Programmed Instruction

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INTRODUCTION

Improvements in the teaching-learning process have always been thought of and efforts have been made to implement the same. Some sort of researches has always been going on in this field with the ulterior motive of all round development. The chief drawbacks of traditional system of classroom teaching are it does not cater to the needs of all those that are sitting in the class, some of them are satisfied and some remained dissatisfied. Population explosion has led to overcrowded classrooms and hindering quality education and resulting into a dearth for qualified teachers. Thus, there has been a rise for the demand of individualised teaching which could lead to quality education. In today's high tech world, there is a need to give instructions in a systematic way and sequenced manner to quicken the pace of learning. A programme is a device to control the students' behaviour and help them to learn without the direct supervision of a teacher. Instruction is the purposeful, orderly, controlled sequencing of experiences to reach a specified goal. And programmed instruction is the presentation of material in a step by step procedure with knowledge of results and the possibility of different courses through instruction. Thus, a programme accepts the responsibility of management of learning situations.

CONCEPT

The programmed instruction method is a highly individualised instructional new strategy for the modification of teacher behaviour. Though used for instructional purposes it can also be employed as a mechanism of feedback device for improving teaching efficiency. Its theoretical knowledge is essential to use for the modification of teacher behaviour. It is in fact a strategy in which various kinds of intellectual, emotional and motor experiences are provided to the learner in a controlled situation.

This technique of instruction was basically developed by B.F.Skinner. This technique is fundamentally based on the principle of reinforcement and self learning, i.e., based on the theory of trial and error and operant conditioning.

This is a technique of learning in which the learner goes forward himself in the process of learning. Thus, it has contributed a lot in reducing the load of a teacher in formal education system.

MEANING

"Programming refers to the arrangement of the stimulus material in an order of presentation that would maximise the rate of learning, resulting in optimal behaviour modification on the prescribed lines."

In this method the material to be learned is arranged in graded units, according to the level of difficulty. It is presented in such an order that it results in the best understanding and retention. Thus a programme is the subject matter to be learned by the students, while programming is the new method of arranging the subject matter to be picked up by the pupils, in graded steps arranged in a psychological and logical sequence having its meaning dependant on the principles of 'from concrete to abstract' and from 'familiar to new'. Here the pupil proceeds from 'fact' to a 'concept'.

Here the learner's responses are gradually shaped to the desired level or refinement. The origin of programming may be credited to Sidney Pressey (1920s) who developed a series of mechanical devices which aims at presenting multiple choice questions to the learners after instruction and which gave them immediate answers.

It is based on the principle of reinforcement. This method of teaching is an autocratic and individualised strategy. It is based on the psychological principles of operant condition. The responses of the learner are strictly controlled by the programmer. Its main focus is to bring desirable change in the cognitive domain of the learner's behaviour. The structure of teaching method is that the selected content is analysed and broken into smaller elements. Each element is independent and complete in itself. The programmer develops frames based on each element. Responses are also provided to the learner in the program on some different leaflets. The correct response of the learner is the new knowledge or new behaviour. Immediate confirmation of correct response provides reinforcement to the learner and he proceeds to the next frame. Wrong responses required feedback. Physical

presence of the teacher is not necessary. He may come to give instructions regarding the program. Students are left for learning at their pace. Thus, even in the absence of a teacher, the work of teaching can proceed profitably. The programmes can be made available in the form of books, cards or machines.

DEFINITIONS

Programmed instruction has been defined as a method of giving individualized instruction, in which the student is active and proceeds at his own pace and is provided with immediate knowledge of result. The physical presence of the teacher is not essential in this strategy.

Sussan Markle (1969) gave a wider definition of programmed instruction. "It is a method of designing a reproducible sequence of instructional events to produce a measurable and consistent effect on behaviour of each and every acceptable student."

Smith and Moore(1962) " Programmed instruction is the process of arranging the material to be learned into a series of sequential steps, usually it moves the student from familiar background to a complex and new set of concepts, principles and understanding.

Michael J Apter "Programmed instruction is a method of instruction in which the information to be taught is broken down into small units which are to be presented to the student (usually in written form) in a carefully planned sequence. Each unit or 'frame' contains not only information but is also terminated with a question .

ASSUMPTIONS OF PROGRAMMED INSTRUCTION

Programmed instruction is based on the following assumptions:

1. A student learns better when he himself is active.
2. A student learns better if he is motivated to learn by confirming his responses.
3. A student learns better if subject-matter is presented to him in small steps (units).

