CHAPTER V

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CHAPTER V

ANALYSIS AND INTERPRETATION

5.1 Introduction

The objectives of the final study have already been stated in the first chapter. The hypotheses to be tested have also been given there. As emerging from the objectives the present investigation deals mainly with two aspects. These are the relative effectiveness of the four programme forms, and the relationship of certain personality variables and achievement of the students on the posttest. Results related to both these aspects are reported separately in this chapter.

However, before reporting the results of the above aspects, it is essential to report the result of the pretest which is the base of the programme forms. The pretest was scored and percentages were computed for all students. It was found that 89.36 per cent of the students of the total sample got 90 per cent or above marks, and 10.64 per cent of the students got between 75 per cent and 90 per cent marks. Since the students' ability to learn and their retention power differ all the students may not get hundred per cent marks.

74 Therefore, the above achievement of the students on the pretest can be considered sufficiently high to assume that the students had the prerequisites needed for learning through the present programme forms.

Before proceeding to study the relative effectiveness, it is appropriate to consider the effectiveness of each programme form in terms of students performance on the posttest. For this purpose students' performance has been expressed in percentiles in respect of the four groups separately. This has been represented in Table 5.1.

Table 5.1 : Students' performance on posttest for the four groups

Percentile	Linear overt form-score in percentage (N=76)	Branching form-score in percentage (N=75)	Skip programme form-score in percentage (N=75)	Response prompt form-score in percentage (N=75)
P_{90}	85.00	90.00	90.00	92.50
P_{80}	80.00	85.00	85.00	85.00
P_{70}	75.00	80.00	80.00	80.00
P_{60}	72.50	77.50	77.50	77.50
P_{50}	70.00	75.00	75.00	72.50
P_{40}	70.00	72.50	70.00	70.00
P_{30}	62.50	70.00	67.50	65.00
P_{20}	60.00	67.50	62.50	65.00
P_{10}	55.00	62.50	57.50	60.00

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It may be observed from Table 5.1 that 80 per cent of the students who have learnt through the linear overt, branching, skip and response prompt forms have scored 80 per cent or above . As mentioned in the third chapter the performance of students on posttest determines the extent to which the terminal behaviours have been attained by the students of each group. Since 80 percent of students of each group have scored 80 per cent or above on posttest, it may be said that 80 per cent or above terminal behaviours are attained by 80 per cent of students irrespective of the programme form through which they have learnt. On the basis of this, each programme form may be considered effective for the purpose of the present investigation.

5.2 Relative effectiveness of the programme forms

Under caption 5.1 the effectiveness of each form has been presented. It has been studied in terms of students performance on posttest. The findings revealed that all the four forms are effective. But whether these forms have proved effective to the same extent, remains to be studied. For this purpose the relative effectiveness of the four programme forms has been considered in terms of the following criteria.

76 (a) performance of the students on the posttest.

(b) time taken to complete the programme.

Students' performance on the criterion test (posttest) is widely accepted evidence of the effectiveness of any instructional programme. If the students learn well from a programme it is fulfilling its purpose. The performance of the students on the criterion test (posttest) shows how much the students have learnt. Table 5.2 shows the means and standard deviations of the students' performance on the posttest.

Table 5.2 : Means and standard deviations of the different groups on the posttest

	Linear overt form	Branching form	Skip programme form	Response prompt form
Mean	28.25	30.48	29.69	29.69
S.D.	4.73	4.06	4.93	4.85

It can be seen from the Table 5.2 that the mean performance of the four groups is different from each other. For studying whether the mean performance of the students on posttest who have studied through different programme forms differs significantly or not, analysis of variance

77 was applied. The results of analysis of variance have been presented in Table 5.3.

Table 5.3 : Summary of analysis of variance

Source of Variation	df	Sum of squares	Mean square	F-ratio
Treatment	3	195.87	65.29	3.014*
Error	297	6433.24	21.66	
Total	300	6629.11		

* significant at 0.05 level

The value of F is 3.014 which is significant at 0.05 level with degrees of freedom (df) 3/297. This means that the four programme forms viz., linear overt, branching, skip and the response prompt differentially affect students' achievement. Thus the null hypothesis that there is no significant difference in the mean performance of the students on the posttest who have studied through the four programme forms is rejected. The differential effect of the four programmes has been further studied by applying the t-test.

Table 5.4 : Significance of difference between mean posttest scores on different programme forms.

Forms	Mean	S.D.	N	Linear overt form	Branching form	Skip programme form	Response prompt form
Linear overt form	28.25	4.73	76		3.09**	1.81	1.84
Branching form	30.48	4.06	75			1.08	1.08
Skip programme form	29.68	4.93	75				0.01
Response prompt form	29.69	4.85	75				

** significant at 0.01 level

79 Table 5.4 shows that only the t-value 3.09 is significant at 0.01 level. That is, the mean performance of the group which learnt through branching form differs significantly from that of the group which learnt through the linear overt form. Since the mean performance of the branching group is higher than that of the linear overt group, it implies that branching form is more effective than the linear overt form. The other t-values are not significant. It means, the mean performance of students who learnt through linear overt form does not differ significantly from the mean performance of students who studied through skip programme and response prompt forms. Also, the mean performance of students who studied through branching form does not differ significantly from the mean performance of the students who studied through skip programme and response prompt forms. Lastly, the mean performance of students who learnt through skip programme form doesnot differ significantly from that of response prompt form.

