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Square	d.f.	Mean Square	F
Between Subjects	1.103	47		
A (Treatments)	0.123	5	0.025	1.09
B (Subjects Within Groups	0.980	42	0.023	
Within Subjects	0.812	240		
B (Trial Gains)	0.002	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.086	25	0.003	1.00
B x Subjects Within Groups	0.724	210	0.003	

For the treatment effect (A), F = 1.09 with 5, 42 d.f. and this is a non-significant value. It indicates that there are no significant differences between the mean scores of the different treatment groups.

Testing the effect of factor B, for significance, F = 0.00. It suggests that there are no differences between the mean scores of the six trial gains when averaged over the six treatments.

Testing the treatment x trial gain interaction mean square for significance, F = 1.00 with 25, 210 d.f. It suggests that the learning curves of the six treatments are of the same form since this value is not significant at the .05 Level.

18. TEACHER QUESTION RATIO:

Table 18, given below summarises the calculations derived from the Table C.XVIII, of the appendix.

TABLE 18 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Squares	d.f.	Mean Square	F
Between Subjects	1.356	47		
A (Treatments)	0.431	5	0.086	3.92*
Subjects Within Groups	0.925	42	0.022	
Within Subjects	0.988	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.169	25	0.007	1.75**
B x Subjects Within Groups	0.819	210	0.004	

* $F_{.99}$ = 3.49 with 5, 42, d.f. Significant at .01 Level

**$F_{.95}$ = 1.57 with 25, 210, d.f. Significant at .05 Level

For the treatment (A) effect, F = 3.92 with 5, 42 d.f. and this is significant at .01 Level. Because the six treatment means A_1, A_2, A_3, A_4 A_5, and A_6, have been averaged over six trials, they correspond to a general overall measure of performance for each treatment and the test of significance indicates that the overall measure of performance for the six treatments differ significantly.

Testing the trial gains mean square for significance, $F = 0.00$ and it suggests that there are no differences between the mean scores of the six trial gains.

For the treatment x trial gain interaction, $F = 1.75$ with 25, 210 d.f. and this is significant at .05 Level. It suggests that the learning curves of the six treatments differ significantly.

In the present analysis to illustrate the significance testing function of the T - Method, $\bar{X}_{.1} = 1.667$, $\bar{X}_{.2} = 1.736$, $\bar{X}_{.3} = 1.684$, $\bar{X}_{.4} = 1.621$, $\bar{X}_{.5} = 1.718$, $\bar{X}_{.6} = 1.718$, and $\sqrt{MS_W/n} = 0.021$ and ${}_{.95}q_{6,42} = 4.23$

To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts $(4.23)(0.021) = 0.089$ from each difference. These calculations are performed in Table 18.1.

TABLE 18.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method

$\bar{X}_{.j} - \bar{X}_{.j}$*	$1 - q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2}$ = -.069	.089	-.069 ± .089 (.020, - .158)
$\bar{X}_{.1} - \bar{X}_{.3}$ = -.017	.089	-.017 ± .089 (.072, - .106)
$\bar{X}_{.1} - \bar{X}_{.4}$ = .046	.089	.046 ± .089 (.135, - .043)
$\bar{X}_{.1} - \bar{X}_{.5}$ = -.051	.089	-.051 ± .089 (.048, - .140)
$\bar{X}_{.1} - \bar{X}_{.6}$ = -.051	.089	-.051 ± .089 (.048, - .140)
$\bar{X}_{.2} - \bar{X}_{.3}$ = .052	.089	.052 ± .089 (.141, -. 047)
$\bar{X}_{.2} - \bar{X}_{.4}$ = .115	.089	.115 ± .089 (.204, .026)*
$\bar{X}_{.2} - \bar{X}_{.5}$ = .018	.089	.018 ± .089 (.107, - .071)
$\bar{X}_{.2} - \bar{X}_{.6}$ = .018	.089	.018 ± .089 (.107, - .071)
$\bar{X}_{.3} - \bar{X}_{.4}$ = .063	.089	.063 ± .089 (.152, - .026)
$\bar{X}_{.3} - \bar{X}_{.5}$ = -.034	.089	-.034 ± .089 (.055, - .123)
$\bar{X}_{.3} - \bar{X}_{.6}$ = -.034	.089	-.034 ± .089 (.055, - .123)
$\bar{X}_{.4} - \bar{X}_{.5}$ = -.097	.089	-.097 ± .089 (-.196, - .008)*
$\bar{X}_{.4} - \bar{X}_{.6}$ = -.097	.089	-.097 ± .089 (-.196, - .008)*
$\bar{X}_{.5} - \bar{X}_{.6}$ = .000	.089	.000 ± .089 (.189, - .089)

*Significant at .05 Level

These results suggest that the mean scores for the treatments A_2 & A_4, A_4 & A_5, and A_4 & A_6 differ significantly in THEIR use of the Teacher Question Ratio. The results demonstrate that the mean performance score of the peer group treatment and both the control groups is significantly higher than the mean performance score on the external observer treatment group in their use of this specific ratio.

