CHAPTER VI
SUMMARY AND CONCLUSION

Programmed learning is a development in education with a sound base of psychological principles. Of all the reading materials available to a teacher, programmed learning materials are structured in such a manner that they exert control over the learning behaviour most. As educators, we all ultimately favour that the reading material used by the students should have substantial control over the learning behaviour, while of course maintaining variety in the interaction between the learner and the material. It was hoped that this would become possible if we had clearly proven or defined types of interaction with us. The study attempted to experiment with programmed learning material employing a variety of well defined interaction contingencies.

6.1 The Problem

The present study attempted to investigate the effect of Step to Para, Extrinsic to Intrinsic Reinforcement and Overt to Covert Response Transformations in Learner Reading Material Interaction on Learner Performance.

6.2 Objectives of the Study

The study was designed to fulfill the following objectives:
1) To create different forms of reading materials (referred to as programmed learning material in the study) by duly effecting transformations at certain fixed points along the variables chosen viz., step size, reinforcement and response mode.
2) To analyze and interpret the effect of transformation made in the materials along the variables of step size, reinforcement and response mode of the learner reading material interaction on learner performance.

3) To identify programmes with specified combinations of three variable levels (or fixed points) which are more or less equally effective in causing higher learner performance.

6.3 Hypothesis of the Study

The major hypothesis of the study was:

In linear programmed learning, transformations made at certain points fixed along the variables of step size, reinforcement and response mode of learner reading material interaction do not cause significant difference in student gain resulting from the use of such reading materials, i.e., programmes employing the three different variable type combinations do not differ in terms of student gain resulting from their use.

6.4 Limitations of the Study

The study had the following limitations:

a) It was restricted to linear programmed instructional material.

b) It took into consideration only the three variables of interaction already noted and assumed certain points along the variables fixed taking previous research, certain theoretical concepts, notions and practical exigencies into account.
6.5 **Review of related Literature**

The review on the three variables chosen clearly indicated that there were studies employing two out of the three variables viz., stepsize, reinforcement and response mode (Lewis and Whitwell, 1971; Gupta, 1972; Davis, 1970; Monteiro, 1977).

The fixed types among the variables chosen in the earlier studies, however, were slightly different from those used by the investigator. Further, no combined study taking all the three variables chosen and transformation attempted was located by the investigator.


The review of related literature helped the investigator to arrive at gradual transformations in the three variables chosen at fixed points. With reference to the variables step size, a small step represents a sentence (or two), and a large step represents six to seven small steps or frames combined, having responding occasions heaped at the end of each large step. Under
the reinforcement variable, KCR deliberately provided by the programmer was treated as extrinsic reinforcement and providing no KCR as intrinsic reinforcement. The three points fixed were - KCR to every frame, KCR to every fifth response and no KCR. Under the response mode variable, overt responding was to construct and write answers, and covert responding was thinking of the answer. The four points fixed were construct and write, underlining in subsequent task, thought evoked, and thought responses.

6.6 Reading Materials and Tests

The various tools employed in the study were programmed learning materials, pre and post tests, and a science aptitude test.

As preparation of programmed material was not the objective of the study a programme in human physiology written by McGuigan (1965) was selected. Four sections from it - the ear, the eye, olfaction and gustation, and, the muscles were chosen, and for each sectional programme corresponding 16 item pre- and post tests were prepared. A 50 item science aptitude test was also prepared by selecting items from science talent search examinations of the years 1964, 1966, 1968, 1969, 1970 and 1971. The three tests were tested for validity and reliability by administering to a sample of 40 students studying in Xth standard. The reliability of the tests was computed by using the split half technique and further application of the 'Spearman Brown Prophency' formula, the validity was found by correlating.
the tests with other tests of the kind. The obtained values 0.753 and 0.830 for reliability coefficients of pre and post tests were significantly higher than the tabled value at 0.1 level. For validity of the tests, obtained values 0.633, 0.681 and 0.662 were also significantly higher than the tabled value at 0.1 level. The obtained value 0.706 for reliability of the science aptitude test was also significantly higher at 0.1 level. The three tests were thus proved to be reliable and valid.

In addition, the correlation coefficient between the pre and post tests of the four programmes chosen were also found to be valid.