It is interesting to note that, of the six possible comparisons for which t-test has been applied only in case of one pair, viz., linear overt and branching, difference in mean performance has been found significant. Thus the differential effect revealed through F-ratio is due to the significant difference in mean performance of these two groups. It may also be noted that the mean performance of

80 branching group is significantly higher as compared with the mean performance of the linear overt group. However the mean performance of the students who learnt through the branching group is not significantly different as compared with the mean performance of students who learnt through the other forms. Also the mean performance of students who learnt through the linear overt form does not differ significantly from the other two forms, viz., skip programme form and response prompt form. These findings do not support the findings of Krishnamurthy (1973). He found that the mean performance of students who studied through the linear overt, branching, skip programme and response prompt forms do not differ significantly from each other.

The four programme forms, when considered in terms of mean performance of the four groups are in the following descending order :

1. branching form
2. response prompt form
3. skip programme form
4. linear overt form

According to Krishnamurthy (1973) the rank order of the forms are as follows in the descending order :

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1. response prompt covert (reading)
2. linear covert (thinking)
3. skip programme
4. hybrid
5. linear overt
6. response prompt overt (copying)
7. branching

As stated earlier the second criterion for studying the effectiveness of the programme has been the time required by students to learn through the particular programme form. The Table 5.5 shows formwise mean and standard deviation of the time required to go through the programmes.

Table 5.5 : Formwise mean and standard deviation of the time required to go through the programmes.

	Linear overt form	Branching form	Skip programme form	Response prompt form
Mean	104.09	92.97	96.07	100.09
S.D.	3.95	5.00	3.05	2.51

It can be seen from Table 5.5 that mean time needed to study through the different programme forms is different. For studying whether the mean time taken by the

students on the different programme forms differs significantly or not, analysis of variance was applied. The results of analysis of variance have been presented in Table 5.6.

Table 5.6 : Summary of analysis of variance

Source of Variation	df	Sum of squares	Mean square	F-ratio
Treatment	3	5292.78	1764.25	125.55**
Error	297	4173.32	14.05	
Total	300	9466.09		

** significant at 0.01 level

The value of F is 125.55 which is significant at 0.01 level with df 3/297. This means that the mean time required for going through the different programme forms, viz., linear overt, branching, skip and response prompt differs significantly. Thus the null hypothesis that there is no significant difference in the mean time required for going through the different programme forms is rejected. The difference in time required has been further studied by applying the t-test. This has been given in Table 5.7.

Table 5.7 : Significance of difference of mean time score on different forms

Forms	Mean	S.D.	N	Linear overt form	Branching form	Skip programme form	Response prompt form
Linear overt form	104.09	3.95	76		15.23**	14.07**	7.40**
Branching form	92.97	5.00	75			4.56**	10.95**
Skip programme form	96.07	3.05	75				8.93**
Response prompt form	100.09	2.51	75				

** Significant at 0.01 level

34 The six possible comparisons has been studied by employing t-test. For all the pairs the values are significant at 0.01 level. The mean time required by the students under linear overt form is significantly higher than under branching form, skip programme form and response prompt form. Secondly, the mean time required by the students who studied through response prompt form is significantly higher than those students who went through branching form and skip programme form. Lastly, the mean time needed by the students who studied through the skip programme form is significantly higher than the branching form.

If the students require less time to learn through a particular form, that form is considered to be more effective when time is taken as a criterion. In the present investigation the students who studied through branching form has taken the least time, next to it comes the skip programme form, then the response prompt form and finally the linear overt form. Therefore, branching programme form is the most effective and the linear overt form is least effective one when time is taken as a criterion. This may be because in branching form if the student chooses a right answer, that will lead him to a route that skips several frames. In the skip programme also if the student's response is correct he can skip several frames. In the response prompt form the student has to go through all the frames, but he has to only

35 copy the response. On the other hand in the linear overt form the student has to go through all the frames, think of the correct answer to the question and then write down the response. These additional processes of thinking and writing down the response on the part of the learner would make him to take comparatively more time on linear overt form. This seems to have been substantiated by the fact that students who studied through the branching form have taken the minimum time and on linear overt form the maximum time. This is supported by the findings of Krishnamurthy (1973), when the results related to four forms, viz., linear overt, branching, skip and response prompt are considered. According to the findings of the present study the rank order of the forms in the ascending order, is as follows :

1. branching
2. skip
3. response prompt
4. linear overt

According to Krishnamurthy's (1973) finding the rank order of the forms in the ascending order is as follows :

1. response prompt covert
2. linear covert
3. branching

86

4. skip programme

5. hybrid

6. response prompt overt

7. linear overt

It was found from the teaching schedules of the teachers who teach the topic of the present investigation that the time spent (3 hours) for covering this topic through traditional way of teaching was more than the time taken by the four groups to have gone through the programmed material for the topic. This can be seen from Table 5.5.