No other differences are statistically significant at the .05 Level for the Tukey tests.

19. INSTANTANEOUS TEACHER QUESTION RATIO:

Table 19, given below summarises the calculations derived from the Table C.XIX, of the appendix.

TABLE 19 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Square	d.f.	Mean Square	F
Between Subjects	1.513	47		
A (Treatments)	0.102	5	0.020	0.61
Subjects Within Groups	1.410	42	0.033	
Within Subjects	0.872	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.108	25	0.004	1.00
B x Subjects Within Groups	0.764	210	0.004	

Testing the treatment mean square for significance, F = 0.61 with 5, 42 d.f. and this is a non-significant value. This suggests that the hypothesis of significant differences between the mean scores of the six treatments can be rejected.

For the effect of factor B, F = 0.00 and this suggests that the six trial mean gain scores do not differ.

For the effect of a x B interaction, F = 1.00 with 25, 210 d.f. and this is not significant. It indicates that the learning curves of the six treatments are of the same form.

20. 9-9 CELL:

Table 20, given below summarises the calculations derived from the Table CXX, of the appendic

TABLE 20 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Square	d.f.	Mean Square	F
Between Subjects	1.459	47		
A (Treatments)	0.466	5	0.093	3.88*
Subjects Within Groups	0.993	42	0.024	
Within Subjects	1.009	240		
B (Trial Gains)	0.000	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.181	25	0.007	1.75**
B x Subjects Within Groups	0.828	210	0.004	

* $F_{.99}$ = 3.49 with 5, 42 d.f. Significant at .01 Level

**$F_{.95}$ = 1.57 with 25, 210 d.f. Significant at .05 Level

For the treatment effect (A), F = 3.88 with 5, 42 d.f. and this is a significant value at .01 Level. The test of significance suggest that the overall measure of performance for the six treatments differ and the hypothesis of significant differences between the mean scores of the different treatments cannot be rejected.

For the effect of trial gains (B), F = 0.00 and this suggests that the six trial mean gains when averaged over the six treatments do not differ.

For the effect of treatment x trial gains interaction, F = 1.75 with 25, 210 d.f. and this value is significant at .05 Level. This suggests that the learning curves of the six treatments are not parallel.

In the present analysis to illustrate the significance testing function of the T - Method, we have, $\bar{X}_{.1} = 1.773$, $\bar{X}_{.2} = 1.668$, $\bar{X}_{.3} = 1.651$, $\bar{X}_{.4} = 1.667$, $\bar{X}_{.5} = 1.700$, $\bar{X}_{.6} = 1.679$, and $\sqrt{MS_W/n} = 0.022$ and ${}_{.95}q_{6,42} = 4.23$

To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts (4.23)(0.022) = 0.089 from each difference. These calculations are performed below.

TABLE 20.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method.

$\bar{X}_{.j} - \bar{X}_{.j^*}$	$1 - q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2}$ = .105	.093	.105 ± .093 (.198, .012)*
$\bar{X}_{.1} - \bar{X}_{.3}$ = .122	.093	.122 ± .093 (.215, .029)*
$\bar{X}_{.1} - \bar{X}_{.4}$ = .106	.093	.106 ± .093 (.199, .013)*
$\bar{X}_{.1} - \bar{X}_{.5}$ = .073	.093	.073 ± .093 (.166, - .020)
$\bar{X}_{.1} - \bar{X}_{.6}$ = .094	.093	.094 ± .093 (.187, .001)*
$\bar{X}_{.2} - \bar{X}_{.3}$ = .017	.093	.017 ± .093 (.110, - .076)
$\bar{X}_{.2} - \bar{X}_{.4}$ = .001	.093	.001 ± .093 (.094, - .092)
$\bar{X}_{.2} - \bar{X}_{.5}$ = -.032	.093	-.032 ± .093 (.061, - .125)
$\bar{X}_{.2} - \bar{X}_{.6}$ = -.011	.093	-.011 ± .093 (.082, - .104)
$\bar{X}_{.3} - \bar{X}_{.4}$ = -.016	.093	-.016 ± .093 (.077, - .109)
$\bar{X}_{.3} - \bar{X}_{.5}$ = -.049	.093	-.049 ± .093 (.044, - .143)
$\bar{X}_{.3} - \bar{X}_{.6}$ = -.028	.093	-.028 ± .093 (.065, - .121)
$\bar{X}_{.4} - \bar{X}_{.5}$ = -.033	.093	-.033 ± .093 (.060, - .126)
$\bar{X}_{.4} - \bar{X}_{.6}$ = -.012	.093	-.012 ± .093 (.081, - .105)
$\bar{X}_{.5} - \bar{X}_{.6}$ = .021	.093	.021 ± .093 (.114, - .072)

*Significant at .05 Level

These findings suggest that the population mean scores for the treatments A_1 & A_2, A_1 & A_3, A_1 & A_4 and A_1 & A_6, differ significantly at .05 Level in the extension of Pupil-initiated pupil talk.