4. A student learns better if sequence of the content is psychologically workable.
5. Learning may be effective if the pre-requisite on the part of the learner are specified.

PRINCIPLES OF PROGRAMME INSTRUCTION

The basic principles of programmed instruction are as follows:

1. Principle of small steps
2. Principle of active responding
3. Principle of feedback
4. Principle of self-pacing
5. Principle of error control

Let us discuss each of these principles in detail.

1. Principle of small steps

This principle includes an analysis of content/subject matter to be learned or taught. The subject or skill to be acquired is broken into small steps. Learning takes place most rapidly if the subject matter is presented in small steps so that the success of the student on the new item is ensured. Each step known as a frame is presented to the student at a time. All the steps are arranged in a logical sequence. Thus, the student proceeds step by step (frame by frame) and achieves the terminal objective put before him or her. Learning each frame gives the student a feeling of satisfaction which in turn reinforces his learning.

2. Principle of active responding

Another principle of programmed instruction is based on active responding by the students. Learners are made to interact with every bit of information and make a response, because the assumption underlying this principle is that in order for meaningful learning to occur, a response must be made by the learner, and the learner should be actively engaged with the subject matter. Responses may be overt (when learners write the answers) or covert (when learners think out the answers).

3. **Principle of feedback**

The term feedback means 'knowledge of results'. Experimental evidence supports this principle that the more immediate, the reward better is the learning. The student comes to know immediately whether he is on the right track. Learning accompanied with success or satisfaction is likely to be more permanent than learning accompanied by failure or dissatisfaction. This mechanism is known as 'controlling the behaviour of the student'.

4. **Principle of self-pacing**

Programmed instruction is based on the assumption that the individual student learns according to his own pace, needs and capabilities. It is student-centred and encourages each student to work at his own speed. Individualised instruction is brought about through self-paced workbooks, branching/scrambled books.

5. **Principle of error control**

Programmed instruction is closely linked to the issue of error control. The learning sequence is broken down into a large number of small steps, so that the rate of error is kept down to a minimum and allows reinforcement to be frequent and immediate. Formative evaluation of the programme helps to reduce errors to a minimum. Thus, it helps to concentrate more on analysis of student performance rather than on his errors.

CHARACTERISTICS OF PROGRAMMED INSTRUCTION

Let us discuss some of the main characteristics of Programmed Instruction:

1. It is a part of educational technology in the sense that programmed material can be presented with the help of machines or computers.
2. It is a new strategy of teaching and learning. Here, learner learns himself without the help of the teacher. Thus, the problem of the dearth of effective teachers can be overcome.
3. It is a technique for the solution of educational as well as teaching problems. We can supply programmed instructional materials to lakhs

of students at a time and can help them to have access to the latest knowledge and its dimensions.

4. It is a technique for the modification of learner's behaviour. Thus, it is opposite of micro teaching where teacher's behaviour is modified. Learner's behaviour is modified by confirming the right response immediately.
5. It cannot replace the teacher from the field of teaching altogether. It is because only an effective teacher can prepare a good programmed material.
6. It requires more creativity and imaginative efforts to develop such individualized instructional material. Every individual learner learns at his own speed here.

Programmed Instruction involved breaking down of content into small pieces of information called frames. A programmed instruction textbook might contain several thousand frames of information. Students would read a frame, and then answer a question about the frame. Then they would check their answer (get feedback) and proceed to the next frame. When Programmed Instruction was delivered by a 'teaching machine' the possibilities for effective teaching seemed unlimited to many. Skinner argued that programmed instruction was more effective than traditional teaching methods since learners have to receive thousands of reinforcements. The early programmed instruction was often delivered by some form of 'teaching machine' but later it brought the concept of interactive text. The programmed instruction movement extended the use of printed self – instruction to all school subject areas to adult and vocational education as well (Romiszowski,1997). Later as the technology developed other media, such as radio, television video and computer, came of use.

The basic concept of Programed Instruction is as follows:

- Contents are very small. i.e., simple statements plus a question or direct question.
- Answers are usually filling the blanks.
- Feedback is in the form of the correct answer.