It can be concluded that the branching form is relatively more effective than the linear overt form when the performance of students on the posttest is taken as the criterion. Except between these two forms, when the performance of the students on posttest is compared, it is more or less the same in all the other forms. But branching form is relatively more effective than all the other forms when time required to go through the programme is considered as the criterion of effectiveness. According to this criterion linear overt form is the least effective of all the other forms.

In programmed learning, the students are expected to learn through self efforts by reading and understanding the written instructional materials. Reading comprehension,

87 therefore, becomes an important factor in the process of learning. Ansuya (1970) found that reading comprehension is related to student's performance. Hence reading comprehension is taken as a covariate in the present study where the students learnt by reading the programmed learning material presented to them.

For studying the difference in mean achievement when adjusted for their reading comprehension analysis of covariance was applied. The ~~results of analysis of covariance was applied.~~ The results of analysis of covariance have been presented in Table 5.8.

It may be observed from Table 5.8 that the value of F is 3.99 which is significant at 0.01 level with df 3/297. This means that the mean performance of students on posttest of the four groups differs significantly when adjusted for their reading comprehension. Thus the null hypothesis that there is no significant difference in the mean performance of students on posttest of the four groups when adjusted for their reading comprehension is rejected. The difference in mean performance of students on posttest of four groups when adjusted for their reading comprehension has been further studied by applying the t-test. The t-values for different pairs have been reported in Table 5.9.

Table 5.8 : Summary of analysis of covariance

Sources of Variation	Σy^2	Σx^2	Σxy	df	$\Sigma y'^2$	$\Sigma x'^2$	$\Sigma x'y'$	F - unadjusted	F- adjusted
Error	6433.24	728.44	929.55	297	21.66	2.45	3.13		
Programme form	195.87	0.91	-5.85	3	65.29	0.30	-1.95	3.01	3.99**
Total	6629.11	729.35	923.70	300					

** Significant at 0.01 level

Unadjusted mean square deviation = 21.66 (df=297)
Reduction sum of squares = 1186.18 (df= 1)
Deviations sum of squares = 5247.06 (df=296)
Adjusted mean square deviation = 17.73 (df=296)

Conco.variables	Reg. coefficients	Std.err. of reg. coeff.	T-values of reg. coeff.
reading comprehension	1.28	0.16	8.18

Adjusted means for dependent variable posttest
Factor 1 programme form.

Level - 1, Mean = 28.16 (N=76)
Level - 2, Mean = 30.44 (N=75)
Level - 3, Mean = 29.76 (N=75)
Level - 4, Mean = 29.75 (N=75)

Table 5.9 : Significance of difference between mean posttest on different forms when adjusted for the reading comprehension.

Forms	Mean	N	Linear overt form	Branching form	Skip programme form	Response prompt form
Linear overt form	28.16	76		3.32**	2.33*	2.33*
Branching form	30.44	75			0.99	1.00
Skip programme form	29.76	75				0.01
Response prompt form	29.75	75				

* Significant at 0.05 level

** Significant at 0.01 level

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It may be observed from Table 5.9 that of the six possible comparisons for which the t-test has been applied only in the case of three pairs of groups viz., linear overt and branching, linear overt and skip, linear overt and response prompt the t-values are significant at 0.01, 0.05 and 0.05 levels respectively when adjusted for their reading comprehension. Since the mean performance of linear overt group is less than branching, skip and response prompt groups, it implies that linear overt form is relatively less effective than the other three forms. The mean performance of students who learnt through branching form, skip programme form and response prompt form does not differ significantly when compared with one another because the t-values are not significant. It means branching, skip and response prompt forms do not contribute to learning in a differential manner.

Here, it can be concluded that linear overt form is relatively less effective than branching, skip and response prompt forms when the means of performance of the four groups of students on posttest when adjusted for their reading comprehension. On the other hand, without adjusting the means of performance of the four groups of students for their reading comprehension, it has been found that linear overt form is significantly less effective in comparison with branching form only and equally effective in comparison

91 with skip programme and response prompt forms. Also, branching form has been found equally effective in comparision with skip programme and response prompt forms. Looking at the results it may be stated that linear overt form is relatively less effective in comparison with the other three forms and branching, skip and response prompt forms are equally effective when adjusted for their reading comprehension.

5.3 Relationship between certain personality variables and the performance of the students on posttest.

Another main aspect of the present investigation is the relationship between certain personality variables and the performance of students on posttest. To find out the relationship between two variables, when the effects of other variables are removed the technique of partial correlation is applied. In this study the dependent variable is posttest. The independent variables which are used in the partial correlation are (a) reading comprehension, (b) academic motivation, (c) dependency and (d) total adjustment.

The technique of partial correlation is used because it was thought that there may be interrelationships between the variables under study. For example if (a) and (b) are related, (a) and (c) may be also related because of the

92 interrelationship between (b) and (c). The results of the relationship between performance of the students on posttest and the above mentioned personality variables have been reported in Table 5.10.