The four programmes chosen were rewritten and modified for simplicity and clarity. These modified programmes were tested for equivalence by administering to 24 students studying in Xth standard. These students were grouped into four equivalent groups based on the marks obtained in science at the IXth standard final examination. The method followed in collecting the data for testing programme equivalence was administering the respective pre test, the programme, and then the post test. The mean gain scores obtained were subjected to statistical test of significance of difference between the mean, using the 't' test. The results proved that the four programmes selected and modified were equal and did not differ significantly in terms of learning gain caused by each. These four basic programmes were randomly distributed to the 24 cells, each of which described a combination of the three variables as described below, and 24 different types of
programmes were prepared. The two levels of stepsize were - small step and large step (i.e., two chunk step and seven chunk step), the three levels of reinforcement were - every response KCR, every fifth response KCR, and no KCR, and the four levels of response mode were - written response, responses to be underlined, responses to be thought evoked, and responses to be thought. The step size was designated as factor A, reinforcement as factor B, and response mode as factor C. Each cell thus was defined by A, B, C types.

6.7 Experimental Design and Procedure

A 2 x 3 x 4 factorial design with repeated measures on the third factor was employed (Winer, 1962).

The 24 reading materials prepared were tried on 54 girls and 48 boys studying in standard X from Sacred Heart Convent School, Hubli, and St. Mary's High School, Hubli, respectively. The experiment was conducted separately on the two samples. The procedure followed for data collection was the same in both the samples. A Science aptitude test was administered two days prior to starting the programme sessions proper. Based on the scores obtained, the students were given serial numbers. Taking the random number table, the serially numbered students were randomly assigned to six groups. After assigning the students to the six groups, they were given special roll numbers for the convenience of administering the programme. Proper care was taken in the seating arrangement to avoid copying (refer figures 4501, 4701, and appendix XV-XX). For treatmentwise distribution of
programmes into the 24 treatment cells refer figure 3.601. The six groups were repeatedly administered programmes on four days respectively at four levels of factor C (response mode). This helped to cover the 24 cells (2x3x4) contemplated in the design. Pre and post tests were administered before and after the programme on all the respective four days of the experiment.

6.8 Data Analysis

The gain scores in the two samples were subjected to analysis of variance separately. The three variables chosen in the study were step size designated as factor A (with two levels a1 and a2), reinforcement as factor B (with three levels b1, b2, and b3), and response mode as factor C (with four levels c1, c2, c3, and c4).

In the girls sample, factor A and factor C stood significant at 0.10 and 0.01 level. Interactions of factor A and factor C, and factor B and factor C were found to be significant at 0.01 level and factors ABC interaction was found to be significant at 0.01 level.

In the boys sample, factor C and interaction of factor B and factor C were significant at 0.01 level.

In both the samples, Hartley's Fmax test was employed separately to test the homogeneity of variance.

Further, in both the samples, essential simple effects were tested separately. In the girls sample, the following...
effects were found: C at a₁, B at Ck, A at Ck and AB at Ck. In the boys sample C at a₁, A at Ck and B at Ck were calculated.

6.9 Interpretation of Results

Some important findings from both the samples are enumerated below.

**Effect of factor A:** Factor A was found significant only in the girls sample. Small step (a₁) programmes fared better than large step (a₂) programmes; and irrespective of type of reinforcement, small step (a₁) fared better.

**Effect of factor C:** Factor C stood significant in both the samples. In the case of girls sample, thought (c₄) and thought-evoked (c₃) modes fared better. In the case of boys sample written (c₁) and thought (c₄) modes were to be favoured. In both the samples underlining (c₂) was not favoured as it yielded low gain.

**Interaction effect of factor A with factor C:** Interaction effect of factors A and C stood significant in the case of girls sample only, for responses to be written (c₁) and underlined (c₂) choosing small step (a₁) frame yielded significantly higher gain.