It can be argued that the mean performance of the treatment group that made self appraisal of behaviour and independently decided further steps for continual self improvement using the technique of interaction analysis is significantly different from the mean performance of the following groups:

(a) student teachers receiving feedback from the peer;

(b) student teachers receiving feedback from the college supervisor;

(c) student teachers receiving feedback from the external observer (class teacher in the present study);

(d) control group having not been taught interaction analysis but taught traditional learning theory.

No other differences are statistically significant at the .05 Level for the Tukey tests.

21. PUPIL INITIATIVE RATIO:

Table 21, given below summarises the calculations derived from the Table C.XXI, of the appendix.

TABLE 21 Summary of the Analysis of Variance: Trial Means With Different Treatments

Source of Variation	Sum of Square	d.f.	Mean Square	F
Between Subjects	1.410	47		
A (Treatments)	0.443	5	0.089	3.87*
Subjects Within Groups	0.967	42	0.023	
Within Subjects	1.090	240		
B (Trial Gains)	0.002	5	0.000	0.00
A x B (Treatment x Trial Gains)	0.096	25	0.004	0.80
B x Subjects Within Groups	0.992	210	0.005	

$*F_{.99} = 3.49$ with 5, 42 d.f. Significant at .01 Level

For the treatment effect (A), F = 3.87 with 5, 42 d.f. and this value is significant. The test of significance suggests that the overall measure of performance for the six treatments differ significantly and the hypothesis of significant differences between the mean scores of the treatment groups cannot be rejected.

For the effect of factor B, F = 0.00 and this suggests that the means of six trial gains do not differ when averaged over the six treatments.

Further, testing A x B mean square for significance, the value for F = 0.80 with 25, 210 d.f. and this value is not significant. It indicates that the learning curves for the six treatments are not of the different form.

In the present analysis to illustrate the significance testing function of the T - Method, we have, $\bar{X}_{.1} = 1.769$, $\bar{X}_{.2} = 1.656$, $\bar{X}_{.3} = 1.696$, $\bar{X}_{.4} = 1.689$, $\bar{X}_{.5} = 1.674$, $\bar{X}_{.6} = 1.652$, $\sqrt{MS_W/n} = 0.022$ and $_{.95}q_{6,42} = 4.23$

To establish confidence intervals around the fifteen possible differences between means, one adds and subtracts $(4.23)(0.022) = 0.093$ from each difference. These calculations are performed in Table 21.1.

TABLE 21.1 Establishing Confidence Intervals Around Differences Between Fifteen Sample Means Using The T - Method.

$\bar{X}_{.j} - \bar{X}_{.j^*}$	$_{1-}q_{j,j(n-1)}(\sqrt{MS_W/n})$	Final Calculations
$\bar{X}_{.1} - \bar{X}_{.2} = .113$	.093	.113 ± .093 (.206, .020)*
$\bar{X}_{.1} - \bar{X}_{.3} = .073$	.093	.073 ± .093 (.116, - .020)
$\bar{X}_{.1} - \bar{X}_{.4} = .080$	.093	.080 ± .093 (.173, - .013)
$\bar{X}_{.1} - \bar{X}_{.5} = .095$	.093	.095 ± .093 (.188, .002)*
$\bar{X}_{.1} - \bar{X}_{.6} = .117$	.093	.117 ± .093 (.210, .024)*
$\bar{X}_{.2} - \bar{X}_{.3} = -.040$	.093	-.040 ± .093 (.053, - .133)
$\bar{X}_{.2} - \bar{X}_{.4} = -.033$	.093	-.033 ± .093 (.060, - .126)
$\bar{X}_{.2} - \bar{X}_{.5} = -.020$	.093	-.020 ± .093 (.073, - .113)
$\bar{X}_{.2} - \bar{X}_{.6} = .004$	.093	.004 ± .093 (.097, - .089)
$\bar{X}_{.3} - \bar{X}_{.4} = .007$	.093	.007 ± .093 (.100, - .086)
$\bar{X}_{.3} - \bar{X}_{.5} = .022$	.093	.022 ± .093 (.115, - .071)
$\bar{X}_{.3} - \bar{X}_{.6} = .044$	.093	.044 ± .093 (.137, - .049)
$\bar{X}_{.4} - \bar{X}_{.5} = .014$	.093	.014 ± .093 (.107, - .079)
$\bar{X}_{.4} - \bar{X}_{.6} = .037$	.093	.037 ± .093 (.130, - .056)
$\bar{X}_{.5} - \bar{X}_{.6} = .023$	.093	.023 ± .093 (.116, - .070)

*Significant at .05 Level

These results suggest that the mean performance on the treatment A_1, is statistically different from the mean performance on the treatments A_2, A_5 and A_6. No other differences are statistically significant at the .05 Level for the Tukey tests.

It can be argued that student teachers who made self appraisal of their individual teaching behaviour and independently decided further steps for continual self improvement made higher Pupil Initiative Ratio, which is significantly different from:

(a) the peer group feedback;

(b) the control group having been trained in the technique of interaction analysis;

(c) the control group having not been taught interaction analysis but taught traditional learning theory.