Table 5.10 : Partial correlation between posttest and (a) reading comprehension, (b) academic motivation, (c) dependency (d) total adjustment

	Linear overt form (N=76)	Branching form (N=75)	Skip programme form (N=75)	Response prompt form (N=75)
1 4.5 11 12	0.276*	0.386**	0.430**	0.395**
1 5.4 11 12	0.072	0.157	0.327**	0.119
1 11.4 5 12	0.074	-0.150	0.025	-0.050
1 12.4 5 11	0.334**	0.084	0.108	0.090

1 - posttest
4 - Reading comprehension
5 - Academic motivation
11 - Dependency
12 - Total adjustment
* Significant at 0.05 level
** Significant at 0.01 level

From Table 5.10 it is observed that for the four groups the correlation between students' performance on posttest and their reading comprehension is significant when the effects of academic motivation, adjustment and dependency are partialled out. This relationship is significant at

93 0.05 level for the group, which studied through the linear overt form, whereas for the other three groups which learnt through branching form, skip programme form and response prompt form, the correlation is significant at 0.01 level. This indicates that the reading comprehension is one factor which is responsible for the performance of the students on posttest. In the present study the students have learnt by going through the programmed learning material. This has been revealed in all the four groups irrespective of the programme forms through which they have learnt. In the light of this, the null hypothesis that there is no significant relationship between posttest scores and reading comprehension scores for the four groups separately is rejected.

The relationship between performance of students on posttest and academic motivation was studied for the four groups separately, when the effects of reading comprehension, adjustment and dependency are partialled out. The correlation coefficients indicate that there is no significant relationship between performance of students on posttest and their academic motivation for the groups who have learnt through linear overt form, branching form and response prompt form. On the other hand, the performance of the students on posttest has been found to be significantly related with their academic motivation for the group who has learnt through the skip programme form. Pimsleur,

94 Sundland and McIntyre (1963) found that motivation was related to students' achievement. This supports the finding of the skip programme form. Thus the null hypothesis that there is no significant relationship between posttest scores and academic motivation is rejected for the skip programme form, but not rejected for the other three forms viz., linear overt, branching and response prompt.

For the four groups the relationship between performance of students on posttest and their dependency trait was studied separately by partialling out the effects of academic motivation, reading comprehension and adjustment. The coefficients of partial correlation for all the four groups are not significant. On this basis, it may be stated that the two variables are not significantly related in the case of these four groups separately. It indicates that the performance of students on posttest is independent of their dependency trait. Therefore, the null hypothesis that there is no significant relationship between performance of students on the posttest and their dependency scores for the four groups separately, is not rejected.

Finally the relationship between the performance of students on posttest and adjustment was studied for the four groups separately when the effects of reading comprehension, academic motivation and dependency are partialled

95 out. The correlation coefficients indicate that there is no significant relationship between performance of students on posttest and adjustment for the groups who have learnt through branching, skip and response prompt forms. But for the students who learnt through the linear overt form the coefficient of correlation between performance of the students on posttest and their adjustment is significant at 0.01 level. It shows that the overall adjustment of those who have learnt through linear overt form affects their performance on posttest. The more they are adjusted, the better is their performance on posttest. Thus the null hypothesis that there is no significant relationship between posttest scores and adjustment is rejected for linear overt form but not rejected for the other three forms separately.

In the tool used to collect data for adjustment variable, adjustment is defined as the individual's orientation towards his parents, teachers, peers, school and himself in terms of satisfaction he derives from his interactional relationship with these significant others and himself. The relationship between performance of the students on posttest and their total adjustment has been studied above. The total adjustment means the adjustment towards home, school, teachers, peers and general together. From Table 5.10 it is found that the posttest scores and total adjustment scores are positively and significantly related in the

96 case of those who have learnt through the linear overt form. Because of this significant relationship, it was thought to study the relationship between performance of students on posttest and the five components of adjustment, viz., home, school, peers, teachers and general separately by employing partial correlation technique. Formwise, partial correlation coefficients have been reported in table 5.11.

Table 5.11 : Partial correlation between posttest and (a) home score, (b) school score, (c) peers score, (d) teachers score, (e) general score.

	Linear overt form (N=76)	Branching form (N=75)	Skip programme form (N=75)	Response prompt form (N=75)
1 6.7 8 9 10	-0.137	0.150	0.108	0.127
1 7.6 8 9 10	-0.091	0.125	0.209	0.173
1 8.6 7 9 10	0.308**	-0.010	-0.148	0.055
1 9.6 7 8 10	0.463**	0.148	0.101	0.046
1 10.6 7 8 9	-0.385**	-0.099	0.039	-0.005

1 - posttest
6 - home score
7 - school score
8 - peers score
9 - teachers score
10 - general score
* significant at 0.05 level
** significant at 0.01 level

From Table 5.11 it can be seen that the relationship between performance of students on posttest and adjustment towards home is not significant on the four forms separately when the effects of adjustment towards school, peers, teachers and general are partialled out. It means that the adjustment towards home does not contribute significantly to the performance of students on posttest. So the null hypothesis that there is no significant relationship between performance of students on posttest and their adjustment towards home when studied for the four groups separately, is not rejected.

