

DEVELOPMENT AND VALIDATION OF MATHETICS STYLE PROGRAMME IN MATHEMATICS FOR GRADE IX STUDENTS

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ABSTRACT

The purpose of this study is to investigate the effects of Mathetics style Programme in Mathematics. This research included 30 students of grade IX of DAV Public School Hamirpur (Himachal Pradesh). For this research students were supplied with the copy of programmed material having instructions in the beginning and the confirmatory responses were printed on the last page of the booklet. Immediately after the programme, a criterion test (CT) was conducted; in order to measure their learning outcomes in terms of scores obtained by them in CT. Descriptive survey method is applied to collect the data. The data collected shows that the Mathetics style Programme in Mathematics is very effective for the attainment of the calculative skills by the learners at their own pace. This method increases the academic achievements of the learners and very helpful in independent learning.

Key Words:Programmed learning, mathetics style programme, self learning, error rate, Mathematics teaching.

INTRODUCTION

A developing country like India is trying her best to cope with other nations in every field of development. Since education is the most potent instrument for the progress of a nation, the quality of education therefore needs to be improved. The quality of education depends on the quality of instruction imparted in the classroom. There are individual differences among children in terms of level of intelligence, level of understanding, attitudes, achievements etc. Therefore same type of instructional methods in class room may not suit to the class room situations. To cater to the needs of individual differences and the abilities we have to adopt innovative instructional procedure (Elias Jijish 2009). Nowadays, student-centered teaching model, methods and technique are used. The beneficial feature claimed for student-centered methods is that they allow more time to be spent by the teacher tutoring individual or very small groups of students. This has been claimed, in particular, by the advocates of computer-assisted learning (Hinchliffe, 1982). Programmed Instruction is the process of arranging the materials to be learned into a series of sequential steps; usually it moves the student from a familiar background into a complex and new set of concepts, principles, and understandings (Smith and Moore 1968). Programmed Learning or Programmed Instruction is a learning methodology or technique first proposed by the behaviorist B. F. Skinner in 1958 (Becker, Henry Jay 1993). According to B. F. Skinner, The purpose of programmed learning is to "manage human learning under controlled conditions" (Pritchard, Alan 2009). Programmed learning has three elements: (1) it delivers information in small bites, (2) it is self-paced by the learner, and (3) it provides immediate feedback, both positive and negative, to the learner' (Ravenscroft, Andrew 2001). Programmed learning is one of the better-known methods of student- centered learning, and its potential advantages have been fully discussed (Skinner, 1958; Young, 1961; Young 1966; Beard, 1973; Boland, 1977; Hinchliffe, 1982). Programmed learning involves self-administered and self-paced learning, in which the student is presented with information in small steps often referred to as "frames" (Pritchard, Alan 2009). Each frame contains a small segment of the information to be learned, and a question which the student must answer. After each frame the student uncover, or is directed to, additional information based on an incorrect answer, or positive feedback for correct answer. Mathetics style Programme is a style of programmed