**Interaction effect of factor A with factor C:** Interaction effect of factor A and C stood significant in the girls sample only for responses to be written (c₁) and underlined (c₂) choosing small step (a₁) frame yielded significantly higher gain.
**Interaction effect of factor B with factor C:** In both the samples there was significant interaction effect of factor B with factor C. Some higher yielding treatment combinations located in the order of gain in the girls sample were - No KCR with thought responses \((b_3 c_4)\), every response KCR with thought-evoked responses \((b_1 c_3)\), every response KCR with written response \((b_1 c_1)\) and every fifth response KCR with written response \((b_2 c_1)\). Some high yielding treatment combinations located in the boys sample were - every response KCR with thought evoked response \((b_1 c_3)\), every fifth response KCR with written response \((b_2 c_1)\) every response KCR with written response \((b_1 c_1)\), and no KCR with thought response \((b_3 c_4)\). Some high yielding treatment combinations were found common to both samples were - No KCR with thought responses \((b_3 c_4)\), every response KCR with thought-evoked response \((b_1 c_3)\), every response KCR with written response \((b_1 c_1)\) and every fifth response KCR with written response \((b_2 c_1)\).

**Interaction effects of factor A, B and C:** Interaction effect of factor A, B and C was found significant in girls sample only. Some common treatment combinations identified in the order of gain in the girls sample were - (1) small step, every response KCR and written response mode \((a_1 b_1 c_1)\) (2) large step, no KCR and thought response mode \((a_2 b_3 c_4)\), (3) large step, every response KCR and thought-evoked response \((a_2 b_1 c_3)\), (4) small step, every fifth response KCR and underlining response \((a_1 b_2 c_2)\), (5) small step, every response KCR and thought evoked response mode \((a_1 b_1 c_3)\) and (6) small step, no KCR and...
thought response (a1 b3 c4)

In the case of boys sample the interaction effect of factor A, B and C was not significant. Some treatment combinations in the order of gain were located by mere inspection. They were -

(1) large step, every response KCR and thought-evoked response mode (a2 b1 c3),
(2) large step, every fifth response KCR and written response (a2 b2 c1),
(3) small step, every response KCR and written response (a1 b1 c1),
(4) small step, every response KCR and thought evoked response (a1 b1 c3),
(5) small step, every response KCR and thought response (a1 b1 c4).

By inspecting both the lists from the two samples, three combinations which were consistently high were (a1 b1 c1), (a2 b1 c3) and (a1 b1 c3), i.e., given an occasion for responding either written or thought evoked type, every response KCR has shown consistency, and small step programmes have fared better.

It is to be noted that B (reinforcement) as a factor, has not stood significant in both the samples, it comes into picture only when responding occasion is provided.

Thus out of the 24 treatment combinations created, only three are to be preferred and remaining five with some skepticism, while the remaining sixteen do not come to the picture at all.

6.10 Recommendations for further Research

(1) In the present study three treatment combinations (a1 b1
c1) small step, every response KCR and responses to be written, (a2 b1 c3) large step, every response KCR and responses thought evoked and (a1 b1 c3) small step, every response KCR and responses thought evoked have fared well in both the samples. For added relevance these treatment combinations can be further tried using a longer programme and on a larger sample. The remaining eight treatment combinations can also be taken up for further study.

(2) As in some of the early studies factor B which was designed following ratio scheduling has not functioned as an influential factor (boys sample), programmes may be so designed as to make availability of KCR more learner need based and the study of the present kind may be repeated so as to get improved effectiveness in respect of some of the AC combinations identified in this study.

6.11 Conclusions

The present study has successfully fulfilled the objectives set up. The study has given a very defined way of operating with the three variables while dealing with linear programmes. It is likely that future researchers take this approach in designing and conducting studies of this kind. The present work has set an example in the direction of inducing variety in creating programmed learning materials. As a by product of this study 24 models of combinations can be used in designing instructional/reading materials. When confronted with such variety, teachers can rely on some of the findings of this study.
to make choices and to provide effective reading experiences to learners. To conclude, an excerpt from a write-up which appeared in a recent issue of Educational Technology is quite in order. Conveying the message of 'Research on Programmed Learning' for policy, planning and management in India, the write-up noted: 'Textbooks provide the only mechanism (and source) of learning by students and trainees. Given the experience of research on programmed learning, one of the possible implications for policy is to introduce elements of programming in the textbooks, semi programmed material, and linear or branched programmes is a matter of details which experts need to examine. But research comprehensively provides a strong case. It would be important to note that elements of programming have found place in the learning modules used for distance education all over the world . . . . There is every hope that while designing textual modules and materials, the methodology of carefully assembling linear small step programmes into large step programmes with appropriate responding occasions heaped at the end will be pursued with confidence.