The relationship between students' performance and their adjustment towards school was studied by partialling out the effects of adjustment towards home, peers, teachers and general for the four groups separately. From the coefficients of partial correlation as indicated in the table 5.12, it can be seen that these two variables are not significantly correlated, as the coefficients of correlation are not significant for any group. That is, adjustment towards school does not affect their academic performance when they learn by using programmed learning material. Therefore, the null hypothesis that the performance of students on posttest and their adjustment towards school are not significantly related for the four groups separately, is not rejected.

98 The relationship between performance of students on posttest and their adjustment towards peers is not significant for the groups of students who learnt through branching, skip programme and response prompt forms when the effects of their adjustment towards home, school, teachers and general are partialled out. But the relationship between these two variables is significant at 0.01 level for those who learnt through the linear overt form. Thus the null hypothesis that there is no significant relationship between the performance of students on posttest and their adjustment towards peers is rejected for the linear overt form but not rejected for the other three forms, viz., branching, skip and response prompt separately.

For the students who have learnt through skip, branching and response prompt forms, the relationship between students' performance on posttest and their adjustment towards teachers is not significant as revealed by the coefficients of partial correlation studied when the effects of students' adjustment towards their home, school, peers and general are partialled out. While, this relationship is significant at 0.01 level for those who have studied through the linear overt form. That means greater the adjustment towards teachers, better will be the performance, while they learn through the linear overt form. Therefore, the null hypothesis that there is no significant relationship between

99 students' performance on posttest and their adjustment towards teachers is rejected for the linear overt form but not rejected for the other three forms, viz., branching, skip programme and response prompt.

Lastly, the relationship between students' performance on posttest and their adjustment in general was studied for the four groups separately when the effects of their adjustment towards home, school, peers and teachers are partialled out. The correlation coefficients for those who studied through branching, skip programme and response prompt forms are not significant. This means, students' adjustment in general is not related significantly with their performance on posttest for those three groups. On the other hand, students' performance on posttest is negatively and significantly correlated at 0.01 level with their adjustment in general for the group who has learnt through the linear overt form. It shows that higher the general adjustment of the students, lower is their performance when they learn through linear overt form. So, the null hypothesis that there is no significant relationship between students' performance on posttest and their adjustment towards general is rejected for the linear overt form but not rejected for the other three forms, viz., branching, skip and response prompt separately.

100

5.4 Relationship between certain variables

Besides the relationship between certain personality variables and achievement of students on posttest, certain other relationships have also been studied. The variables under study were posttest and pretest, posttest and programme time, posttest and attitude towards programmed learning, pretest and programme time, pretest and attitude, and attitude and programme time.

These relationships have been studied by computing product moment correlation between these variables and the results have been reported in Table 5.12.

5.12 : The relationship between different variables

Variables	Linear overt form (N=76)	Branching form (N=75)	Skip programme form (N=75)	Response prompt form (N=75)
Posttest and Pretest	0.245*	0.236*	0.279*	0.080
Posttest and Programme time	0.195	-0.036	-0.623**	0.173
Posttest and attitude	-0.167	0.054	-0.163	-0.086
Pretest and Programme time	0.053	-0.107	0.182	0.016
Pretest and attitude	0.061	0.193	0.035	0.034
Attitude and Programme time	-0.098	-0.081	-0.047	0.152

* significant at 0.05 level ** significant at 0.01 level

101 The coefficients of correlation between scores on posttest who studied through the linear overt, branching and skip programme forms and their scores on pretest are positive and significant at 0.05, 0.05 and 0.05 levels respectively. It may, therefore, be said that the students performance on the posttest is positively and significantly related with students' performance on pretest. This implies that a student who scores high on pretest will also score high on the posttest. But in the case of response prompt group the relationship between pretest scores and posttest scores is not significant. In this form students have to copy the answers already provided in the frames. Since the students, generally are not used to learn this way, copying the responses which may not be accompanied by adequate thinking may not be enough for effective learning. It might have led to the situation of having no significant relationship between posttest and pretest in respect of response prompt form. Therefore the null hypothesis that there is no significant relationship between posttest scores and pretest scores is rejected for the skip programme, branching and linear overt forms separately but not rejected for response prompt form.

The students' performance on posttest has been studied with respect to time taken by them to learn through the various forms. This relationship has been studied by computing coefficient of correlation between performance of

102 students on posttest and time taken by students to go through the four groups separately. Posttest scores and time taken in going through the programme are not significantly related, as it is indicated by the correlation coefficients, in case of linear overt, branching and response prompt groups. In the case of skip programme group, this relationship is found to be negatively and significantly correlated at 0.01 level as revealed by the correlation coefficient studied. This indicates that lesser the time taken by students to go through the skip programme form the better is the performance. So the null hypothesis that there is no significant relationship between posttest scores and time taken to go through the programme is rejected for the skip programme form but not rejected for the other three forms, viz., linear overt, branching and response prompt separately.