learning. This style of programming has been propagated by "Thomas F. Gilbert in 1962". Derivative meaning of Mathetics has been derived from Greek word "mathein", which mean 'to learn'. According to Gilbert, Mathetics is defined as it is the systematic application of reinforcement theory to the analysis and construction of complex behavior repertoires which represent the mastery of subject matter (Mangal, S.K. 2002). Major emphasis in Mathetics is on "mastery in subject matter" through Retrogressive or backward chaining. Retrogressive chaining makes it unique among all the programming techniques. The child learns the last step first, then goes to the next one before it and thus to the introductory part. This procedure where the tasks are connected from the last to the first is called as chaining (Elias Jijish 2009). In Retrogressive chaining DPR (demonstrated, prompted, released) approach is used, in this students are first given to demonstrated exercise (in this entire procedure is demonstrated to the student. The programmer supplies the student with all the steps up to the mastery step), then prompted exercise (here the programmer supplies the student with all the steps leading up to mastery step and prompt him to perform the mastery step) and finally released exercise (here the programmer provides all the steps, leading up to the step that immediately precedes the last sub mastery step, prompt this step and release the student to practice the mastery step). The programmer continues in this manner, each time allowing the students to perform an additional step until he/she has worked back of the first time step in the procedure and can perform the entire task (Mangal, S.K. 2002). In this programme each frame assumes the reinforcement value of accomplishment. The frames are small and learner is not allowed to move to the next frame unless he responds correctly to the exercise in hand. The completeness of the task provides reinforcement to the learner. 'Once the stimulus and response are associated, the response is likely to occur without the stimulus being present. It holds that responses that produce a satisfying or pleasant state of affairs in a particular situation are more likely to occur again in a similar situation. Conversely, responses that produce a discomforting, annoying or unpleasant effect are less likely to occur again in the situation' ('The law of effect' published by Edward Thorndike in 1905). In programmed learning the lessons start from the student's initial knowledge and in small steps proceed to a final learning goal. Because of active student participation, small steps, immediate feedback and reinforcement, programmed learning can be very effective. All students work through the same sequence (Anderson and Fretzin, 2004). The Mathetics programming also control the individual variations of the learners. This programming gives equal weightage to learning situation, desirable behavior and mastery of content. Programmed text is superior to other methods and that the high and low income group students following the program text were distinctively superior to those who had traditional teaching with home assignment and grading (Pandey 1980). Seshadri (1980) developed a linear program of 2074 frames for mathematics of class IX. She found that the strategy of having programmed learning Material (PLM) assist major component worked better than the traditional mode of teaching. Chaudhary (1985) prepared programmed learning material in geography for secondary level. He found that after pursuing PLM, students gained significantly as far as knowledge of the subject is concerned. The material was equally effective for both urban and rural students. Desai (1986) developed programmed material on heat in physics for pupils studying in standard XI and found that pupils took active interest in reading and learning through programmed material. (Inamdar, J.A. 1981) found that the programmed learning technique was superior to the conventional technique. Kaur Ramanjeet (2012) developed a programmed material in linear style programming on structure of the cell for IX grade students and found that students are able to acquire the science concepts at a rapid pace while learning it through linear style programming. Programmed learning is being used not only for self instructional purpose but also as mechanism of feedback for improving teaching efficiently. Mathetics style Programme is also best for teaching Mathematics. Thus investigator developed a programme on topic "CONE", which has been taken from Mathematics text book prescribed by N.C.E.R.T (National Council of Educational Research and Training) for grade IX students, in English language. This programme consists of 27 exercises. After the small group tryout a copy of final programmed material in Mathetics style was made.

METHODS

For the present study Descriptive survey method is applied to collect the data. In final field tryout the entire programme consists 30 students (M/F) of age group (+14) belonging to middle or upper middle class socio-economic strata, having diverse cultural background, and rural/urban residential status studying through English medium of DAV Public School Hamirpur (Himachal Pradesh). The printed exercises were presented to

the students in actual classroom situation, the title of the programme was announced and specific written instructions were read out before the students. The confirmatory responses were printed on the last page of the booklet. Students were asked to tally their responses with correct response after writing it. The limit of time ranged from 120 min to 150 min. The students were asked to take their own time while working on the programme. Investigator had given some time to the learners to discuss the difficulties faced by them while going through the programme. Immediately after the programme, a criterion test (CT) was administered, in order to check the competency attained by them.

Research Scope And Sampling

The research has been confined to Mathematics style Programme in Mathematics on topic “CONE” for grade IX students only. The sampling of research, on the other hand, consists of randomly chosen 30 students of grade IX of DAV Public School Hamirpur (H.P.).

Materials

In this research, the investigator developed four Programme in total (as shown in Table 1). Each one of them has 6 to 7 exercises (Table 2). In each exercise there were 5 frames. In demonstrated exercises all the 5 frames were solved. Students were asked to go through these exercises and to get his/her basic clear about the topic under study. They saw the procedure of solved problem. Impromptu exercises, 1st exercise has 5th frame blank, 2nd has 5th and 4th and so on. Students go through these frames and completes the frames as they proceed. In released exercise all the 5 frames were unsolved, and no guidance was provided to the students.

