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SUMMARY, FINDINGS AND SUGGESTIONS

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The present investigation was undertaken to study the relative effectiveness of different forms of programmed learning material. For this purpose, a programme on "Thermometers" was prepared in English in seven different forms. The relative effectiveness was assessed in terms of immediate posttest, percentage of retention and time taken to finish the programme. The design called "Analysis of Covariance in Duplicate Experiments in Randomly Selected Schools (Lindquist, 1970) was used and the differences between two treatments were tested by Least significant Difference (L.S.D.) test.

The present volume embodies the complete account of the conduct of the experiment and data processing.

In the 'Prologue', an attempt was made to have a closer look at the classroom practices and classroom situations. A short description was given indicating certain major issues of classroom teaching. The factors included were - lack of knowledge of results, late knowledge of results and incomplete knowledge of results (just like saying 'right' or 'wrong' without indicating the exact correct response). Another aspect mentioned was passive role of the students (listening). The limitations of

'teacher centered, group oriented, and textbook based' system of education were described. It was observed, however, that larger classrooms could not provide much opportunities for individual student participation. It was discussed how principles of good classroom teaching are taken care of in programmed learning. It was also mentioned how teaching and testing go together in programmed learning.

The prologue was given with a view to providing a background to indicate the psychological principles generally found wanting in the classroom. As a next step, it was necessary to go into theoretical aspects of programmed material. This was done in the first chapter on "Different Forms of Programmed Material - Their Nature and Rationale". The features of different forms were mentioned in detail along with the underlining rationale. The different forms of programmed material used in the investigation were described and illustrations of frames were given for each form. The psychological principles applied in each form were presented in a tabular form.

In the second chapter on "Review of Relevant Researches" an attempt was made to review the studies dealing with different forms of programmed material. It was found convenient to group the studies under the following heads:

- i) Studies on overt and covert response mode
- ii) Studies on prompting and confirmation
- iii) Studies on reading form
- iv) Studies on constructed response and multiple choice, and
- v) Studies on linear and branching forms.

Certain technical and design deficiencies of the studies were noted. It was found that most of the studies dealt with overt and covert response modes and relatively few studies used branching forms. It was mentioned that effectiveness of skip programme forms and hybrid forms needed further investigation.

The third chapter, "The Present Investigation - Plan and Procedure" was devoted to a detailed description of the various steps that were taken in the process of preparing and standardizing the programme.

It was decided to use the following seven forms:

- A. Linear Overt Form
- B. Linear Covert Form (Thinking)
- C. Response Prompt Overt Form (Copying)
- D. Response Prompt Covert Form (Reading)
- E. Skip Programme
- F. Branching Form
- G. Hybrid Form

The sample consisted of 322 students randomly divided into seven groups; the sample was drawn from 11 classes of Std. VIII, from English medium schools of the City of Baroda. The scope and limitations were mentioned. The hypotheses were stated. Effectiveness was to be measured in terms of immediate posttest, percentage of retention and time. An analysis of the criterion frames called exercises and criterion test was given. A flow chart showing the task analysis was given in detail.

In the fourth chapter, the focus was on "Statistical Analysis and Interpretation". The general observations were followed by the analysis of covariance taking intelligence as the initial score and the immediate posttest performance/percentage of retention/time as the final score. In the chapter, various computations like the computation of sum of squares and sum of products for classes, schools and methods were given. The steps involved in calculating the F value were also given in detail. And the values of L.S.D. at .01 level and .05 level were also included.

FINDINGS

- 1 Of all the seven forms tried out, the Branching Form (F) proved to be the least effective in terms of the immediate posttest, its average performance being 68%. All the same, the Branching Form (F) required less time as compared to the Linear Overt Form (A).
- 2 Of the seven forms tried out, the Linear Overt Form (A) required maximum time.
- 3 From the viewpoint of percentage of retention, the differences of the seven forms tried out were not statistically significant.
- 4 The Response Prompt Covert Form (D) proved to be the most effective with regard to the immediate posttest and the time taken. The Linear Covert Form (B) came next on ~~the~~ both the measures.
- 5 The Response Prompt Covert Form (D) was significantly more effective in comparison to the Linear Overt (A), the Response Prompt Overt (C), and the Hybrid (G) forms from the viewpoint of immediate performance and the time taken.
- 6 The Linear Overt Form (A) was significantly less effective in comparison to the Linear Covert (B), the Response Prompt Covert (D), the Skip programme (E), the Branching Form (F), and the Hybrid (G)

forms from the viewpoint of time.

- 7 The following table gives an idea of the relative standing of the seven forms on the three criteria of effectiveness.

Table 5.1

The Relative Effectiveness of the Seven Treatments on the Immediate posttest, Percentage of Retention and the Time taken to finish the programme

Programme Forms	Ranks on Immediate Posttest	Ranks on the Percentage of Retention	Ranks on the time taken to finish
A. Linear Overt	5	1	7
B. Linear Covert (Thinking)	2	6	2
C. Response Prompt Overt (Copying)	6	4	6
D. Response Prompt Covert (Reading)	1	5	1
E. Skip Programme	3	7	4
F. Branching	7	3	3
G. Hybrid	4	2	5

IMPLICATIONS

The present study seems to support the findings of Shah (1971) where it was found that the covert responding was at least as effective, if not more, as overt responding from the viewpoint of immediate score, retention score and time. On the basis of his study, Shah (1971 a) suggested that a strategy of efficient and effective learning should be decided after giving due consideration to the following:

- i) Which response mode is most effective in terms of immediate test score on the criterion test?
- ii) Which response mode is most effective from the viewpoint of retention?
- iii) Which response mode is least time consuming?
- iv) Which response mode is least expensive?
- v) Is effectiveness of a mode related to the nature of subject matter?
- vi) Is ^{there} ~~their~~ significant interaction between response mode and other factors such as age, I.Q., personality variables, etc.?