The performance of students of the four groups who learnt through linear overt, branching, skip programme and response prompt forms when studied in relation with attitude towards programmed learning, shows that there is no significant relationship between posttest and attitude towards programmed learning for each group separately. This means that students' attitude towards programmed learning does not seem to affect their performance on posttest. Thus the null hypothesis that there is no significant

relationship between posttest scores and attitude towards programmed learning is not rejected for each form separately.

The students' performance on the pretest has been studied with respect to time taken by them to read through the various forms. It has been studied by computing coefficient of correlation between performance of students on pretest and time taken by students to go through the four forms separately. The relationship as indicated by correlation coefficients are not significant. It means that the time needed to learn through the programmed learning material is independent of the pre-requisites possessed by the four groups separately. Therefore, the null hypothesis that there is no significant relationship between pretest and time taken by the students to go through the four forms of programmes separately is not rejected. One of the reasons may be that each group is homogeneous in respect of the prerequisites. This homogeneity might have lowered down the correlation coefficients in each group.

The relationship between pretest scores and attitude towards programmed learning for the students who have learnt through linear overt, branching, skip programme and response prompt forms have been studied separately by computing product moment correlation. All the four correlation coefficients are not significant. This shows that pretest and attitude are not significantly related with each other.

104 It means that the students' attitude towards the programmed learning material do not affect their performance on pretest. Hence, the null hypothesis that there is no significant relationship between pretest scores and attitude scores of the four groups separately is not rejected.

Finally, a relationship between attitude towards programmed learning and the time required to learn through the different forms separately by the students has been studied. Since, none of the coefficients of correlation is found to be significant, attitude scores and time taken to go through the programme are not significantly related in the case of the four groups under study. It shows that the time required to learn through the programmed learning material is not affected by their attitude towards the material. Thus, the null hypothesis that the attitude towards programmed learning and time needed to learn through the programme forms are not significantly related when studied separately for the four groups, is not rejected.

5.5 Sex as a variable

One objective of the present investigation is to test the significance of means of (a) posttest soore, (b) time taken to go through the programme forms, and (c) reading comprehension scores of boys and girls on each

105 form separately. Abraham (1969) found that boys are significantly superior to girls on several achievement variables. But, since in the present investigation, the students learnt through programmed learning material which is a new technique of learning to these students the question of sex difference might arise. Thus, sex is taken as a variable in this study.

The t-test was applied to study whether the means of (a) posttest scores, (b) time taken to go through the programme forms, and (c) reading comprehension scores of boys and girls differ significantly or not on each form separately. The results of these have been given in Table 5.13.

Table 5.13 : Significance of difference between mean scores of males and females on posttest, programme time and reading comprehension separately for the different forms

Variable	Linear overt form				Branching Form				Skip Programme form				Response prompt form			
	Males (N=37)	Females (N=39)	df	t-value	Males (N=27)	Females (N=48)	df	t-value	Males (N=35)	Females (N=40)	df	t-value	Males (N=37)	Females (N=38)	df	t-value
M	27.676	28.795			31.741	29.771			29.200	30.100			28.486	30.868		
Posttest			74	1.032			73	2.060*			73	0.787			73	2.180*
S.D.	4.732	4.719			4.025	3.948			4.658	5.173			5.053	4.394		
M	103.405	104.744			95.148	91.750			95.800	96.300			99.973	100.211		
Programme time			74	1.488			73	2.971**			73	0.706			73	0.408
S.D.	3.826	4.005			4.418	4.931			2.862	3.221			2.834	2.171		
M	10.811	11.410			10.852	11.208			10.971	11.000			10.676	11.316		
Reading comprehension			74	1.634			73	0.956			73	0.079			73	1.814
S.D.	1.745	1.446			1.725	1.443			1.581	1.536			1.717	1.317		

* Significant at 0.05 level

** Significant at 0.01 level

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It can be seen from Table 5.13 that the mean performance of boys in posttest does not differ significantly from that of girls in the case of those who have learnt through linear overt form. The same was observed in the case of boys and girls who have learnt through skip programme form. On the other hand t-values have been found to be significant for the branching group as well as the response prompt group. It shows that boys' and girls' mean performance on posttest differ significantly from each other for the branching group and response prompt group separately. In the case of branching group, the mean performance of boys is higher than that of girls. It means boys could learn significantly more than girls through the branching form. From this it may be said that branching form suits more to boys than girls. In case of group which has learnt through response prompt form, the mean performance of girls is significantly higher than that of boys. This indicates that response prompt form suits more to girls than to boys. Therefore the null hypothesis is rejected for the branching and response prompt form, but not rejected for the other two forms, viz., skip programme and linear overt.

From the above results two important findings can be highlighted. Firstly, branching form and response prompt forms are the only two forms, out of the four forms which

108 have been studied, where the sex differences are significant. Secondly it reveals that branching form is better suited for boys whereas response prompt form is better suited for girls.