Here is an example on programmed English (M.W Sullivan) presented by Joyce, Weil & Calhoun (2000:333):

1. Words are divided into classes. We call the largest class nouns. Nouns are a class of _____. words
2. In English, the class of words called nouns is larger than all the other _____ of words combined classes

STEPS OF PREPARATION OF A PROGRAMME INSTRUCTION

Preparation of programmed instruction text involves three stages:

Stage -1: Preparation

Stage-2: Writing the Frames

Stage-3: Evaluation or Try out / revision

Now, let us discuss each stage in detail.

STAGE 1: Preparation Stage: This stage is also known as the planning stage. The teacher selects the topic for the programme. He should be thoroughly familiar with the topic and limit the area to be dealt and decide the suitability of the programme. He should identify the objectives and then do the content analysis for developing the instructional procedure. Writing objectives here means keeping clear the entering behaviour and the terminal behaviour which the programme intends to bring about. Developing the criterion test for assessing the performance acquired in the programmed and to evaluate the attainment of the objectives is also done. Here identifying the entering behaviour describes the abilities and skills which are essential for the instructions leading to new terminal behaviour.

STAGE 2 : Writing the Frames: This stage involves designing of the frames, sequencing of the frames and editing of the programmes. Designing the frame needs to fulfilled four components, viz, the stimulus, the response, prompts or cues and confirmation of results. The stimulus is a small segment of content that is presented in a frame. The format of response is generally a blank. This stimulus material of the frame and the response constitutes an S-

R relationship. Immediate confirmation of results is provided and the correct response is usually given against the next frame. The student compares his response with the given one and if he is correct he moves ahead. Prompt is a supplementary stimulus which is added to the terminal stimulus to make the item easier. It helps the student to give correct response and prevents him from making unnecessary errors.

STAGE 3: Evaluation or try out/revision: This is the last stage of the development of the programme. It helps the programmer to assess whether the programme is an effective instructional tool or not. When the first draft is ready, it should be tried out on several persons and re-edited. The original frames should be typed and their response given on the back page. Now it should be given to small group of students. It has to be seen where mistakes are being committed. This will facilitate revision of the frames later. Two types of evaluation are conducted - the internal and external evaluation. Internal evaluation takes place through field testing which is conducted on around 15-30 students. Extensive try-outs and revisions ensure a high quality programme. A written record of their responses should be obtained to permit an analysis of error rate for each frame. An achievement test designed specifically for the particular programme should be administered. External evaluation helps to determine the worth of the programme against some external criteria like: a)90/90 standard – Here after administering the programme to a small group of students, the data are statistically analysed for criterion measures which is called 90/90 standard. It means that when 90% of the students are able to answer 90% or more of the frames in the programme. b) Cost estimates – It is essential to determine the cost of producing the programme and the number of students it can be used for. c) Student Attitudes-The attitude of the students towards programme is another essential criteria which helps to evaluate the effectiveness of a programme.

Thus the steps of programme development lead us towards instructional design which would be equally effective in face to face as well as distance teaching.

STYLES OF PROGRAMMING

Programmed instruction was introduced in the 1950s in classroom teaching and since then many styles of programming have emerged. The three main types which we will be discussing here are as follows:

a)Linear programming style

b)Branching programming style

c)Mathetics

Let's now try to understand them.

a) **Linear programming style:** A linear programme consists of a series of small segments of instructional units called frames. Subject matter is presented to a student in small bits. In this style of programming, all students proceed in a predetermined way, i.e., all students follow the same linear sequence of frames, each frame being of small size. The student starts from the initial frame and progresses towards the terminal frame. As the sequence is linear and every student follows an identical path decided by the programmer, so linear programmes are considered to be extrinsic. Linear programme allows students to progress at their own rate through a series of small steps, each step proceeding logically through the subject matter. The students begin with frame one and then proceed to frame two. Each box represents a frame.
b) **Branching programming style:** Branching style of programming was conceived by a psychologist, Norman Crowder in 1954 and it is also called as the Crowderian style of programming and has been defined as a programme which adapts to the needs of the students without the medium of extrinsic device such as computer. This style of programming is also called intrinsic because herein the learner within himself makes the decision to adapt the instruction to his needs according to his background of the subject. In this programming, a student is to read a unit of material followed by a multiple choice question. If he chooses the right answer to the next question, he is presented the next paragraph of the material and the next question. If he chooses the wrong response, then he is presented the material,

written specifically to rectify his errors. This remedial material is followed by a direction to return to the original presentation to make a second choice. Thus the student proceeds through programmes along different routes or branches.