Overt responding has some advantages. Leith and Buckle (1965) have suggested that overt responding serves

a number of purposes in learning, some of which may be redundant or even inhibiting. They have been listed as follows:

- i) Response learning and integration--which needs to be involved if the responses to be taught are not in learner's repertoire.
- ii) Attention focussing--which may be useful under 'noisy' conditions.
- iii) Giving a sufficient duration for covert responses such as labelling, classifying, inferring, etc.
- iv) Setting limits to an apprehension span--thus preventing the onset of retroactive interference from succeeding frames.

Experiments could be done to see if overt responding is more effective with the younger and underachieving pupils and whether previous knowledge is an important factor. One of the studies by Goldbeck and Campbell (1962) suggests that easy material is less effectively learned by overt response at the adolescent level. Covert responding, on the other hand, has some advantages. It is argued that overt responding may give way to intrusion of irrelevant covert responses. It may also delay the 'on going' process and may result in boredom, loss of attentiveness. This may be expected in subjects like mathematics which have a

well organized structure. Shah's study (1971) with his programme on algebra partially supports this view. This view was confirmed in a study by Leith and Burke (1965) in which the learning material ^{had} ~~was having~~ a low level of organization viz., English spelling. Thirteen and fourteen year old secondary boys responded overtly and covertly to a 600 frame programme. The difference in number of spellings gained ~~was~~ significantly favouring^{ed} ~~ing~~ the overt group.

The question which seems to be crucial is whether being aware of the answer before attempting to respond leads to poor learning. Shah's study (1971) has shown that it does not, Guthrie's theory on contiguous conditioning holds that any event which intervenes between the stimulus and the response^e elements of learning situation inhibits learning. Leith and Guhman (1966) on the other hand, hold that "being aware of the answer before making a try does not necessarily lead to poorer learning". The results of the present study seem to support this contention, because the two covert groups scored higher, the most effective being the Response Prompt Covert Form (D) followed by a Linear Covert Form (B). It may mean that even when the answers are already given in the response blanks, learners do not merely 'read', and even when they are allowed to make a covert response like 'thinking', they do not merely 'cheat'.

Thus, the results of the present study are not in conformity with the assertion of Holland (1960) that only overt responses suitably reinforced are learned, and that the students must 'write' the programme.

Covert modes, that is, 'thinking' and 'reading' modes, take less time. It is quite expected. They are far less time consuming than writing out a response. As Markle (1969) points out, 'as its name implies, covert responding is responding'.

Apart from the above-mentioned theoretical considerations, there are certain practical implications to be appreciated. It is argued that programmes would be expensive in developing countries like India. It is good to ask, "Could we reduce the cost of a programme without loss of effectiveness?" Experts advocate the use of separate answer sheets in order to bring down the cost of a programme. It appears that response prompt covert form would further reduce the cost in two ways:

- a) Firstly, it would not require any extra space like margins, etc., for providing correct responses. Programmes written or printed in the Skinnerian style, on the other hand, require many pages because of the big margins provided for correct responses. In the present study itself linear forms required pages while response prompt forms required pages.

- b) Secondly, the covert forms do not require a separate answer sheet.

Thus, the Response Prompt Covert Forms are somewhat less expensive, both spacewise and timewise, without any loss of effectiveness whatsoever.

The Response Prompt Covert Form (D) would be less fatiguing because it is less time consuming as compared to overt forms. It may also be mentioned here that reactions like 'cheating' (looking at the answer ahead, skipping (etc.)), would result only due to accumulation of fatigue.

Suggestions for Further Research

In the light of the experience gained, and the findings mentioned, the investigator deems it worthwhile that there is need for further probing. Below are given some suggestions for further research in this area.

- i) In a branching programme, one can now think of using the response prompt covert (reading form) for remedial frames. Such a practice would have two possible advantages:
 - a) it may be simple and time saving
 - b) it may increase the effectiveness of branching form.

An inquiry should be made as to whether such practice is simple, time saving and more effective.

- ii) The present investigation could be extended to other school subjects and the generalizability of the findings arrived at could be ensured.
- iii) The present experiment could be replicated at other levels of education, viz., primary and university. One could also extend the inquiry in other areas like industry, defence and adult education.
- iv) An inquiry should also be made whether there is any interaction between programme forms and personality variables, I.Q. and age.
- v) An inquiry should also be made whether effectiveness of a programme form is anyway related to the
 - a) difficulty of the content covered
 - b) level of organization (Leith & Burke, '65)
 - c) achievement level of the learner
 - d) achievement motivation of the learner.

In ~~five~~, the investigator suggests that this area of research in programmed learning deserves further probing in Indian context. It is hoped that the movement of Programmed learning would profit from such down-to-earth studies because we look forward to having a learning strategy which is most efficient, least expensive and, above all, time saving. It is no doubt a big challenge. It is indeed a venture of faith, a venture which deserves success.

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