The sex differences in terms of mean time required to learn through different forms have been studied separately. The formwise t-values are reported in Table 5.13. From this it can be observed that t-values are not significant for the groups who have studied through linear overt, skip programme and response prompt forms separately. So, the mean time taken by boys does not differ significantly with the mean time taken by girls in these three forms. But in the case of branching form group t-value is significant at 0.01 level. It shows the mean time required by the boys differs significantly from that of girls. The mean time required by boys is significantly higher than that of girls. It means girls have learnt faster than boys. But the mean performance on posttest of the girls is significantly lower than the mean performance of boys on posttest. It may be said from this, that higher the reading speed lower the performance. In the light of the above findings the null hypothesis that there is no significant difference in the programme time of the boys and girls is rejected for the branching form but not rejected for other three forms, viz., linear overt, skip programme and response prompt separately.

109 Lastly, the mean reading comprehension of boys and girls have been compared for the four groups separately by employing t-test. The t-values for the four groups separately have been found not significant. It means the mean reading comprehension score of boys and girls do not differ significantly for the four groups separately. It may be said that the sample under study was homogeneous in respect of reading comprehension. Therefore, the null hypothesis that the mean reading comprehension of the boys does not differ significantly from that of girls for the four groups separately, is not rejected.

5.6 Academic motivation as a variable

The objective of studying this variable is to test the significance of means of (a) posttest scores, (b) time taken to go through the programme forms, and (c) reading comprehension scores of the high and low academic motivation students on each form separately. As mentioned earlier Pimsleur, Sundland and McIntyre found that motivation was related to students' achievement. In the present study students learnt through programmed learning technique.

In this context, it would be appropriate to study the means of (a) posttest score, (b) time taken to go through the programme forms, and (c) reading comprehension score of the high and low academic motivation students on each form separately. The t-test was applied for this purpose and the t-values have been reported in Table 5.14.

Table 5.14 : Significance of difference between mean scores of high and low academic motivation students on posttest, programme time and reading comprehension separately for different programme forms.

Variable		Linear overt form				Branching Form				Skip programme form				Response prompt form			
		H.M.L. (N=38)	L.M.L. (N=38)	df	t-value	H.M.L. (N=42)	L.M.L. (N=33)	df	t-value	H.M.L. (N=40)	L.M.L. (N=35)	df	t-value	H.M.L. (N=43)	L.M.L. (N=32)	df	t-value
Posttest	M	28.447	28.053	74	0.362	31.048	29.758	73	1.374	30.675	28.543	73	1.902	30.837	28.156	73	2.447*
	S.D.	4.488	5.008			4.126	3.921			3.990	5.664			4.771	4.587		
Programme time	M	103.763	104.421	74	0.724	93.095	92.818	73	0.237	96.000	96.143	73	0.201	100.442	99.625	73	1.406
	S.D.	4.090	3.832			4.757	5.365			3.464	2.546			2.576	2.366		
Reading Comprehension	M	11.500	10.737	74	2.105*	11.262	10.848	73	1.150	10.950	11.029	73	0.218	11.464	10.375	73	3.192**
	S.D.	1.409	1.735			1.547	1.544			1.679	1.403			1.403	1.540		

H.M.L. - High Motivation Level

L.M.L. - Low Motivation Level

* Significant at 0.05 level

** Significant at 0.01 level

111 Table 5.14 shows that the mean performance of the high academic motivation students does not differ significantly from that of low academic motivation students for the linear overt, branching and skip groups separately because the t-values are not significant for these groups. The reason might be that they would not have adjusted well with this style of learning. On the other hand, the t-value is significant at 0.05 level for the group which has learnt through response prompt form. Since the mean performance of high academic motivation students on posttest is significantly higher than that of low academic motivation students, the high academic motivation students have learnt significantly higher than the low academic motivation students. So, the null hypothesis that there is no significant difference in mean posttest score of the high and low academic motivation students is rejected for the response prompt form, but not rejected for the other three forms, viz., linear overt, branching and skip programme.

The mean time taken to learn through the programme by high academic motivation students has been compared with the mean time taken by low academic motivation students for the four groups separately. The t-values are not significant for all the four groups which have learnt through linear overt, branching, skip programme and response prompt forms. It means in all the four forms the high academic motivation students have taken more or less the same time

112 as the low academic motivation students. Therefore, the null hypothesis that the mean time required to learn through the programme does not differ significantly from that of low academic motivation students for the four groups separately, is not rejected.

Lastly, the mean reading score of high academic motivation students has been compared with that of low academic motivation students for the four groups separately by computing t-values. The t-values for the students who have learnt through the branching and skip programme forms are not significant. It means, in these two groups the mean reading comprehension score does not differ significantly for the high and low academic motivation students; whereas the t-values for the students who have learnt through linear overt form and response prompt forms are significant at 0.05 and 0.01 levels respectively. In the case of linear overt and response prompt groups the mean reading comprehension score of the high academic motivation students is significantly higher than that of low academic motivation students. Thus, for the linear overt group and branching group high motivation students have higher reading comprehension. In the light of the above findings the null hypothesis is rejected for the linear overt and response prompt forms, but not rejected for the branching and skip programme forms.