c) **Mathetics:** The word Mathetics is derived from the Greek word 'mathein' which means 'to learn'. This style of programming was first conceived by Thomas Gilbert in 1962 and is defined as 'the systematic application of reinforcement theory to the analysis and reconstruction of those complex behaviour repertoires usually known as subject matter mastery of knowledge and skills.' Mathetics tends to use much larger frames to maximize step size and produces frames with as few frames as possible. Gilbert called the step/frame an exercise. The mathetics exercises are presented on various logical techniques for structuring the subject matter. The main objective is that student is supposed to do the exercises and master that particular operation/task. It is a prescriptive rather than descriptive process.

ADVANTAGES OF PROGRAMMED INSTRUCTION

We can discuss the advantages as under:

1. Student is kept active and alert: It makes the student active and self-reliant. He gets good exercise in using new words, concepts and relationships; and lack of attention is detected immediately. Even if he commits a mistake, he is immediately aware of it and can correct himself. It is individualized learning and the student can proceed at his own pace.

2. Learning is made easy and simple: It makes learning easy and simple because the learning material is presented in small instalments due to individualized learning, it motivates the student for further learning.

3. Teacher gets relieved of doing ordinary jobs and he can play the role of guide, counsellor, motivator, organiser, etc. It may help the teacher in reduction of their total load of work. The time thus saved may be utilized by the teacher in some creative activities.

4. A well-programmed self-instructional device is tailored to cater to the needs of individual students of the class: It helps to yield good results as the programmes are better prepared and planned material. And it is better as compared to traditional teaching method. It gives self motivation to the students. It also helps to do work in an organised and systematic manner without pressuring the students. And each student work at his own interest and pace.

5. Programmed instruction makes learning interesting: The learning material is presented in such a way that learning becomes an interesting game in which the learner is challenged by his capabilities. The novelty of learning by advice provides extra motivation to the learner. It develops scientific attitude among the learners because they are able to think rationally and logically.

6. Helpful for in-service teachers and correspondence studies: In-service teachers can be kept abreast with the latest developments in the field of education through programmed instruction material. It also quite useful for correspondence course students who want to continue their higher studies by sitting at home or by continuing studies along with their jobs or vocations.

7. Programmed instruction is helpful for teaching complex subject-matter: The complexity of the material is simplified through the analysis of the subject-matter into small and more easily assimilated segments of information. Well-programmed materials give the teacher the method and the individual sufficient time to comprehend more complex concepts.

8. Programmed Instructions, as a teaching procedure, is particularly useful for developing countries and where there is shortage of good teachers. It is very useful in certain situations where human instructors are not easy to provide, e.g., small isolated schools in the hilly areas.

9. Failing standards can be easily checked and suitable remedial measures can be given with the help of programmed material. And for those few, who are intelligent or gifted, they can be provided with more courses through programme instructions and thus they can make more progress without hindering the rest of the class.

LIMITATIONS

No doubt, programmed instruction has a large number of advantages, it also has a few shortcomings.

1. The orthodox teachers who are indifferent to any change in methodology of teaching will not relish accepting programmed learning material for classroom teaching.

2. Teacher-taught relationship is important but through programmed learning it is not strengthened.

3. Some students are not habitual of working at their own and may not study at all. A few of them may become lazy and not want to proceed further.

4. There is a need for preparing suitable programmes for the learners in the Indian situations which is not possible and will be quite expensive too.

5. It cannot foster proper attitudes, aesthetic appreciation, moral standards, etc.

6. In programmed learning, subject matter is presented to the learners and they give response. It does not help in the development of their imagination.

7. No flexibility is there because every learner has to follow the same track rigidly.

8. This programme is totally proved to be worthless when the students starts looking at the key without reading the frame and we do not have any mechanism to control this dishonest behaviour of the learners.

9. The preparation cost of this material is also very high. And it is also a time consuming method of learning and makes the students bored very soon.

Suggestion for this teaching strategy

1. A programmer should have thorough knowledge of the content and technique of content analysis.
2. This strategy should be used as a supplementary device for remedial teaching in the class room.