Table 1: Table of Content

Major Concepts	Sub Major Ideas	Macro Ideas	Micro ideas
1.CONE	<p>1.1. Area</p> <p>1.1.1 Base Area</p> <p>1.1.2 Lateral or Curved Surface Area</p> <p>1.1.3 Total Surface Area</p> <p>1.2 Volume</p> <p>1.2.1 Volume</p>	<p>1.1.1.1 Calculation by the formula $A = \pi r^2$; r = radius of base</p> <p>1.1.2.1 Calculation by the formula $E = \pi r \sqrt{r^2 + h^2}$ or $E = \pi r l$; r = radius, h = height, l = slant height</p> <p>Calculation by the formula $E = \pi r(l + r)$; r = radius, h = height, l = slant height</p> <p>1.2.1.1 Calculation by the formula $\frac{1}{3} \pi r^2 h$; r = radius, h = height</p>	

Table 2: No. of Exercises

Sr. No.	Unit	Demonstrated	Prompted	Released	Total No. of Exercises
1	Base Area	1	4	2	7
2	Lateral or Curved Surface Area	1	4	2	7
3	Total Surface Area	1	3	2	6
4	Volume	1	4	2	7
	Total	4	15	8	27

In Mathematics Programme learner gets an additional step (frame) each time. In this way the programmed topic becomes easier for him and he solves all such exercises automatically by himself. After completion of programme a CT was conducted, which consists of 8 questions all of them were in released form.

RESULT AND DISCUSSIONS

In order to check the success of Programme researcher evaluated the CT. Then related sequence progression chart for all of four concepts consisting 27 exercises were prepared. The error rate in CT was calculated on the basis of the responses given by the students by (Table 3) using the formula

$$\text{Error Rate (\%)} = \frac{\text{Total No. of errors} \times 100}{\text{Total No. of Items} \times \text{No. of students}}$$

Error rate in programme was calculated on the basis of the responses given by the students by (Table 4) using the formula

$$\text{Error Rate (\%)} = \frac{\text{Total No. of errors} \times 100}{\text{Total No. of Responses} \times \text{No. of students}}$$

Table 3: Criterion Test Scores

Students identification No.	Marks Obtained	Error
1	40	0
2	35	1
3	25	3
4	35	1
5	40	0
6	40	0
7	30	2
8	35	1
9	40	0
10	40	0
11	40	0
12	30	2
13	30	2
14	30	2
15	30	2
16	30	2
17	25	3
18	40	0
19	35	1
20	30	2
21	30	2
22	40	0

23	30	2
24	40	0
25	35	1
26	25	3
27	35	1
28	30	2
29	30	2
30	40	0
Total Errors		37

Table 4: Concept-Wise Error committed by the students in various exercises

Sr. No.	Unit	Responses Required	Error
1	Base Area	20	8
2	Lateral or Curved Surface Area	20	21
3	Total Surface Area	15	13
4	Volume	20	23
	Total	75	65

Error rate for Table 3 = 15.42%

Error rate Table 4 = 2.89%

Table 5: Concept-Wise Error committed by the students in various exercises in percentage

Sr. No.	Unit	Error in (%)	% of Success
1	Base Area	1.3	98.7
2	Lateral or Curved Surface Area	3.5	96.5
3	Total Surface Area	2.89	97.11
4	Volume	3.83	96.17
5	Total	11.22	88.78
6	Mean	2.81	97.19

Result of this study revealed that error rate of all exercises, of all concepts in the whole programme don't exceeds 2.89% implies that learners were able to compute 97.11% of exercises correctly and success obtained by students in CT comes out to be 84.6% implies that students were able to grasp 84.6% of the content in the programme. The maximum error committed by students in individual exercises is 3.83%. The error rate of the program is less than 10%, the criterion suggested by Skinner to check the validity of an effective programme.

CONCLUSION

Programmed learning is a method which promotes the optimum development of the potentialities of the individuals. It is very useful for students as well as for teachers. Teachers can also prepare programme on different topic of Mathematics, different subjects and in different languages, so that instruction can be imparted to the students in best way. It is also useful for the students because it helps all type of students to learn at their own pace. This type of programme also useful for correspondence and private students, who don't have direct contact with teachers. Moreover this programme saves time and energy as the students are able to learn through it in short time. This study is very useful in field of teaching Mathematics. Programmed learning as a self instructional technique needs to be tried out in India.

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