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5.7 Dependency as a variable

In this study dependency is taken as a variable. The definition of dependency and the tool to measure dependency are given in Chapter IV. According to the scores, dependency level is judged. If the score is above 12, it is level-1 (high) dependency, if it is between 12 and 7, it is level-2 (average) dependency, if it is below 7, it is level-3 (low) dependency. It was thought to study level of dependency on the performance of posttest because it would enable to understand for which dependency trait the programme will be more suitable.

Analysis of variance was applied to find out whether there is any significant difference in the mean posttest score for the different levels of dependency. The result has been reported in Table 5.15.

Table 5.15 : Summary of analysis of variance

Source of Variation	df	Sum of squares	Mean Square	F-ratio
Treatment	2	71.945	35.972	1.634
Error	298	6557.164	22.003	
Total	300	6629.109		

114 The value of F is 1.63 which is not significant. This means that the means of posttest score for different levels of dependency do not differ significantly. The present finding indicates that for different levels of dependency posttest score will be more or less the same. In other words it cannot be said that for high level of dependency posttest score will be high or low. Thus, the null hypothesis that there is no significant difference in the means of posttest score for different levels of dependency in all the forms together is not rejected.

Time taken to go through the programme and dependency level.

Posttest score and time taken to go through the programme forms are the criteria of effectiveness in the present investigation. Therefore it was decided to study whether there is any significant difference in the means of time taken to go through the programme forms for the different levels of dependency in all the forms together. Analysis of variance was applied for this purpose. The results have been shown in Table 5.16.

115 Table 5.16 : Summary of analysis of variance

Source of Variation	df	Sum of squares	Mean square	F-ratio
Treatment	2	65.960	32.980	1.045
Error	298	9400.132	31.544	
Total	300	9466.093		

The value of F is 1.05 with df 2/298 which is not significant. This means that the means of time taken to go through the programme forms for different levels of dependency do not differ significantly. The present finding indicates that for different levels of dependency, time taken will be more or less the same. In other words according to the levels of dependency, there will not be difference in time taken. Hence the null hypothesis that there is no significant difference in the means of time taken to go through the programme forms for different levels of dependency in all the forms together, is not rejected.

5.8 Attitude towards programmed learning as a variable.

Attitude towards programmed learning method is another variable which has been taken up in this investigation. The tool used to measure the attitude of the students towards

116 programmed learning method is the attitude scale developed on the lines suggested by Thurstone. The details about it are given in Chapter IV. The total of the scale values gives the attitude score of each student. According to the students' scores, attitude has been classified into three categories, viz., positive, neutral and negative. It was thought to study the type of attitude on the performance of the posttest because it would enable to understand for which type of attitude, the programme will be more suitable.

Analysis of variance was applied to find out whether there is any significant difference in the mean posttest score for the different types of attitude towards the programmed learning. The results have been reported in Table 5.17.

Table 5.17 : Summary of analysis of variance

Source of Variation	df	Sum of squares	Mean square	F-ratio
Treatment	2	25.048	12.524	0.565
Error	298	6604.061	22.161	
Total	300	6629.109		

117 The value of F is 0.57 with df 2/298 which is not significant. This means that the means of posttest score for different types of attitude towards programmed learning do not differ significantly. The present finding indicates that for different types of attitude towards programmed learning, posttest score will be more or less the same. Therefore, the null hypothesis that there is no significant difference in the means of posttest score for different types of attitude towards programmed learning in all the forms together, is not rejected.

Time taken to go through the programme and attitude towards programmed learning.

As mentioned earlier posttest score and time taken to go through the programme are the two criteria of effectiveness. Hence, it was thought to study whether there is any significant difference in the means of time taken for the different types of attitude towards programmed learning in all the forms together. For this purpose, analysis of variance was applied. The results have been reported in the Table 5.18.

118 Table 5.18 : Summary of analysis of variance

Source of Variation	df	Sum of Squares	Mean square	F-ratio
Treatment	2	3.199	1.599	0.050
Error	298	9462.893	31.754	
Total	300	9466.093		

The value of F is 0.05 with df 2/298 which is not significant. This means that the means of time taken to go through the programme for different types of attitude towards programmed learning do not differ significantly. It indicates that whatever be the students' attitude towards programmed learning, the time taken to read the programme will be more or less the same. So, the null hypothesis that there is no significant difference in the means of time taken to go through the programme for different types of attitude towards programmed learning in all the forms together, is not rejected.

One important conclusion can be drawn from the above findings. Whatever be the students' dependency level, or type of attitude, the performance of students on posttest and the time required to learn through the programme are not affected.

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5.9 Measurement of students' attitude towards programmed learning

Another objective of the present investigation is to study the attitude of the students towards programmed learning. Table 5.19 shows the percentages of students who are having favourable, neutral and unfavourable attitude towards programmed learning on each form separately and all the forms combined.

Table 5.19 : Students' attitude towards programmed learning.

Form	Favourable	Neutral	Negative
Linear overt	72.37	22.37	5.26
Branching	72.00	20.00	8.00
Skip	74.67	18.67	6.66
Response Prompt	77.33	14.67	8.00
Overall	74.09	18.93	6.98

From the table it can be noted that majority of the students are having favourable attitude towards programmed learning in each form separately and in all the forms together.

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