3. It should be used in distance education or continuing education programs where no rigid time table is applied.
4. If not at a primary level or higher level of education, this strategy may be useful at secondary level of education where many new subjects are introduced in the curriculum and they create problems in learning. If applied in class room teaching, teacher should be present in the class. He can maintain discipline in the class and help in eradicating the difficulties of the learners. Personal touch of the teacher can be more fruitful and effective in student's learning.

CONCLUSION

In conclusion we can say that in Programmed Instruction, the main emphasis is on individual differences and students' involvement. There is no fixed time interval for learning. Students may learn at their own pace. Learning by doing maxim of teaching is followed to involve learners in the learning process. Students are exposed only to correct response, therefore, possibility to commit errors is reduced. Immediate confirmation of the results provides reinforcement to the learners and encourages the learners to proceed further. Feedback is provided to wrong answers, so that learner is able to develop mastery over the content.

Thus, programmed instruction has revolutionised the theory and practice of teaching in the last decade. It is rich in potential. It is expected that programming skills may become a part of every teacher's methodology. It is also possible that the backbone of tomorrow's instructional text books and programmed sequenced becomes an integral part of most textbooks.

OBJECTIVES

The main objectives of this chapter is to acquaint the students about the :
i) concept of programmed instruction;

ii) meaning of programmed instruction;

iii) principles of programmed instruction;

iv) characteristics of programmed instruction; and

v) advantages and limitations of programmed instructions.

SUMMARY

Programmed instruction is based on theories of psychology, more specifically operant conditioning. It is a new technique of teaching learning. Programmed instruction is the presentation of material in a step by step procedure with the knowledge of results, and the possibility of different courses through instruction. The basic principles of programmed instruction are: principle of small steps, principle of active responding, principle of feedback, principle of self-pacing and principle of error control. There are three styles of programming, linear programming, branching programming and mathetics. Development of programmed instruction material is a specialized and skilled job. The three stages involved in programme development are preparation, writing of frames and evaluation (which includes try out and validation) the programme is repeatedly tested on the students and the weaknesses are improved upon or revised. The process is repeated until a fairly perfect programme is developed.

GLOSSARY

i) Frame: The small bit of information or a single step of instruction given to students at a time and responses from them is called a frame. It provides immediate feedback to learners.

ii) Prompt or cue: Additional information contained in a frame to help the learners to respond the frame correctly.

iii) Linear model: Programmed prepared in a straight line from easy to difficult where no additional response from a frame is possible.

iv)Branching: Sequencing of frames in a relatively big form depending upon students' responses.

v) Entry behaviour: Entry behaviour includes the prerequisite knowledge; attitudes or skills which the student already possesses that are relevant to the

learning task or subject matter and that one may require students to demonstrate before beginning any learning module.

vi)Terminal behaviour: Terminal behaviour refers to all those responses and behaviour which are helpful for achieving desired objectives. They refer to what a learner can do.

vii) Stimulus: It refers to the content or information presented in the frames.

viii) Feedback or reinforcement: It is the knowledge of the result of a learner's response whether it is right or wrong.

ix) Overt: Overt behaviours refer to actions that are able to be observed.

x) Covert: Covert behaviour is that behaviour that is not seen or observed. It includes thoughts and emotions.

FREQUENTLY ASKED QUESTIONS

1. What is programming?

Ans: Programming refers to the arrangement of the stimulus material in an order of presentation that would maximize the rate of learning, resulting in optimal behaviour modification on the prescribed lines. It gradually shapes learner's responses to the desired level or refinement.

2. What is a frame in programmed instruction?

Ans: A frame is the smallest bit of information that is supplied to a learner at a time. It provides immediate feedback to the learners.

3. What is the basis of programmed instruction?

Ans: Programmed instruction is based on the concept that it is a technique for the modification of learner's behaviour. Thus the learner's behaviour is modified by confirming the right response immediately.

4. What is the rationale behind linear programming?

Ans: The rationale of linear programming is that recall is more effective in the learning process than recognition. The act of responding tends to cause

learning hence; no incorrect response should be there as they affect learning adversely. And too many errors would be discouraging and hence small steps should be there and it would be more likelihood of correct responses.

5. What are the basic differences between linear and branching programme of instruction?

Ans: B.F. Skinner introduced linear programming and Norman Crowder introduced branching programming. The learning theory of linear programming is that it is based on operant conditioning and it is a response centred approach of learning (R-S) and branching is based on configuration theory of learning. It is a stimulus centred approach of learning(S-R).

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